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What Is *Natural* about Natural Capital during the Anthropocene?

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Abstract: The concept of natural capital denotes a rich variety of natural processes, such as ecosystems, that produce economically valuable goods and services. The Anthropocene signals a diminished state of nature, however, with some scholars claiming that no part of the Earth’s surface remains untouched. What are ecological economists to make of natural capital during the Anthropocene? Is natural capital still a coherent concept? What is the conceptual relationship between nature and natural capital? This article wrestles with John Stuart Mill’s two concepts of nature and argues that during the Anthropocene, natural capital should be understood as denoting economically valuable processes that are not absolutely—but relatively—detached from intentional human agency.

Keywords: the concept of nature; natural capital; the anthropocene; ecological economics

1. Introduction

Hardly anyone would deny that natural capital is fundamental to the transdisciplinary field of ecological economics, even if the concept remains deeply contested [1]. After all, the canonical debate between weak and strong sustainability, for instance, hinges on the putative substitutability of natural capital and the vast majority of ecological economists and their life scientist colleagues maintain that instances of natural capital, such as ecosystems, produce goods and services essential to human well-being and the continued existence of our species [2–4].

The concept of natural capital typically denotes a rich variety of economically valuable production processes that are afforded to human agents, *gratis*. Nature not only affords human agents passive materials and raw resources to be improved by labor, but endows them with various production processes that generate valuable goods and services in a manner that is detached from human agency. One classic study concluded that the Earth’s entire biosphere, including a wide range of services generated by natural capital—such as the purification of water, nutrient cycling and the detoxification of wastes—is worth between \$14 and \$54 trillion dollars, annually [5,6].

Despite the significance of natural capital for ecological economics, the relationship between this concept and the concept of nature remains unsettled [7,8]. What concept of nature, if any, is presupposed by the concept of natural capital? Specifically, what is meant by “natural” with respect to natural capital? What ought to be meant by it? Perhaps one reason why the answers to these questions have not been forthcoming is that the concept of nature is wrought with ambiguity and confusion. As the Scottish Enlightenment philosopher and friend to Adam Smith, David Hume, remarked in his *A Treatise of Human Nature*, there is no more ambiguous and equivocal word in the English language than the term “nature” [9].

While a world replete with nature might safely ignore the conceptual entanglement between nature and natural capital, we no longer live in such a world. Increasingly, our world is one that is dominated, or at least heavily influenced, by intentional human agency and the unintended

consequences that arise from it. Last year, a multidisciplinary body of scholars within the International Commission on Stratigraphy, the Anthropocene Working Group, endorsed this claim when they recommended that the world officially recognize the Anthropocene as the new geological epoch [10]. The most striking feature the Anthropocene is that humans are a major geological and environmental force on par with natural forces. While the Anthropocene emphasizes the scale of human agency and its consequence for various Earth systems, it simultaneously conveys a diminished state of nature or “natural agency” on the planet. Ecological economists have begun to wrestle with the implications that the Anthropocene has for their transdisciplinary field but the conceptual relationship between nature and natural capital has been left mostly unanalyzed [11–13].

What consequence does the Anthropocene—and the diminished state of nature it represents—have for the concept of natural capital, a concept that is supposed to denote the economic value of non-human agency? Is natural capital still a coherent concept during this new geological epoch? If so, how should we understand the conceptual relationship between nature and natural capital during the Anthropocene?

To tackle this set of questions, this article grapples with John Stuart Mill’s two concepts of nature. For Mill, nature is either everything actual and possible, or a realm of phenomena that has not yet been affected by human agency. At first glance, neither option appears desirable for making sense of natural capital. After all, nature as everything actual and possible includes the items denoted by the concept of manufactured capital, and if ecological economists wish to continue distinguishing between natural and manufactured capital, this concept of nature seems unacceptable. On the other hand, nature construed as a realm of phenomena detached from human agency ignores the sheer magnitude of intentional human agency during the Anthropocene. This article champions Mill’s first concept of nature and shows that, even if we accept that everything actual and possible is natural, we can still distinguish between human activity and the rest of nature for operational purposes. It will be argued that, during the Anthropocene, the concept of natural capital denotes a rich variety of natural and economically valuable processes that are *relatively*—not absolutely—detached from intentional human agency.

2. Mill’s Two Concept of Nature and Natural Capital

In one of his *Three Essays on Religion*—the essay entitled *Nature*—Mill considers a variety of possible meanings of “nature” and eventually boils his analysis down to two distinct concepts. He states:

It . . . appears that we must recognize at least two principle meanings in the word ‘nature’. In one sense, it means all powers existing in either the outer or inner world and everything which takes place by means of those powers. In another sense, it means, not everything which happens, but only what takes place without the agency, or without the voluntary and intentional agency, of man. This distinction is far from exhausting the ambiguities of the word; but it is the key to most of those on which important consequences depend. [14]

Mill’s first concept of nature denotes everything actual and everything possible, including human agents and their intentional activities. Because this concept includes *Homo sapiens*, it dovetails nicely with Charles Darwin’s concept of nature in *The Origin of Species*, in which he describes nature as a “web of complex relations”, whereby no single organism can live independently of that web [15,16]. The second concept of nature, the one that Mill prefers, drives a wedge between intentional human agency and that realm of phenomena that has not yet been affected by human agency [17].

Perhaps the first thing to acknowledge is that G.F. Hegel and Karl Marx also recognized these same two concepts of nature but placed them under the same general heading of “Nature.” As Leo Marx explains, for these scholars, “First Nature” is the biophysical world as it existed before the evolution of *Homo sapiens* and “Second Nature” is what most would refer to as the artificial—the material and cultural environment that our species has imposed upon “First Nature” [18]. This view of

nature sustains a division between human activity and everything else, but ultimately it is in agreement with Mill's first concept of nature as denoting everything actual and possible.

It is also worth noting that Mill's two concepts elide the normativity of nature. In *The Moral Authority of Nature*, Lorraine Daston and Fernando Vidal take "nature" to task by exposing the hidden normative authority of this concept [19]. To suggest that specific social conventions and political arrangements are "by nature" or "natural," is often to assert that such institutional arrangements are either irrevocable or optimal. All too often, Daston and Vidal state, "Nature appears as an external authority, even if its imperatives are lodged deep in the body or psyche. Nature's authority can also be internalized, made "natural" in the sense of seeming inevitable or effortless" [19]. Bernadette Bensauade-Vincent and William R. Newman echo Daston and Vidal's analysis. In their *The Artificial and the Natural*, they state "the concept of nature functions and has always been used as a cultural value, a social norm and a moral authority" [20]. Since terms such as "nature" and "natural" do not merely possess a descriptive component but a normative one as well, it is crucial to recognize that the concept of natural capital is not exempt from such influences. Indeed, the concept of natural capital would appear to be one instance of what the philosopher Bernard Williams refers to as a "thick concept"—a concept that is both descriptive and action-guiding [21]. In any case, for the purposes of this article, it will be sufficient to point out, as a cautionary note, the inherent normativity of nature.

Prima facie, Mill's first concept of nature is attractive because it is clearly compatible with naturalism—a thesis that states there are no supernatural phenomena. As the philosopher of mind, Daniel Dennett, reminds us, "artificial environments are themselves a part of nature, after all" [22]. The problem with this all-encompassing concept of nature, however, is that it seems to be discordant with the concept of natural capital for the obvious reason that everything actual and everything possible includes the items denoted by manufactured capital, including capital goods. If this first Millian concept of nature requires that everything is part of nature, then it would appear to be a poor fit for shedding light on what ecological economists mean by natural capital during the Anthropocene. After all, what good is a concept of nature if, by deploying it, it destroys the very feature that makes natural and manufactured capital distinct from one another in the first place? We will return to Mill's first concept of nature below, in Section 3.

Mill's second concept of nature—which denotes processes that take place independent of human agency—has roots in the writings of the ancient Greeks, particularly those of Aristotle. For Aristotle, the concept of nature had several meanings [23,24]. In one sense, it denotes specific items that exist by nature and not by any other causes. This concept emphasizes the origin or genesis of an item and requires that natural objects exist by non-human causes, thus making a firm distinction between human and non-human agency. This particular concept of nature presumes that there are things that exist by skill (the artificial) and things that exist on their own when left to themselves (natural objects). Aristotle has this sense of nature in mind when, for example, he reviles usury or the charging of interest. As Joel Kaye explains, "Aristotle believed usury was the most despicable and unnatural, because in the usurious loan, money, which was invented solely as an instrument of exchange, is made to generate itself, to give unnatural birth to itself" [25]. Money does not exist by nature but by law or convention [26]. The charging of interest involves money begetting money and is unnatural because this activity is not in accordance with the end for which money was originally created (to facilitate exchange).

In his *Physics*, Aristotle affirms that nature denotes an inner principle of change that is characteristic of self-moving things. Unlike artificial objects, natural ones are involved in a process of growth, change and flux. Nature, in this sense, is deeply intertwined with how things behave when left to themselves, free from intentional human agency. Since instances of natural capital can produce in a self-generative way whereby production processes materialize from within—without the need for external causes—this concept of nature is particularly fitting for understanding what ecological economists mean by nature when they invoke the concept of natural capital to denote ecosystems. Moreover, this concept of nature can account for the fact that instances of natural capital

can be manipulated, modified and generally controlled by human agents without losing their essential identity as items of natural capital (becoming purely artificial).

Aristotle gives the example of a wooden bed in Book 2, Chapter 1 of *Physics*. While the shape and structure of the bed has been fashioned by an intentional human agent, the carpenter, this formal cause is merely “human impositions on the unchanged matter that remains a natural product” [20]. If one were to plant the bed in the ground and that bed were to sprout anything at all, it would not generate beds but trees. In this case, the inner principle of change or motion is independent of the form that is imposed on it by the carpenter and the nature of the object is associated with the unchanged matter. In this sense of “nature,” the natural world would be one that owed its entire existence to natural causes and, therefore, would exclude all intentional human activity. This world would be one populated by objects, whether biotic or abiotic, without any forms imposed on them from without. It would be a world that was left entirely to itself, independent of human agency. Indeed, this Aristotelian concept of nature can serve us with a good thought experiment to give shape to what a *bona fide* natural world would look like independent of any form imposed on them by intentional agents. Of course, one can easily imagine a contrary world as well, one where there is no biotic or abiotic items that are left to be naturally expressed, where every last object and bit of material has been subject to the intentional activity of human agents. Indeed, the environmental philosopher, Alan Holland, has described such a world as a “human-made world,” since it would be one where every object owed its form to human causes.

Mill’s second concept of nature appears to fit the concept of natural capital particularly well since ecological economists are wont to claim that specific instances of natural capital, unlike manufactured capital, are production processes that generate welfare-enhancing benefits to economic agents in a manner that is more or less independent from intentional human agency. Moreover, at least some of the time, ecological economists distinguish natural capital from manufactured capital by emphasizing materials or processes that have not yet been subject to direct human agency. This is especially true when it is acknowledged that the items denoted by natural capital are generally unproduced means of production that do not have to be intentionally built or constructed by human labor.

However, there appear to be at least two problems with Mill’s second concept of nature as it applies to natural capital. First, some instances of natural capital are modified and improved by intentional human agency but Mill’s second concept of nature would deny that such processes are genuinely natural given this causal intervention. Whether through ecosystem engineering and ecosystem restoration, it is difficult to deny that many instances of natural capital are intentionally constructed or built by human agents for some intended effect (consider, for example, the Catskills watershed which is discussed below). In many cases, the productivity of natural capital can be improved or enhanced by direct human intervention, as would be the case when invasive species and other undesirables are extricated from ecosystems to facilitate the production of specific ecosystem goods and services. Natural capital denotes unproduced means of production that are capable of producing in a manner that is detached from human agency but not every instance of natural capital is separated or detached from human agency in this way. A strict application of Mill’s second concept of nature would entail excluding the latter processes as genuine instances of natural capital.

Mill’s second concept of nature is beset with another related problem. During the Anthropocene, the extension of this concept appears to be empty. A growing number of scholars argue that there is no longer any part of the Earth that remains completely unaffected by human technologies [20,27,28]. In his *The End of Nature* Bill Mckibben states,

An idea, a relationship, can go extinct just like an animal or a plant. The idea in this case is ‘nature,’ the separate and wild province, the world apart from man to which he has adapted, under whose rules he was born and died. In the past we have spoiled and polluted parts of that nature, inflicted environmental ‘damage’ . . . We never thought we had wrecked nature. Deep down, we never really thought that we could: it was too big and too old. Its forces, the wind, the rain, the sun—were too strong, too elemental. But, quite by accident, it turned

out that the carbon dioxide and other gases we were producing in pursuit of a better life—in pursuit of warm houses and eternal economic growth and agriculture so productive it would free most of us for other work—*could* alter the power of the sun, could increase its heat. And that increase could change the patterns of moisture and dryness, breed storms in new places, breed deserts. Those things may or may not have begun to happen but it is too late to prevent them from happening. We have produced carbon dioxide—we have ended nature. We have not ended rainfall or sunlight . . . But the meaning of the wind, the sun, the rain—of nature—has already changed. [29,30]

Mckibben's (1990) claim that "we have ended nature" is obviously not meant to suggest that there is nothing left that is actual and possible—Mill's first concept of nature. Rather, there is simply no longer any part of the Earth's that can be truly described as detached from human agency. More recently, Paul Wapner draws a similar conclusion when, in his book *Living through the End of Nature*, he remarks, "the wildness of nature has indeed largely disappeared as humans have placed their signature on all the earth's ecosystems" [28]. Wapner continues:

Empirically, a growing human population, unparalleled technological prowess, increasing economic might and an insatiable consumptive desire are propelling us to reach further across, dig deeper into and more intensively exploit the earth's resources, sinks and ecosystem services . . . the cumulative force of our numbers, power and technological mastery has swept humans across and deeply into all ecosystems to the point where one can no longer easily draw a clean distinction between the human and nonhuman realms. Whether one looks at urban sprawl, deforestation, loss of biological diversity, or ocean pollution, it is clear that humans have been progressively overtaking large swaths of nature and thereby imprinting themselves everywhere. [28]

Indeed, the technology of our species is now so vast that it has extended far beyond the sub-lunar region to include the Cydonia (the region of Mars) [20]. While this may be news to some, even Karl Marx had once remarked that, "the nature which preceded human history no longer anywhere exists" [31]. In any case, it would appear that the claim that there is some realm of phenomena on Earth that remains unaffected by human agency is simply false and if there is nothing left on Earth that remains unaffected by human agency, then the very processes denoted by the concept of natural capital, could not be considered genuinely "natural" in this Millian sense.

3. The Millian Dilemma?

Mill's two concepts of nature appear to present us with a dilemma. After all, his first concept would judge that every instance of natural *and* manufactured capital are equally part of nature. On the other hand, a staunch defender of Mill's second concept of nature would insist that—strictly speaking—there is no more nature and, therefore, no more natural capital left on Earth, full stop. Neither horn of this dilemma is particularly attractive to anyone wishing to establish a coherent concept of natural capital during the Anthropocene.

Fortunately, this dilemma is more apparent than real. The way out of this predicament is to concede that while everything, metaphysically, is natural we can still operationalize the concept of nature by insisting that those items which remain relatively detached from human agency, including those items that do not possess significant features caused by intentional human agents, are natural. In taking this pragmatic approach, I am following the philosopher of conservation biology, Sahotra Sarkar, when he states:

Even if humans are conceptualized as part of nature, we can coherently distinguish between humans and the rest of nature. There is at least an operational distinction; that is, one that we can straightforwardly make in practical contexts. We can distinguish between anthropogenic features (those largely brought about by human action) and non-anthropogenic ones. [32]

By making this operational distinction, Mill's two concepts of nature are treated as compatible (in a sense) because one does not necessarily preclude the other. On this view, Mill's first concept of nature is more fundamental because even the most artificial of objects, including atomic bombs and jumbo jets, are natural. On the other hand, for practical purposes, these same items are deemed artificial since they were intentionally built by human agents and possess a variety of essential anthropogenic features. The same is true for items denoted by the concept of natural capital. Since everything actual and everything possible is natural, every instance of natural capital must also be natural. However, in light of the empirical claim that no phenomena denoted by the concept of natural capital is completely insulated from human agency during the Anthropocene, it is always a question about the relative detachment that such processes have in relation to intentional human agency.

On this account, the natural and artificial are located along a spectrum or continuum with the most natural objects being those that remain relatively detached from human agency and the most artificial objects are those that have been built and constructed by intentional human agents. There is no *sui generis* difference between artificial and natural objects since the difference is always a matter of degree. In other words, there is a blending of the natural and the artificial. This approach to the natural/artificial distinction has the virtue of preserving the practically significant distinction between, for example, intentionally modified environments such as city centers, from environments that have been subject to relatively little human agency, such as remote uninhabited islands in the Pacific Ocean that were recently generated by purely natural causes.

Rather than imposing a strict division between natural and artificial objects, I propose that the artificial/natural distinction be described as a continuum whereby phenomena are branded as more (less) natural or more (less) artificial, depending on their degree of detachment from intentional human agency. It will be useful to distinguish objects that remain completely detached from human agency from those which have a *first* or *second* degree of detachment. These divisions are represented in Figure 1, below.

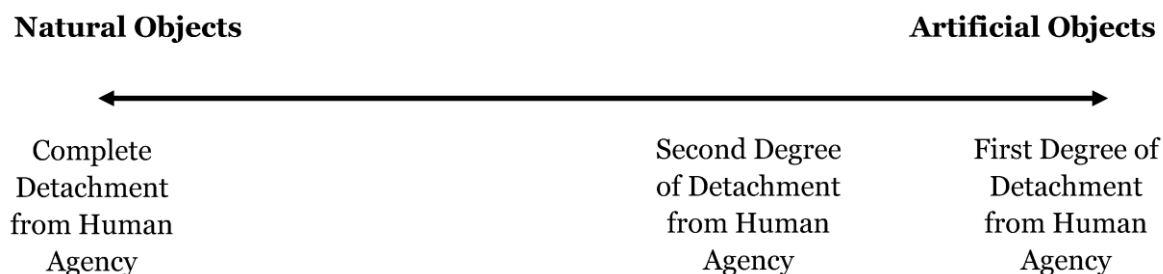


Figure 1. The artificial/natural continuum.

To be clear, the Artificial/Natural Continuum depicted Figure 1 is almost certainly *not* shared across all cultures. In his *Beyond Nature and Culture*, the anthropologist Philippe Descola convincingly argues against the universality of the artificial/natural distinction, insisting that the distinction is specific to Western culture alone [33]. However, with this qualification in mind, the Artificial/Natural Continuum is still helpful for understanding the concept of natural capital during the Anthropocene. Figure 1 shows that the most natural objects in the universe are those found to the left side of the continuum. They remain completely detached from human agency in the sense that they have not causally interacted with intentional human agents: they have been neither affected directly nor indirectly by human agents. Such objects might include, for example, distant astrological or celestial objects—such as distant galaxies or stars. It seems reasonable to suppose that the unobservable part of the universe is certainly natural in this sense. If there truly is no longer any part of the sub-lunar region that is completely detached from human agency, then it follows that describing the Earth, or parts of the Earth, as entirely natural, would be incorrect. However, parts of the Earth might well still be described as relatively natural when compared to objects that owe their forms to human agency and

have been completely instrumentalized to serve human ends. Only that part of the universe which has not yet been affected by human agents is a candidate for complete detachment from human agency.

On the opposite end of this continuum, to the right side of Figure 1, are those items that have been completely instrumentalized by intentional human agents to serve their own ends. This category includes ordinary technical artifacts, such as tables and chairs, which consist of materials found and have subject to the intentional modifications of human agents. On this account, something is artificial when it is the result of a deliberate intentional act, usually involving the application of some art or skill [30]. Not only are chairs an example of an object that has been intentionally planned and built by the woodworker, in combination with manufactured tools or machines but the actual construction of this object normally involves transforming or modifying materials to bring about certain desirable characteristics of the object at hand. Under this framework, all such items, including capital goods (such as manufactured machines and tools), possess a *first degree* of detachment from intentional human agents.

Objects that have been either directly or indirectly affected by human agency but that have not yet been completely instrumentalized by intentional human agents can be described as possessing a *second degree* of detachment. This category includes items that have not been intentionally made by human agents but that, nonetheless, have arisen at least in part as a consequence of human activity. For example, the sawdust caused by the woodworker building the chair is a consequence of intentional human agency but since it is not the goal of such activity and has not (yet) been instrumentalized for human purposes, it can be described as having a *second degree* of detachment. Therefore, unlike those items which can be described as having a first degree of detachment from human agents, establishing that some object has a second degree of detachment is much weaker since it merely requires that there be some causal connection between some intentional human agent and that object.

To make the category “second degree of detachment from human agency” more salient, consider a well-known example: the Catskills Watershed. This watershed provides water filtration services to the residents of New York. Historically, this watershed afforded citizens—upwards of ten million people—with high-quality drinking water. This watershed, which covers 5000-square-kilometers, not only purified the drinking water but meted water out gradually, stabilizing drinking supply and mitigating the possibility of floods [34]. Until the early 1990s, the natural water purification processes, by root systems and soil microorganisms, together with filtration and sedimentation, cleansed the water to such a degree that the Environmental Protection Agency’s (EPA) standards were met [35]. However, housing development and the pollution from vehicles and agriculture threatened the water quality of the region and in 1991 the EPA ordered New York City to build a water filtration plant, unless the city could somehow maintain water quality without it [3].

By 1996, New York City was confronted with a choice between restoring the Catskills watershed and constructing a water-purification plant. This choice has been construed as one between investing in either natural or manufactured capital. As it turned out, restoring the ecological integrity of the Catskills or investing in the “machinery of the watershed” was less costly than constructing a “human-constructed” water filtration system [34]. While protecting and restoring the Catskills was estimated to cost 250 million dollars over ten years (mainly to purchase and set aside over 140,000 hectares in the watershed), the overall cost was expected to reach up to 1.5 billion dollars; by contrast, the total cost of pursuing the alternative path, building and operating the filtration system, was estimated to cost between 6 and 8 billion dollars [3]. New York City opted for the former option and, since 1997, has invested nearly 2 billion dollars in “land management changes and innovative tactics such as purchasing land around reservoirs to preserve forests and wetlands that buffer against pollution, paying landowners to restore forest along streams and offering technical aid and infrastructure to farmers and foresters” [34].

Where might the Catskills fall along the spectrum between natural and artificial objects depicted in Figure 1? While there may be no definitive way to determine the exact location of the Catskills along this spectrum, it seems reasonable to claim that the Catskills is located somewhere between

the two extremes of natural objects completely detached from human agency and objects that have a first degree of detachment from human agency. The Catskills is a strong candidate for possessing a second degree of detachment from intentional human agency because while it has been modified and improved by human agents for the production of specific ecosystem goods and services, it has not been completely instrumentalized for human purposes. After all, unlike technical artifacts used in the production process of traditional economic goods and services, the Catskills remains characterized by unpredictable spontaneous productions of the Earth, a feature that makes it distinct from most genuine artifacts.

Claiming that the Catskills has a second degree of detachment from human agency is fully compatible with Mark Sagoff's claim that the ecosystem goods and services produced by the Catskills cannot be characterized as "natural" in Mill's second sense [36]. As Sagoff makes clear, no one should deny that the Catskills has been and continues to be intentionally modified and improved, through both action and omission, to bring about certain desired effects. To claim otherwise would be mistaken. The way forward is to accept Mill's first concept of nature while simultaneously allowing for the operational distinction between relative and absolute detachment from intentional human agency. On this proposal, the Catskills remains one instance of natural capital, even though it has been subject to various degrees of intentional human agency.

4. Conclusions

The Anthropocene presents a challenge to the concept of natural capital. While this concept has traditionally denoted natural production processes that operate independently of intentional human agency, this new geological epoch renders it controversial whether any such process is wholly detached from human agency. The main purpose of this article has been to develop a coherent concept of natural capital for the Anthropocene by analyzing the conceptual relationship between nature and natural capital.

I proposed collapsing Mill's two concepts of nature. While Mill's first concept denotes everything actual and possible, including human agents and their intentional activities, his second concept denotes that realm which has not yet been affected by human agency. The main problem with adopting Mill's first concept of nature—without qualification—is that it would not equip ecological economists with the conceptual resources to distinguish between manufactured and natural capital for the obvious reason that everything is natural. It was then argued that Mill's second concept of nature is equally problematic because it denotes processes detached from human agency but there is virtually no part of (the surface of) the Earth that is completely insulated by human activity during the Anthropocene. In response to this dilemma, I proposed accepting Mill's first concept of nature as the most fundamental but for operational purposes, allowing for the distinction between humans and their activities from the rest of nature. This unassuming move enables one to distinguish between anthropogenic and non-anthropogenic features for practical purposes.

Properly understood, the concept of natural capital during the Anthropocene remains a coherent concept. The various processes denoted by this concept, including the Catskills watershed, generate economically valuable goods and services in a manner that is *relatively* detached from human agency.

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