

# Securing ourselves *from* ourselves? The paradox of “entanglement” in the Anthropocene

Scott Hamilton<sup>1</sup>

© The Author(s) 2017. This article is an open access publication

**Abstract** The Anthropocene presents new challenges to the natural and social sciences by claiming that humanity is “entangled” with a myriad of scales, spaces, being(s), and temporalities. Yet, how does this entanglement alter our understanding of security? This article argues that the Anthropocene threatens not our physical security, but our *ontological* security: our deep and normalized conceptions of humanity and what it means to be a human “self” in a stable and continuous world. By replacing the foundation of ontological security in modernity – the uncertainty of death – with a new uncertainty of *anthropos*, the result is an existential discontinuity emanating from our own human selves. The Anthropocene thus manifests the need to secure humanity from humanity, or the paradox of securing oneself *from* oneself. Recent turns to the concept of “quantum entanglement” attempt to resolve this paradox by re-instilling a certain and secure “entangled” human self within an otherwise uncertain and insecure Anthropocene epoch. The article concludes that this move actually illustrates humanity’s separation, or dis-entanglement, from nature. Ethical and moral responsibilities to mediate and safeguard life and the planet derive not from (quantum) science nor from entanglement, but from a social world within which humans possess the agency to mediate and judge how to act through such concepts.

We live in a world where the impact of humanity upon the Earth’s natural processes and systems is becoming frighteningly evident. Atmospheric concentrations of carbon dioxide (CO<sub>2</sub>) have recently passed the dreaded 400 parts per million (ppm) threshold, portending runaway anthropogenic climate change in the future [1]. Biodiversity loss, or the vanishing of species at rates more than 100 times faster than without human interference, points to the Earth’s sixth mass extinction – the first caused by humans [2]. And with these two core planetary boundaries transgressed, along with others such as land system transformation and biogeochemical cycles of nitrogen and phosphorus

---

✉ Scott Hamilton  
s.t.hamilton@lse.ac.uk

<sup>1</sup> The London School of Economics and Political Science (LSE), London, UK

surpassed [3], a growing chorus of scientists now declare that the Earth has moved out of the geological epoch of the Holocene into uncharted territory: a new, human-induced geological epoch in Earth's history called *the Anthropocene* – the human epoch.

With its unprecedented scope, scale, and implications for transforming human (and perhaps all forms of) life, it is no surprise that the Anthropocene has moved beyond geological and environmental disciplines to be considered a security problem. As Biermann notes, the Anthropocene affects both global and domestic security: “Economic crises or mass migration due to transformations of the Earth system will not be confined to some countries; they will affect all. Spatial ecological interdependence binds all countries” ([4], p. 38). Yet even beyond the physical implications of mass migration, resource wars, and violent future conflicts, the Anthropocene implies a transformation in the very essence of how humans can think and “be” in the world. As scholars such as Harrington note, reconsidering foundational and statist security logics “requires both dissolving the image of humans as unbounded and outside nature, while simultaneously acknowledging the diverse, entangled nature of humans with the multiple subjects also threatened with future catastrophe” ([5], p. 494). In other words, the Anthropocene entangles humanity, security, and nature, to an unprecedented degree. “The advent of the Anthropocene, then, puts into question one of the key organizing logics of modernity on which much security thinking is built: the separation between human and nature” ([6], p. 2). Hence, the urgency and relevancy of the questions driving this special issue: How can we incorporate the condition of the Anthropocene into security? How can we amend or understand security in ways that meet this “most prescient challenge” of Anthropocene entanglement? What does it mean to be secure in an entangled world?

This article argues that an epoch defined by and through the action of *anthropos*, the human, does not represent an entanglement of humanity with things, nature, or the Earth. Instead, the Anthropocene illustrates and intensifies a profound separation or *dis*-entanglement of humanity from nature. It replaces what was once the primary and objective concern of security – i.e., survival, or avoiding death – with *anthropos*, the human being, as a new geological and spatiotemporal force to be problematized and secured in both the present and the future. Rather than protecting itself from physical threats in an external world, humanity now subsumes that world by making itself the simultaneous subject/object of security; an Archimedean point. With the catastrophic prognoses for the Anthropocene's future making humanity's temporal, ontological, and epistemological essence uncertain, a paradox forms: an existential discontinuity, in which humanity must secure itself in the future *from* itself in the present.

This “Paradox of the Anthropocene” forms an ontological *in*security that is evinced through the concept of “entanglement” now borrowed from quantum physics and applied to human/nature relations. As noted above, entanglement is commonly used as an expression emphasizing humanity's enmeshment with, and hence its ethical responsibility towards, non-human forms of life and matter. However, although its complex understanding of space, time, and the nature of reality offers a quantum rejoinder to neo-Newtonian or “classical” understandings of physics, upon closer inspection ‘entanglement’ is found to replicate and exacerbate these same classical dynamics within Anthropocene discourses. The atomic scale and nature of “quantum” is so complex that any observation of nature in-itself is impossible, in that any knowledge of quantum always *already* presupposes human interference and

involvement in nature [7]. This implies that security or morality in the Anthropocene cannot be derived from, nor based upon, the mathematical principles of entanglement alone. Rather, it is from humanity’s dis-entanglement – the gap or distance between our mathematical knowledge of entangled phenomena and the social world within which we as humans reside – from which ethics, norms, and values are derived. The danger lies not in promoting and demanding humanity’s ethical responsibility towards nature and Earth – a noble and essential task indeed – but in attributing these ethics to entanglement, thereby forgetting how it is only through a social and human world that forms of security and responsibility are made practicable and thinkable.

This article proceeds as follows: First, it provides a brief overview of how security and entanglement are commonly used and combined in scholarly literature. The Anthropocene’s “entanglement” claims are generally positioned as a new form of human/nature order in response to the destabilization of traditional subject/object binaries that outmoded logics of security were previously grounded upon. Second, it examines how a specific variant of security – “ontological security”, or the existential securing of a continuous sense of self<sup>1</sup> – best exemplifies or situates security discourses surrounding the Anthropocene today. The success of the concept of the Anthropocene is an artifact or product of this profound new ontological (in)security. In an uncertain future, the Anthropocene provides a new ontological certainty and stable understanding of what humans as individuals, *and as a species*, have become: a planetary force [8]. Third, by examining the concept of quantum entanglement in greater detail, this article outlines how its version of *anthropos* is made always already present in a neo-Newtonian guise. By elevating itself to the status of a present *and* future global security problem, the human is neither entangled or entwined with nature, but only with its own classical knowledge *of* nature. Finally, the article concludes by outlining a possible solution to this paradox: to embrace humanity’s *dis*-entanglement from Nature as a social space, within which to recognize and act ethically against humanity’s catastrophic effects on the planet. This requires grasping the quantum lesson that humanity will never be fully enmeshed or entangled with Nature: “Thus even in science the object of research is no longer nature itself, but man’s investigation of nature. Here, again, man confronts himself alone” ([7], p.24).

This article is not intended as a refutation or negation of the science of the Anthropocene, nor is it to detract from valuable attempts at an Anthropocene ethics, nor of post-, trans-, or past-humanisms. It is sympathetic to calls for greater enmeshment with, and understandings of, all forms of life and matter. However, although securing the “safe operating spaces” of our future Anthropocene condition is a laudable and noble goal for natural and social scientists alike, we must be very cautious when adopting or mixing logics and concepts of geology, geophysics, Earth system science, and quantum physics, with the social sciences and security studies (see [9]). The explicit application or enmeshment of disparate scholarly disciplines might conceal implicit conceptual meanings or binaries that ultimately detract from, or skew, the arguments intended therein.

<sup>1</sup> For a small but influential sample of the use of “ontological security” in International Relations and security studies, see Huysmans [17], Mitzen [20], and Steele [45].

## The security condition of the Anthropocene

When asking how security might be incorporated into the condition of the Anthropocene, we are immediately confronted by two questions: what is this “Anthropocene condition”, and what is security? Generally speaking, the Anthropocene is portrayed as a condition of unprecedented discontinuity in Earth’s geologic history; a human-made rupture that breeds immense uncertainty about the future of humanity and the future conditions for all life on the planet. With unpredictable and intergenerational effects, the Anthropocene “is about securing the future,” notes Dalby, “and doing so in terms of managing risk and contingency” on scales as vast as the “remaking” of the biosphere (2013, p. 185). Rather than limiting itself to the traditional tropes of “security” so familiar to disciplines such as International Relations (IR), in which nature and the environment are always tacitly assumed as stable and given background contexts for first-order security conflicts,<sup>2</sup> in the Anthropocene condition “[i]nsecurity is now a geological matter, not a matter of just biology or ecology in a given set of natural circumstances” ([10], p. 3). Bringing the Anthropocene into security is thus intended to create something new:

Security comes from being more connected, not less. Gone are the days of billiard ball states and national security based on keeping the Other out or deterred. . . . We cannot survive without accepting the cosmopolitan and enmeshed nature of this world. We are an array of bodies connected and interconnected in complex ways that have little to do with nationality. ([11], p. 502)

In other words, the scale and complexity of the Anthropocene demands that scholars and their security discourses abandon outdated statist assumptions of bounded, competing, rational, atomistic units and bodies. “Security” in the new Anthropocene condition is framed as moving beyond specific referent objects and physical threats, to the shaping of a new Earth system and human condition. This is not just post-IR, a focus on complexity theory, or the politicization of ecology, but it is *post-human*; an epoch in which everything is more enmeshed and interconnected than ever previously imagined. Longstanding boundaries of subject/object, human/nature, and agent/structure, are rendered mutable and transcended [5]. Engaging the Anthropocene in light of this paradigm shift, therefore, studies of security are told to become more interdisciplinary and holistic, as participants in an ongoing engagement that grapples with things, scales, temporalities, and interconnections previously overlooked or unthinkable when objectifying the ‘high-politics’ of physical survival, interstate war, and violent conflict. It is thus deemed as both the goal and the nature of security in the Anthropocene to reconceptualize this newfound consanguinity of life and non-life – and, as highlighted by this special issue! – as a new condition of *entanglement*.

What does “Anthropocene entanglement” mean? “This entanglement does not refer simply to co-existence between humans and the natural world,” stresses Harrington, “but to a deeper type of entanglement, all the way down with other humans, beings, things, and processes. The concepts of self and other fade away” ([5], p. 490). This

<sup>2</sup> For a foundational critique of environmental security, see Deudney [46]. For a more recent critique of security in the Anthropocene, see Fagan [6].

entanglement provides deeper or more essential connections to the world(s) and things of nature, and thus new forms of security must grasp this interconnectedness in order to be effective or relevant as humanity descends deeper into its own epoch.

As planetary boundaries are transgressed [12], and Earth systems continue to change our geopolitical contexts in unpredictable ways,

[t]he advent of a truly entangled socio-physical nature emerges as a reason to radically challenge and rethink the possibility and desirability of unified scientific accounts of environmental change, and to experiment with multiple and situated ways of seeing and acting upon the hybrid world that we now inhabit ([13], p. 215).

To be secure in the new Anthropocene condition, therefore, we are told to recognize that *anthropos* – the human – is always entangled in a myriad of complex spatiotemporal connections, revealed to us through geophysical and geological investigations and Earth system sciences. Safety is secured not simply by avoiding violent physical conflict per se, but by recognizing the shockwaves and ripples in spacetime that entanglement implies, thereby taking steps *today* to remain within “safe operating spaces” and planetary boundaries of tomorrow. “Safety and danger link the logics of security to the practices of everyday life as well as to matters of geopolitical order” ([14], p. 186), and so the Anthropocene demands we now reorient our daily practices to account for the uncertain future of our planet. Indeed, recognizing the “human-made” Anthropocene condition means that it is now up to us to decide upon, and secure, the future conditions of humanity, and life, on Earth.

## **Ontological (in)security and *Anthropos***

If our new “Anthropocene condition” is accepted, then security logics must best ensure the immediacy of physical survival in the present by mediating the uncertainty of planetary conditions in the future. This moves security well beyond a focus on the individual, since if we are entangled with all forms of nature, matter, and Earth, then “the larger picture of an Earth system in transition provides the context within which security now needs to be rethought” ([15], p. 2). The key here is that this systemic and geologic transition – from the stability of the Holocene epoch to the unpredictability of the Anthropocene – is one defined by futures *uncertain*. Try as we may to model and predict the future conditions of the Earth system, no one truly knows how this security picture will actually play out [16]. In the Anthropocene, “[t]here is no stable environment that can be protected or secured”, notes Dalby. There are only “different pathways into what will be different futures, each with pitfalls and difficulties” ([10], p. 16).

With its background Holocene context destabilized, humanity faces an unprecedented situation in determining its own existence. It is asked how it wants to shape the planetary conditions of its future generations, and even of humanity itself. “The Anthropocene confronts us with the condition in which we must redefine the very notion of the human and its freedom. There is, no more, a ‘human condition’ as such” ([11], p. 521). As we erode the immutability of the Holocene’s stable ‘nature’ as our background, so this narrative goes, so we also erode the conditions that stabilize what it

means to be human. The issue becomes, therefore, how security may best be applied to a transforming Earth *and an uncertain human condition*. Achieving security in the Anthropocene involves securing the existential condition of a humanity gone off the rails.

Now, although debates over whether a “human condition” exists as an immutable or malleable component of human nature or social construction are important, they will not be pursued here.<sup>3</sup> Instead, the point is to highlight how the certainty and security of humanity in the Holocene becomes an uncertainty and insecurity of *anthropos* in the Anthropocene. If security is considered as something that defines “our relations to nature, to other human beings and to the self” ([17], p. 31) – security as a discourse that is co-constitutive with a transforming human condition – then the changing and unpredictable conditions of the Anthropocene is perhaps best captured by a concept dealing with the uncertainty of a discontinuous human self: *ontological security*.

Having recently gained traction in IR, ontological security refers not directly to planetary, state, or physical security. Instead, it specifies how social and cultural practices secure the “human condition” by constructing stable identities, routines, and meanings for humans. Understood broadly, ontological security is “a subject’s capacity to uphold a stable view of its environment and thereby ‘go on’ with everyday life” ([18], p. 31). It is the establishment and maintenance of an existentially continuous, stable, and consistent sense of *self*, or one’s being in a world. Today, the “self” is taken as a subjectivity – an “I” – that is certain of its own existence, or that it “is” in being. Yet, what this being is – its ontology – is formed intersubjectively through norms and practices of selfhood and its recognition. “Without ontological security,” writes Zarakol, “the self cannot know where it begins and ends,” and this is a prerequisite for any type of (physical) security because “what is essential to the body (and its survival) can only be defined by the self” ([19], p. 1). It is a security that makes secure and certain what exactly a thinking “I” *is*. Whether thinking of multiple-selves, entangled-selves, or a single subjective “I”, therefore, the point is that there is some “self” doing the thinking.

Only after a self is subjectively secured as what it is – single, multiple, entangled, etc. – may objective dangers to oneself and one’s community, group, or state, then be intersubjectively shared and established as meaningful [20]. As Mitzen argues, even war and conflict may bring ontological security because each can establish a clear sense of self-certainty and routine to which a self can relate, deriving meaning from consistency [20]. Ontological security is thus temporal; derivative of believing one knows what’s coming in the future. Without this stable and secure self from which to engage and act in a world, security becomes amorphous.

How is this ontology of the self shaped by security? For Huysmans [17], ontological security establishes meaning by relating the self to practices of ordering and to objects of uncertainty. These may be described in two ways. First, social order and stability secures a human self by establishing feelings of continuity; by positioning people, practices, and things within a shared social context of repetition and continuation. Secondly, since security is always a strategy aimed at giving and enhancing meaningful *life*, it always mediates and articulates a specific understanding of, and relation to, *death*. Death is the fulcrum around which all meaningful security practices gravitate,

<sup>3</sup> For more on this question, see Hamilton [35].



because it is the ultimate object that security practices aim to avoid. Yet, death remains an ephemeral or abstract concept (it cannot be seen, touched, tasted, etc.), and so it is dealt with by the self and human groupings by concretizing it into specific objects and referents, which are then incorporated into routines and habits. The uncertainty surrounding death is “displaced by concretized dangers, inimical forces ranging from the devil to criminals and rival states” ([17], p. 237). “Security” involves, therefore, not only accounting for the power of other humans to kill, but “a fear of uncertainty, of an undetermined condition... The way to deal with this fear is to objectify death” ([17], p. 235). Explicit acts securing oneself against objective threats, therefore, evince this implicit foundational uncertainty surrounding death, the ultimate security threat.

It should strike us immediately that the Anthropocene dissolves the traditional understandings of both “stable order” and “death” that are the prerequisites for modern forms of ontological security. What it is to be human, and the nature of mortality, are now celebrated as being transformed in this coming planetary epoch where the relationship between humanity, the Earth, and even the future, is made indeterminate and uncertain. As the authors of the recent Planet Politics manifesto declare, “We must face the true terror of this moment... We must be in tension with *status quo* struggles within our disciplines,” so as to foster a revolutionary new global political project ([11], p. 500, 502–503). Naturally, by upsetting (inter)subjective *status quos* of order, and calling for new ideas, stories, myths, and social practices, both the human condition and the security threats it previously normalized within the background context of “everyday” statist geopolitics are upended and transformed. But what replaces the subjective, national, and geopolitical stability of individuals and states acting as agents in structures of international statist order? This is where “entanglement” enters IR and security: “we need to adapt to the world we have created... [while longing for] a future that allows us all to survive and honours our deep entanglement with the planet” ([11], p. 500). By re-placing the uncertain human self in a new entanglement of being(s), the Anthropocene’s all-embracing indeterminacy is matched by an equally complex scientific and quantum system. “The possibility of dialogue, and its accomplishment in many contexts,” notes Rose, “rests in the fact that our situatedness is neither wholly destructive nor wholly beneficial. The multi-species, multi-sited entanglements within which all life is lived give us grounds for action” ([21], p. 130).

Although “entanglement” will be discussed in detail below, the point here is to note how traditional types of human spatiotemporal order – both subjective and objective, spatial and temporal, agent and structure – are upset and transformed by the Anthropocene, provoking an ontological insecurity of how the world operates, how the human self relates to it, and what exactly the individual and collective human condition is to become. “When it is almost impossible to hierarchize threats and when the general impression is that one is in a permanent state of crisis and urgency, trust in the capacity to keep threats at a distance crumbles” ([17], p. 243). In the uncertainty of the Anthropocene, therefore, “entanglement” is ultimately an expression of a new type of relational order that accepts the impossibility of distancing humanity from entangled threats. Here, the certainty of the human self becomes derived from this entanglement.

This leads to a second crucial component of ontological (in)security in the Anthropocene: the epistemological uncertainty surrounding death and its mediation. According to Huysmans, the “driving force of knowledge is a fear of death as the undetermined. In that sense, death constitutes the condition of possibility of

knowledge” ([17], p. 237). This future-unknown, death, congeals into objects that may then be researched and made known, thereby alleviating existential anxieties and insecurities. However, in the Anthropocene it is not death, but *the human self – anthropos* – that is substituted for death as the ultimate “object” of future uncertainty and existential angst. In this human epoch, “what needs to be done, the future of humanity, the potential of technology and the prospects for civilization”, are all up for grabs ([22], p. 2). Traditional understandings of human mortality are displaced by assertions that the Anthropocene bestows upon humanity godlike or Promethean powers to make nature and its own human condition. The Golden Spike replaces Genesis as a new creation narrative, and humanity assumes the power of a God. Earth system scientists confidently declare that it is “an undeniable reality” that “we are taking control of Nature’s realm... becoming the dominant force for change on Earth... Remember, in this new era, nature is us” [23].

If humans *are* nature, and the Anthropocene demands the securing of humanity (and all life) from the unpredictable planetary conditions “we” are “making”, then the aim of security ultimately becomes that of securing oneself *from* oneself. Humanity/nature must be secured from nature/humanity. In the Anthropocene, therefore, the object stoking ontological insecurities and demanding new and unprecedented forms of knowledge to alleviate uncertainty is *anthropos*. Security in the Anthropocene condition is thus humanity entangled not with nature or the planet, but most foundationally, with itself.

This results in what this article calls *the Paradox of the Anthropocene*. For Huysmans, it was a paradox of death that generated the self’s ongoing quest for ontological security. Death is an awkward “non-object” for humans, demanding the most intensive possible reasoning because it is both the ultimate truth (we all die), and the ultimate absurdity (we may externalize and think of death, but we can never truly know it because its arrival ends all cognition and reflection ([17], pp. 236–237)). Simply put, “There is a paradoxical relation between death and knowledge” because knowledge is engendered and driven to know and to secure itself against what is ultimately impossible to know and to secure itself against ([17], p. 237).

In the Paradox of the Anthropocene, the human self becomes the abstract object of knowledge that drives and defeats both reason and security in this paradoxical manner. The future *anthropos* and its world of geologic uncertainty is just as intractable to the self as death. As Wapner notes, “In the Anthropocene, neither nature nor humanity—empirically or conceptually—exists with any kind of independence or certitude. Neither can provide political ground or straightforward guidance on how to conduct our collective lives” ([24], p. 343). Destabilizing our subjective and collective meanings, the Anthropocene proclaims an ultimate truth (we are all human, and we all affect nature in some way that has contributes to this emerging human epoch); and it situates this truth within an ultimate absurdity (we must all rationalize our actions in the present, based upon the actions of humans in the past, so as to adhere to, and fit with, an uncertain and unpredictable future). The profound spatiotemporal uncertainty of not knowing which dangers to confront, which to ignore, and what effect our behavior today ultimately creates in the future (see [20]), results in ontological insecurity.

In an attempt to gain self-certitude in relation to this paradox, the Anthropocene is now mediated through ordering concepts such entanglement. These concepts resituate and make certain or secure our own sense of being in an otherwise indeterminate world



and future. Yet, as will be explored below, the Paradox of the Anthropocene becomes even more evident when asking how the future can be different from the past when we are still conceptualizing it through the same implicit neo-Newtonian logics, technologies, subjectivities, and rationalities, that created the Anthropocene itself.

## The question of Anthropocene entanglement

“Entanglement” is now a popular term that refers to how humanity situates or orders itself in relation to nature and forms of matter in the Anthropocene. As Earth system science highlights humanity’s deleterious impact upon the planet, and creates the spatiotemporal (ontological) insecurities noted above, entanglement offers a way to mediate and understand human/nature or post-human/post-nature relations. With modernity’s binaries problematized and made uncertain, re-conceptualizing humans, beings, matter, and Earth as co-constituted and interwoven, opens space for new political actions and discourses that “honours our deep entanglement with the planet” ([11], p. 500). Rather than being ontologically distinct, therefore, dualities of humanity and nature collapse into a hybrid form that signifies the ‘end of nature’ as it was typically conceived throughout modernity; as the stable background context for IR, security, and our general being in the world [6, 24]. Hence the rise of entangled post-human, trans-human, anti-human, etc., discourses in IR [25].

For instance, recognizing the failures of modernity’s subject/object or human/nature binaries to safeguard the Earth, Instone writes that “The shift to recognizing our entanglements in the imbroglios of the Anthropocene—biodiversity loss, global warming, social injustice—is an important first step” to reconciling our newfound hybridity with the human impacts scarring the planet and our uncertain future ([26], p. 36). Indeed, there are widespread multi-disciplinary uses of “entanglement” in recent literature about the Anthropocene, and each cannot be discussed in the space of this article. So, rather than delve into theories of materialism, posthumanism, or actor-network theory (ANT) (for an overview, see [27]), this article aims to explore it in a different way: by following this special issue’s provocation to conceive of the “genesis” or conceptual foundation of entanglement in quantum physics.

Generally put, quantum entanglement refers to what Einstein once disparaged as “spooky action at a distance”: the ability of particles to instantaneously influence one another regardless of spatial distance, and – as some physicists now argue – regardless of time [28]. How is this conceivable, let alone possible? For Einstein, the “principle of locality” described how the closer separate objects are to one another, the more they can influence one another in a causal sequence. A cause thereby implies local actions and an effect. Entanglement, however, describes *nonlocality*, or how separate particles can influence each other’s “spin” instantaneously, regardless of tiny or massive distances. This nonlocal entanglement is a generalized form of quantum “superposition”, which is a state of complete indeterminacy (as described by the thought experiment of Schrödinger’s cat).<sup>4</sup> Here, think of an object such as an electron existing, but without

<sup>4</sup> Ironically, Schrödinger’s thought experiment was protesting the concept of a cat simultaneously alive and dead in an attempt to discount the quantum superposition of Bohr’s Copenhagen Interpretation of quantum phenomena.

any place or definite position. It does not congeal into one detectable state *until* it is observed, meaning that, prior to observation, *it existed in all and any possible configurations*. In other words, a “quantum superposition is a nonclassical relation among different possibilities, . . . [meaning that] being/becoming is an indeterminate matter”, and thus classical notions of identity, ontology, distance, and time, are undone ([28], p. 251).

For physicists such as Bohr and Heisenberg [7], entanglement illustrated how the formation and existence of the quantum concepts being studied actually depended upon the apparatuses of measurement being used in experiments. Here, no quantum entity has a fixed nature or temporality, but these are only acquired only through a complex entanglement of “the object” and its “agencies of observation” in the measurement process [28]. What quantum entanglement implies, therefore, goes far beyond the simple and classical notion of two or more states/entities/events being intertwined or enmeshed, or a human agent measuring and observing an objective or external world. Instead, it is “a calling into question [of] the very nature of two-ness, and ultimately of one-ness as well” ([28], p. 251). It is the measurement that makes quantum phenomena real or objective, rather than vice-versa.

This is hard to reconcile with IR and security studies, and for good reason. Entanglement is confusing and counter-intuitive because it opposes the classical or neo-Newtonian physics upon which our everyday modes of thinking about science and IR – our metaphysics – rest. Classical and Western (meta)physics tells us that physical objects are individual, bounded, measureable, and calculable; they exist on a linear plane of spacetime, moving from causes to effects that may in fact be predicted if we learn enough about their internal and external causal mechanisms and conjunctions by measuring them. Wendt has recently noted how classical physics shapes the social sciences by determining the world in five ways: as material, separable, defined at micro- *and* macro-levels, responsive to local stimuli or causal forces, and as comprehending behavior according to internal and external forces operating causally on bodies ([29], p. 151–152). So, in order to overcome this mechanistic and classical reading of reality that has resulted in our Anthropocene condition, many scholars now advocate adopting post-Newtonian and non-human centered accounts of (social) reality [30].

Enter quantum physics and entanglement, which offers a drastic break from classical Newtonian physics. Recently, for example, Der Derian [31] has investigated how spooky connections of a networked global media result in spacetime oscillations between virtual and real wars, creating a type of “quantum war”. For Montgomery, a quantum take on security offers the potential to grasp global processes that transcend national boundaries instantaneously, such as cyberspace processes or the local-global components of drone strikes. Like quantum states, he argues, these issues and entities span the globe “potentially even existing simultaneously in multiple spaces or even, like quantum states, acting at a distance” ([32], p. 104). Hence, with global yet simultaneous events transcending local spatialities, IR’s security studies is attempting to scrap notions of independent, discrete, ontological units, for quantum narratives of superpositionality and entanglement.

This brings us to the combination of “security” and “entanglement” in discourses of the Anthropocene. Although entanglement refers to the behavior of particles at the smallest of imaginable quantum levels, it is now used commonly as a metaphor linking

disparate spatialities and entities from micro to macro levels in IR.<sup>5</sup> Declarations of our “entangled Anthropocene condition” thus imply a quantum or paradigm-shifting transition away from classical understandings of localized, mechanistic, and bounded units such as bodies and states, to an understanding of politics and humanity as being as enmeshed with all life systems on Earth. Calls to incorporate geophysical sciences such as Earth system science (ESS) and its popular planetary boundaries model, are indicative of this move to re-conceptualize how security can and will operate: through complex and simultaneous entangled interconnections or intra-actions, rather than the classical buffering of the space(s) between a subject in need of protection, and the external object from which it must be secured.

Upon inspection, however, entanglement does not replace nor re-conceptualize our understanding of security in the Anthropocene. Ultimately, it tacitly embraces neo-Newtonian conceptual foundations that repeat classical scientific and metaphysical assumptions concerning humanity, physical security, and the manner in which a human self represents the Earth spatiotemporally as an object. In other words, entanglement secures the ontological insecurity prompted by the Paradox of the Anthropocene firmly upon Newtonian pillars. This can be argued by examining its relation to time, ESS, and planetary boundaries.

First, consider *time*. The Anthropocene relies upon sciences, epistemologies, and ontologies of a neo-Newtonian and classical understanding of geologic time. As Maslin has recently stressed, the basic concept of the Anthropocene is ultimately dependent upon the geologic sciences and their understanding of a linear stratigraphic history. There is a strict temporal hierarchy of ever-finer hierarchical units or stages (dating from the earliest eon, to the more recent era, period, and finally, ‘epoch’). Basically, “[d]ivisions represent differences in the functioning of Earth as a system and the concomitant changes in the resident life forms” ([9], p. 3). The point here is not to dispute the social construction of these dating practices, nor to ignore their historicity or the fact they were initially constructed by the co-constitution of Victorian sciences and politics imbued with racist and misogynistic understandings about nature and humanity (see [33]). Instead, the point is that, ultimately, the conceptual foundation of the Anthropocene depends upon the measurement and recognition of discrete units of time that must be placed in a temporally linear sequence in relation to the golden spike of *anthropos*, the human. Regardless of its planetary politics, the Anthropocene “revolves around a series of technical and evidential questions about how to determine the boundary of a distinct ‘human’ controlled geological time unit” ([9], p. 9). If there is no geologically and stratigraphically discrete and sedimented linear foundation to the Anthropocene, the concept loses its significance and impact. This raises the question of how an entangled human/nature hybrid can truly form, when its recognition and justification ultimately depends upon hierarchical and classical understandings of discrete temporal measurements, as well as the insertion, identification, and development of humanity and its impacts into a linear geologic timeframe. Rather than non- or a-temporal quantum entanglement, therefore, the conceptual root of the Anthropocene looks more like thin layers of rock, secured as objects in a layered and linear temporal hierarchy determined by the human subject.

Second, and following from this first point, the ESS that brings the Anthropocene into being depends upon complex mathematical computer simulations combining the

<sup>5</sup> For a direct application of quantum physics to social or ‘macro’ phenomena, see Wendt [29].

physics of fluid (thermo)dynamics with economic theory [34]. “Socio-ecological models are built based on our understanding of real-world systems, grounded in physical laws for the biophysical components, and economic theory and observations for the socio-economic system components” ([16], p.332). Although the nature of complexity science and ESS will not be explored here, it is worth considering how these simulations operate: by quantifying nature as grids of small and discrete variables or ‘parameterizations’, which then model “direct cause-and-effect explanations through multivariate statistics of available datasets” ([16], p.332). In short, these models *project* nature outwards through the representational and neo-Newtonian metaphysics noted above, in which every ‘thing’ in nature becomes a calculable coherence of objective forces that are amenable to quantification and simulation (see [35, 36]). Note that these ESS models lack the capacity to parameterize and predict the inexorably unpredictable *social* events and drivers of change, and hence, rational-choice algorithms from “economic theory and observations for the socio-economic system components” are used ([16], p.332). If ESS struggles to integrate society and human behavior into its models, then layering quantum entanglement on top of them appears epistemologically and ontologically incongruous. Rather, it implies that entanglement is a way of ordering the human self in relation to nature, as computed through ESS; through a vague analogy implying the certainty of holism or unity, despite a quantified and representational root.

Although the basics of quantum physics also depends upon statistics and a type of quantum causality to make predictions, “quantum mechanics is incompatible with the view that physical observables possess pre-existing values independent of the measurement context” ([37], p. 259). Nature might be manifested in certain phenomena in the macro world, but conceived through entanglement, these manifestations would be so incommensurable to everyday neo-Newtonian thought that they would be “irreducibly beyond anything we can experience or beyond anything we can possibly conceive of” ([38], p. 1653). In other words, quantum uncertainty rules entanglement in a mind-boggling way, while classical certainty (i.e., causality) rules Newtonian metaphysics so uniformly that today we barely even notice it. Declaring classical sciences and renderings of nature to be “entangled”, therefore, does not actually make them so. It actually masks the certainty of a classical Newtonian causality still working beneath the Anthropocene’s discursive surface. One cannot overcome Western metaphysics simply by reading about how to overcome Western metaphysics, and then asserting it to be so. This only intensifies the underlying conceptual foundations that treat quantum entanglement itself as a concept, tool, or object that can be causally applied to a human subject and its world.

For example, following Maslin, take the concept best framing the effect of humanity upon the Earth system: planetary boundaries ([9], p. 2). These are discrete and quantitative boundaries, units, or limits, within which humanity should operate to achieve a safe space for human development. Notions of quantified “safe” spaces obviously retain the classical Newtonian epistemologies of calculating secure, bounded limits for the “future” of humanity; a predictive orderly security, designed to reduce uncertainty within discrete limits, to ensure survival from chaos outside these spatiotemporal limits. Indeed, humanity must respect the limits of these linear thresholds as “Earth’s ‘rules of the game’ or, as it were, ... the ‘planetary playing field’ for the human enterprise” (Röckstrom et al., 2009). The point here is that ESS and its planetary

boundaries model replicates a Western secular cosmology that works by explicitly measuring the distance *between* an “objective” nature and humanity. Nature is once again placed into a structural numerical box as the background context from which humanity is contrasted in order to make itself secure [34]. As Fagan [6] has noted, an implicit human/nature dualism results from this. Any relation of the environment and security supposedly erasing the boundaries between humanity and nature becomes itself a violent act [6]. In this case, entanglement becomes, therefore, an analogy masking a neo-Newtonian ordering of subject to object that is actually inherent to the ESS, and thus to conceptualizing the Anthropocene. If we were actually entangled, not only should there be no boundaries, but it would be impossible to detect them. This new metaphysical orientation would have to replace or transcend thinkable subject/object binaries, rather than focus on or assert their interdependence or interconnection, which we still see in IR’s security discourses today.

### Security as dis-entanglement?

If the analogy of ‘entanglement’ fails to cohere with the Anthropocene, then why has it gained so much traction? Assertions of entangled human selves attempt to rekindle a sense of agency and order concerning humanity’s relation to nature. It fosters a self-certainty that is otherwise lost in the future world of the Anthropocene’s incalculability and unpredictability. However, as this section argues, rather than an entangled holism it illustrates a profound dis-entanglement that is fueled by the existential uncertainties outlined above. Recognizing dis-entanglement is thus to accept how the Western neo-Newtonian science underpinning the ESS and the Anthropocene remains caught within a representationalist metaphysics that orients our sense of self, and our relation to the world.

Humans are undoubtedly a part of, and drastically affect nature. However, notions of planetary stewardship, responsibility, accountability, enfolding and intimacy, etc., are only one side of the entanglement coin. If we are truly entangled beings along quantum lines, then we cannot *choose* what to be entangled with, or how. We simply *are*. Yet, if this is the case, we must also be equally entangled with death, destruction, catastrophe, guile, etc. And yet despite this, it is stewardship, morality, and ethical responsibility in the Anthropocene that (rightly) rises to the fore of our ethical compass and scholarly debate. Why? If *all* being/matter is entangled, then why the assumption the latter values are somehow intrinsic to us, and the former are reprehensible and should be avoided?

This capacity for ethical and moral reflection about entanglement and human agency as safeguarding or intra-acting with nature highlights humanity’s dis-entanglement. It remains dependent upon the metaphysical gap between the supposedly entangled object or matter, and the self as an ‘I’ or subject actively thinking about this entangled relation. In this gap, socially and politically constructed notions of responsibility and morality are still able to shape how the human self chooses to act ethically. Importantly, these ethical and moral inclinations are not derived from scientific rationalities or quantum physics (see [39], p. 270–71). From the ESS to entanglement, “all quantification in science appeals to our sense of objectivity, but even the most mathematically and computationally sophisticated model will not absolve us of the need for judgment, nor of the need to justify our judgments in human terms” ([40], p. 80). Entanglement,

in-itself – *like all scientific concepts* – is amoral, indifferent, and ethically vacuous. It simply “is” as any mathematical projection “is”. It is *thought* that makes it matter.

The argument here is certainly not to evacuate ethics from the Anthropocene – a frightening thought – but to highlight how claims borrowed from (quantum) sciences belie implicit conceptual limits that affect how they can be thought and enacted. Although sympathetic to arguments calling for greater attention to the interconnections or enmeshments of heterogeneous beings (see [41]), and agreeing with scholars such as Barad and Zylinksa (2016) that ethical reflections – i.e., cultural practices regulating ways of co-existing and co-emerging with others to become *better* in and with the world ([42], p. 93) – are indeed essential to the Anthropocene, this article argues that they cannot arise from entanglement. Indeed, as Heisenberg wrote about quantum phenomena: “Many modern creeds which claim that they are in fact not dealing with questions of faith but are based on scientific knowledge, contain inner contradictions and rest on self-deception” ([7], p. 28). Why contradiction and a deception emanating from the self? As noted above, through the measurement apparatus, all knowledge of quantum entails an implicit human self-projection and representation built into its analyses. We can never know “entanglement” in-itself as an object or concept, but only as a mathematical measurement enacted by a human being and thought in human terms. In other words: “As a final consequence, the natural laws formulated mathematically in quantum theory no longer deal with the elementary particles themselves but with our knowledge of them” ([7], p. 15). Entanglement is always, therefore, grounded on a human observation and projection of itself (its own knowledge), with what is entangled, how, and why. Hence the similarity and congruity with the Paradox of the Anthropocene outlined above, and why entanglement functions as a convenient and synchronous type of order for us today. In explicit claims to entanglement, implicitly, *anthropos* is always still seeing, projecting, and making certain, its own self.

This does not mean we should abandon hope for an Anthropocene ethics, however. True, entangled particles do not have agency; they simply are/not depending upon how they are affected through a measurement apparatus. Yet despite being enmeshed in nature, dis-entangled humans *do* have the capacity for choice, judgment, and agency. Humans inexorably reside in a social and political world of historical and cultural norms and practices, of which, today, science and subjectivity are essential parts. We can and now must choose how to act responsibly as human agents as we enter into a future of grave environmental instability.

The potential for the re-establishment of ontological security in the face of the Paradox of the Anthropocene, therefore, could perhaps reside in an ethos of a dis-entangled self, aiming at what scholars such as Mitchell [43] have described as cosmopolitics: an openness towards multiple (yet differentiated) beings that are affected by our political choices or actions. Indeed, a routine identification and acceptance of the ethical responsibility of one’s dis-entangled being as an agential part of nature, and thus its responsibility to safeguard and improve the planetary conditions sustaining all forms of being, could still provide a form of order mediating the Paradox of the Anthropocene. In a discipline such as IR, where security is a key concept, the point is to remember the inexorably historical and political struggles shaping the nature and hence the importance of this ethical responsibility [44]. The gap opened by dis-



entanglement is therefore not a refutation or disparagement of Anthropocene ethics, but the space within which calls to act ethically may be routinely analysed and pursued. “Armed with ontological security, the individual will know how to act and therefore how to be herself” ([20], p. 345).

## Conclusion

This article has argued that the Anthropocene fosters a new form of ontological insecurity: a Paradox of the Anthropocene. In this human-made epoch, faced with an unprecedented spatiotemporal discontinuity and uncertainty in a geological timescale, *anthropos* replaces death as the ultimate object of uncertainty and knowledge. Humans are told to secure their present/future self *from* its future/present self. In response, many scholars now use the quantum concept of “entanglement” as a way to order this new relation of *anthropos* to nature. Entanglement implies ontological certitude in otherwise uncertain times: epistemologically, to know more about humanity’s enmeshment with nature is to know more about oneself. Ontologically, if humanity is coeval with nature and is mineralized into geologic strata, then the existential uncertainty surrounding human space, time, and mortality, is also reduced. Ethically, humans are individually and collectively responsible and accountable for the past and the future of the planet.

Upon analysis, however, the quantum implications of “entanglement” are irreconcilable with the classical and neo-Newtonian foundations upon which the Anthropocene is grounded. Ultimately, entanglement discourses rely upon a thinking and acting human “I”, still caught within a Western secular cosmology, measuring subjects against objects. Although it is used as an effective analogy and a desirable ethical aspiration, the danger here is forgetting the representationalist metaphysics still undergirding entanglement in this Paradox of the Anthropocene. This risks entrenching it further, albeit under other names or theories. Upon deeper inspection, therefore, the entangled self – *anthropos* of the ESS – is still projecting and seeing only itself, relating a calculating human subject to every single referent it can cognate. As such, it is hoped that recognizing the ethical and agential possibilities emerging from the grasping of ourselves as dis-entangled from nature and Earth, that a more accountable and responsible *anthropos* can emerge. We can take lessons from quantum science and entanglement, but it is in our inability to become it – our dis-entanglement – that an ethics derived from the context of our political and social world can and must spur us to act.

**Acknowledgements** My many thanks go to Emma, Cameron, and Clifford for their kind invitation to contribute to this Special Issue, and for their excellent comments and suggestions along the way. I also thank Iver B. Neumann, and the participants on the panel “The Power of Framing and Discourse: the Anthropocene and Images of the Future” at the 58th International Studies Association (ISA) 2017 conference, for their suggestions on an earlier draft of this paper.

**Open Access** This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

## References

1. Kahn, B. (2016). September, 17. In *Earth's CO2 passes the 400PPM threshold – Maybe permanently*. Scientific: American <https://www.scientificamerican.com/article/earth-s-co2-passes-the-400-ppm-threshold-maybe-permanently/>. Accessed 27 October 2016.
2. Ceballos, G., Ehrlich, P. R., Barnosky, A. D., García, A., Pringle, R. M., & Palmer, T. M. (2015). Accelerated modern human-induced species losses: Entering the sixth mass extinction. *Science Advances*, 1(5), 1–5. doi:10.1126/sciadv.1400253.
3. Scripps Institution of Oceanography. (2015). *Earth Has Crossed Several “Planetary Boundaries,” Thresholds of Human-Induced Environmental Changes*. <https://scripps.ucsd.edu/news/earth-has-crossed-several-planetary-boundaries-thresholds-human-induced-environmental-changes>. Accessed 15 September 2016.
4. Biermann, F. (2014). *Earth system governance: World politics in the Anthropocene*. Cambridge: The MIT Press.
5. Harrington, C. (2016). The ends of the world: International relations and the Anthropocene. *Millennium: Journal of International Studies*, 44(3), 478–498.
6. Fagan, M. (2016). Security in the anthropocene: Environment, ecology, escape. *European Journal of International Relations*, (online) 1–23. DOI: 10.1177/1354066116639738.
7. Heisenberg, W. (1958). *The Physicist's conception of nature*. London, UK: Hutchinson & Co. Publishers.
8. Chakrabarty, D. (2009). The climate of history: Four theses. *Critical Inquiry*, 35, 197–222.
9. Barry, A., & Maslin, M. (2016). The politics of the anthropocene: A dialogue. *Geo: Geography and Environment*, 3(2), e00022, 1–12.
10. Dalby, S. (2015). Anthropocene formations: Environmental security, geopolitics and disaster. *Theory, Culture & Society*, 34(2–3), 233–252.
11. Burke, A., Fishel, S., Mitchell, A., Dalby, S., & Levine, D. J. (2016). Planet politics: A manifesto from the end of IR. *Millennium: Journal of International Studies*, 44(3), 499–523.
12. Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H., Nykvist, B., De Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R. W., Fabry, V. J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P., & Foley, P. J. (2009). Planetary boundaries: Exploring the safe operating space for humanity. *Ecology and Society*, 14(2), 32 <http://www.ecologyandsociety.org/vol14/iss2/art32/>. Accessed 10 May 2017.
13. Löwbrand, E., Beck, S., Chilvers, J., Forsyth, T., Hedrén, J., Hulme, M., Lidskog, R., & Vasileiadou, E. (2015). Who speaks for the future of earth? How critical social science can extend the conversation on the Anthropocene. *Global Environmental Change*, 32, 211–218.
14. Dalby, S. (2013). Biopolitics and climate security in the Anthropocene. *Geoforum*, 49, 184–192.
15. Dalby, S. (2014). Rethinking geopolitics: Climate security in the Anthropocene. *Global Policy*, 1(5), 1–9.
16. Verburg, P. H., Dearnig, J. A., Dyke, J. G., van der Leeuw, S., Seitzinger, S., Steffen, W., & Syvitski, J. (2016). Methods and approaches to modeling the Anthropocene. *Global Environmental Change*, 39, 328–340.
17. Huysmans, J. (1998). Security! What do you mean? From concept to thick signifier. *European Journal of International Relations*, 4(2), 226–255.
18. Browning, C. S., & Joenniemi, P. (2016). Ontological security, self-articulation and the securitization of identity. *Cooperation and Conflict*, 52(1), 31–47.
19. Zarakol, A. (2016). States and ontological security: A historical rethinking. *European Journal of International Relations*, 1–21. DOI: 10.1177/0010836716653158.
20. Mitzen, J. (2006). Ontological security in world politics: State identity and the security dilemma. *European Journal of International Relations*, 12(3), 341–370.
21. Rose, D. B. (2015). Dialogue. In K. Gibson, D. B. Rose, & R. Fincher (Eds.), *Manifesto for the Anthropocene* (pp. 127–132). Brooklyn, NY: Punctum Books.
22. Dalby, S. (2016). Framing the Anthropocene: The good, the bad and the ugly. *The Anthropocene Review*, 3(1), 33–51.
23. Crutzen, P. J., & Schwägerl, C. (2011). Living in the Anthropocene: Toward a new global ethos. *Yale Environment*, 360 [http://e360.yale.edu/feature/living\\_in\\_the\\_anthropocene\\_toward\\_a\\_new\\_global\\_ethos/2363/](http://e360.yale.edu/feature/living_in_the_anthropocene_toward_a_new_global_ethos/2363/). Accessed 18 April 2017.
24. Wapner, P. (2014). The changing nature of nature: Environmental politics in the Anthropocene. *Global Environmental Politics*, 14(4), 35–54.

25. Kuehls, T. (1996). *Beyond sovereign territory: The space of Ecopolitics*. Minneapolis: University of Minnesota Press.
26. Instone, L. (2014). Dialogue. In K. Gibson, D. Bird rose, & R. Fincher, (Eds.), *Manifesto for Living in the Anthropocene* (pp. 127–133). Brooklyn, NY.: Punctum books.
27. Hodder, I. (2014). The entanglements of humans and things: A long-term view. *New Literary History*, 45(1), 19–36.
28. Barad, K. (2010). Quantum entanglements and Hauntological relations of inheritance: Dis/continuities, SpaceTime Enfoldings, and justice-to-come. *Derrida Today*, 3(2), 240–268.
29. Wendt, A. (2015). *Quantum mind and social science: Unifying physical and social ontology*. Cambridge: Cambridge University Press.
30. Cudworth, E., & Hobden, S. (2013). Complexity, ecologism, and posthuman politics. *Review of International Studies*, 39(3), 643–664.
31. Der Derian, J. (2013). From war 2.0 to quantum war: The superpositionality of global violence. *Australian Journal of International Affairs*, 67(5), 570–585.
32. Montgomery, A. H. (2016). Quantum mechanisms: Expanding the boundaries of power, space, and time in global security studies. *Journal of Global Security Studies*, 1(1), 102–106.
33. Moore, J. M. (Ed.). (2015). *Anthropocene or Capitalocene? Nature, history, and the crisis of capitalism*. Oakland, CA: PM Press.
34. Dahan, A. (2010). Putting the earth system in a numerical box? *The evolution from climate modeling toward global change. Studies in History and Philosophy of Modern Physics.*, 41, 282–292.
35. Hamilton, S. (2016). The measure of all things? The Anthropocene as a global biopolitics of carbon. *European Journal of International Relations*, (online) 1–25. DOI: [10.1177/1354066116683831](https://doi.org/10.1177/1354066116683831).
36. Heidegger, M. (1977). *The question concerning technology and other essays*. New York: Garland Publishing, Inc..
37. Brickner, C. (2014). Quantum Causality. *Nature Physics*, 10, 259–263.
38. Plotnitsky, A. (2003). Mysteries without mysticism and correlations without Correlata: On quantum knowledge and knowledge in general. *Foundations of Physics*, 33(11), 1649–1689.
39. Arendt, H. (2006). *Between past and future: Eight exercises in political thought*. New York: Penguin Books.
40. Oreskes, N. (2000). Why believe a computer? Models, measures, and meaning in the natural world. In J. S. Schniederman (Ed.), *The earth around us: Maintaining a livable planet* (pp. 70–82). San Francisco: W.H. Freeman.
41. Mitchell, A. (2015). Thinking without the ‘circle’: Marine plastics and global ethics. *Political Geography*, 47, 77–85.
42. Zylinska, J. (2016). *Minimal ethics for the Anthropocene*. Ann Arbor, MI: Open Universities Press.
43. Mitchell, A. (2016). Beyond biodiversity and species: Problematizing extinction. *Theory, Culture & Society*, 33(5), 23–42.
44. Neumann, I. B. (2014). International relations as a social science. *Millennium: Journal of International Studies*, 43(1), 330–350.
45. Steele, B. J. (2008). *Ontological security in international relations: Self-identity and the IR state*. London: Routledge.
46. Deudney, D. (1990). The case against linking environmental degradation and National Security. *Millennium: Journal of International Studies*, 19(3), 461–476.