

Anthropocene Ecologies: Biogeotechnical Relationalities in Late Capitalism

Dagmar Lorenz-Meyer, Cecilia Åsberg, Christina Fredengren, Maris Sõrmus, Pat Treusch, Marja Vehviläinen, Eva Zekany and Lucie Žeková

Abstract

This position paper outlines a multidirectional approach to what we call Anthropocene ecologies, its diverse genealogies, and methodological and conceptual foci. Under the heading of Anthropocene ecologies we seek to fertilize the sciences of ecology with approaches of queer and feminist new materialisms, and engage in multiple collaborations across the humanities, sciences, and everyday ecological practices. Specifically we draw on ecology as the object of analysis and the methodology, building on concepts and approaches from the sciences, material feminisms, science and technology studies, human/animal studies and material ecocriticism. Five modes of attention become particularly salient for our analysis of the Anthropocene ecologies of solar energy, human-animal relations, organic food production, wetlands, and human-robot relations. First we attend to how these ecologies are generated within and affect the webs of *multispecies ecologies* in late capitalism. Second we suggest the concept of *biogeotechno-power* to capture the entanglements of the biological, the geologic and the technological in new formations of power that invest, regulate, enhance, and dispose of (more-than-)human bodies in particular ecological relationalities. Third we examine the multiplicities of ecological temporalities, including the *deep time* of mineralisation, fossilisation and past and future species survival. Fourth we attend to *affect* as an entangling force in ecological relations. And fifth we investigate an affirmative posthuman ethics of concern and response-ability in relations with living and nonliving materialities that might *not* be close by (spatially and/or temporally). Anthropocene ecologies thereby include the technical, informational, temporal, affective, and ethical *as integral parts of* ecological intra-actions, and remain attuned to the differential, paradoxical and unexpected.

Keywords: Anthropocene, affect, biogeotechno-power, capitalism, deep time, ecological assemblages, etho-ecologies, media ecology, multispecies relations, natureculture, posthuman ethics

Introduction

The unprecedented environmental changes and challenges of climate change, energy crisis, species extinction, unsustainable agriculture, toxic waste and other planetary degradation make palpable the inextricable entanglements of human, nonhuman, nature and culture. In the epoch referred to as the Anthropocene, human activities significantly impact on geological, biotic and climatic processes (Crutzen and Stoermer 2000). This working group explores some of the complexities at stake in what we call *Anthropocene ecologies*. A point of departure are concerns that the notion of Anthropocene singles out an undifferentiated huMan at the expense of examining historically specific biogeotechnical assemblages of interacting terraformers (Haraway 2015; Moore 2014; Yusoff 2013); that people in late Capitalism are ill-equipped with the mental, emotional and imaginary repertoires for dealing with the spatiotemporal scales of these phenomena (Stengers et al. 2008; Latour 2014; Charkrabarty 2012) and that these concerns have remained depreciated research and policy priorities (e.g. Neimanis, Åsberg and Hedrén 2015).

Under the heading of *Anthropocene ecologies* we seek to fertilize the science of ecology with approaches of queer and feminist new materialisms, and engage in multiple collaborations across the humanities, social, natural and technosciences, and everyday ecological practices. More precisely, we draw on ecology as the object of analysis and the methodology for conducting interdisciplinary research. Thus, we consider ecology as a highly productive vantage point to study the interrelations or intra-actions (Barad 2007) between different – human and more-than-human – agents, materialities and broader economic and political environments through a collaborative, interdisciplinary approach.

Genealogies of Naturalcultural Ecologies

Denoting the dynamic interactions of living forms with their environments, ‘including, in the broad sense, all the “conditions of existence”’ *Oecology* (Haeckel 1866, 286) (from Greek *oikos* ‘house, habitat’) has an interdisciplinary impetus. Humboldt and Bonpland’s observations and measurements of the structure and composition of vegetation, animals, and cultivation in relation to the physics and chemistry of the atmosphere in the Andes, advocated a science that ‘can progress only by individual studies and by connecting together

all the phenomena and productions on the surface of the earth... dealing with modifications of matter' (Humboldt and Bonpland [1807] 2013, 214). *Interrelations* became the 'first principle' (Odum [1953] 2013) of the science of ecology that explored the mutual constitution, the intense flows of energy and mineral nutrients within and between 'ecosystems' that have no pre-existing boundaries (Tansley [1935] 2013). While ecology is often equated with a functionalist system science (e.g. Schrader et al. 2015), ecological scientists have paid increasing attention to disruption, friction and resilience. According to Holling, for example, ecosystems are 'continually confronted by the unexpected, [so that] the constancy of [their] behaviour becomes less important than the persistence of the relationships' (Holling [1973] 2013, 245). This entails 'not the presumption of sufficient knowledge, but *the recognition of our ignorance*, not the assumption that future events are expected but they will be unexpected' (p. 255, emphasis added).

What distinguishes ecology from the classical sciences is that it includes humans in its remit. Thus, ecological scientists have long urged that 'ecology must be applied to conditions brought about by human activity' (Tansley [1935] 2013, 228). The recognition that humans are 'part of complex "biogeochemical" cycles' (Odum 2013) also gave rise to ethical considerations *in* the work of ecological scientists, for example in terms of effecting a shift from 'the present day concept of "unlimited exploitation of resources" ... to the "unlimited ingenuity in perpetuating a cyclic abundance of resources"' (Odum 2013, 235).

Ecological thought has further travelled into and been developed within the social sciences and humanities. Drawing on cybernetics Bateson fleshed out an 'ecology of mind' where mind is not confined to an isolated organism but 'immanent also in pathways and messages outside the body' (Bateson 1972, 488), that is, in the structures of human relationships, society and ecosystems. 'Ecology, in the widest sense', Bateson wrote, 'turns out to be the study of the interaction and survival of ideas and programs (i.e. differences, complexes of differences etc.) in circuits' (1972, 489). Analytical units of 'informational and entropic ecology' thus have to encompass relevant pathways. Building on Bateson, Guattari's *The Three Ecologies* calls for 'learning to think transversally ([1989] 2000, 43) in terms of an 'ethico-political articulation' – or 'ecosophy' – of the ecological registers of environment, social relations and human subjectivity in order to tackle the global ecological crises of 'Integrated World Capitalism'. Social ecosophy contributes to rebuilding human relations by

activating new practices of ways of living ‘on a microsocial [and] institutional scale’ (2000: 35); mental ecosophy inspires new relations of subjects to bodies and aesthetic creations that open up different becomings; and environmental ecology activates new initiatives for restoring and reinventing the environment. These ecologies are partially connected, and embody an eco-logic that is concerned with creative and relational process, and experimental praxis.

Within science and technology studies (STS), Star has suggested to study science and technology *as* ecological. Similar to Stengers (2005) ecology of practice, this is a move to ‘refuse social/natural or social/technical dichotomies’ (Star 1995, 2), and to understand *all* the components that make up a particular system or ‘webbing location’ (1995, 20) without recurring to functionalist or organicist frameworks. For Star, a recursive and reflexive ecological approach ‘confront[s] head-on questions of scale, of boundary drawing, and of mystifying science and technology, *as well as* questions of race, sex, and class’ (1995, 14). It also entails thinking ‘matter as ... the rearranging of space time configurations... [whose] rhythm and speed derive from its context’ (1995, 19, 18). As Puig de la Bellacasa (forthcoming) puts it, in contrast to prevailing network metaphors, ecology focuses on ‘the *power of relation-creation*, by what and how the different participants affect to each other, their *poesis*... An ecology ... evokes a site of intensities, synergies and symbiotic processes within relational compounds’ (emphasis added), as well as finitude and renewal.

Drawing on these and other new materialist genealogies, including ecofeminism, cybernetics and ecocriticism, the working group examines the Anthropocene ecologies of solar energy, human-animal relations, food production and consumption, wetlands and water, human-robot relations, and more, taking into account different positionalities and ontologies (Blaser 2013; Verran 2002). It does so in ways that empathically include the technical, informational, temporal, affective, and ethical *as integral parts of* ecology, and remains attuned to the differential, paradoxical and unexpected.

Ecologies as a Methodology

With a new materialist take on ecology the working group contributes to research methodologies for studying ecology through the material-discursive practices of ecological actants. These methodologies include concepts and approaches from material feminisms,

science and technology studies, human/animal studies and material ecocriticism. One important analytical tool of new materialist methodologies, as well as our working group, is *situated knowledges* (Haraway 1988) that advocates an account of knowledge production that is always embodied and located, but not restricted to localities, and accountable to how 'we' are always already implicated within the ecological. Situated knowledges make salient the material-semiotic agency of 'objects', unstable *boundary drawings*, and their constitutive exclusions (also Star 1995; Barad 2007). Another important tool for examining different mattering practices (Law 2009) is the concept/methodology of *transcorporeality* that suggests following 'the interconnections, interchanges and transits between human bodies and nonhuman natures' (Alaimo 2010). *Intersectionality* (Crenshaw 1989; Lykke 2010) foregrounds the analysis of inequalities and power asymmetries through integrated feminist, anti-racist, anti-colonial, queer and bio- or earth-centric frameworks (Plumwood 2003; Neimanis 2012). Here, important bridges are built to environmental justice, regional development and decolonizing work (e.g. de Chiro 2008, Gibson-Graham 2011; Nixon 2011). As Verran has argued in view of different commitments to ontological 'things' of indigenous people and environmental scientists, 'what we need is not meta-sameness but "infra-sameness", a sameness that is good enough merely for a few here-and-nows... "sameness" that enables difference to be collectively enacted, that expands collective imagination' (Verran 2002, 750, 730).

New materialist methodologies thereby include tools and concepts from STS, *environmental humanities* (Oppermann 2013a; Åsberg 2014) and *material ecocriticism* (Iovino and Oppermann 2014; Sörmus 2014), which contribute to developing a non-anthropocentric concept of *posthuman agency and affect*. The basis for a material ecocritical view that innovates new materialism with a literary-ecological perspective is, on the one hand, the connection of matter and agency, and on the other, the interactions of bodies and meanings (both human and more-than-human), with attention on bodily experience. Material ecocritics propose an understanding of storied matter, claiming that matter is thick with stories and meaning, 'teeming with countless narrative agencies that infiltrate every imaginable space and make the world intelligible' (Oppermann 2013b, 57): matter becomes 'a site of narrativity' (ibid.), exhibiting creativity and expressiveness. These emerging fields

thereby contribute ‘to re-frame global environmental change issues fundamentally as social and human challenges, rather than just environmental issues’ (Palsson *et al* 2011, 5).

The following five interrelated modes of attention are particularly salient for researching and intervening in Anthropocene ecologies: multispecies relations, biogeotechno-power, deep time, affect, and posthuman ethics. We briefly outline these in turn.

Multispecies Ecologies

With their focus on relational emergence and intra-acting phenomena of naturecultures, Anthropocene ecologies examine a ‘becoming with many’ (Haraway 2003) that takes place in intra-acting relations of material-discursive practices. These relations are historical, impure, complex and often asymmetrical, involving partners in becoming that do not precede their relating (Haraway 2008; Kirksey and Helmreich 2010; Livingston and Puar 2011). Importantly multi-, inter- and companion species approaches to ecology suggest a focus not primarily vertically on descent and reproduction but horizontally on practices and relations of contact, care, contagion, and indigestion in ways that are attentive to power and politics. What is delineated as a species including humans is co-constituted by many others, companions, such as micro-organisms and bacteria, as well as what are often considered technical prosthesis; they are “coshapings all the way down, in all sort of temporalities and corporealities’ (Haraway 2008, 164). In fact companion species often *are* biotechnologies of particular breeding practices, intimately intertwined with global techno-economic systems. As Haraway has succinctly put it, they ‘designate webbed bio-social-technical apparatuses of humans, animals, artefacts, and institutions in which particular ways of being emerge and are sustained. Or not’ (2008, 134). These formulations call up the cyborg as one prominent figuration of entangled naturecultures that can be regarded as ecologies of emergence. Situated knowledges in their sensitization for the material-discursive character of knowledge production combine located, embodied knowing and knowing about relations within multispecies ecologies.

Specifically, the working group examines how ecological change initiatives, such as solar energy installations, organic agriculture, food production, and socially assistive robots, are generated within and affect the webs of multispecies ecologies (Vehviläinen 2013; 2014; Žeková 2014). How for example does the fragmentation of bodies that live within another or

the co-production of bodies reconfigure subject/object boundaries and conceptions of agency? And how do promises of human-computer symbiosis or an energy commons tie in with capitalist logics of exploitation and gendered re/production (Treusch 2015; Lorenz-Meyer 2015)?

BioGeoTechno-Powered Ecologies

Anthropocene ecologies explicitly challenge the view that technoscientific artefacts stand outside the power of ecological relation-creation in postindustrial capitalism or constitute mere supplements or prostheses of (more-than-human) natures. Rather they consider technology, humanity and nature as ontologically entangled (condensed in the notion of *Capitalocene* (Moore 2014; forthcoming; Haraway 2015)) and forefront ‘a necessary contamination of the living by the non-living, of the natural by the technical, of *physis* by *techné*’ (MacKenzie 1999). (BioGeo)Technology is broadly conceived as ‘an accelerating reorganisation, or refolding of matter, living and non-living’ bodies in sequences of events’ (1999, 108) that coproduces ‘new kinds of bodies’, embodied capacity (Muenster 1999), and economic, cultural and metabolic regimes. The concept of *ontological technicity* has been suggested for examining technology’s forces, efficacy and operative functioning in entangling humans and nature (Hoel and van der Tuin 2013).

We suggest the concept of biogeotechno-power as an umbrella term to capture the entanglements of the biological, the geologic and the technological in new formations of power that invest, regulate, enhance, and dispose of human and more-than-human bodies in particular ecological relationalities. The concept builds on the Marxist legacy of thinking technology and capitalism in tandem, and extends the Foucauldian notion of biopower through recent insights rendered by cultural geography and media ecology. For Marx technological change was a means of increasing surplus value, and instituting new ways in which human bodies could be put to use in the service of economic structures. Biopower after Foucault focuses on the constitution of ‘the species body’ (Foucault [1976] 1990, 139) through the administration of bodies, and the optimisation of forces and aptitudes ‘at the level of life itself’ (1990, 143). Through measuring, qualifying and hierarchizing life, biopower effects distributions around the norms of health, production and reproduction, increasingly on a molecular scale (Rose 2007). Geopower, likewise bound up with modern

capitalism, could be conceived of as harnessing, intensifying and managing the powers of the *geos*. Human collaboration with fossil fuels, for example, propelled societies into a new energetic metabolism (Mitchell 2009) and shaped the earth's climate as well as human bodies and subjectivities. As Yusoff (2013) has put it 'these fires of combustion that underpin modernity – the energy, the heat, the vital materialism – are irreducibly part of what it is to be human in this moment.' Media ecology turns attention to the (deep-time) mattering processes of (information) technologies, given that 'relations with the earth are mediated through technologies and techniques of visualization, sonification, calculation, mapping, prediction, simulation, and so forth: it is through and in media that we grasp earth as an object for cognitive, practical, and affective relations' (Parikka 2015, 12; Maxwell *et al* 2014).

Three processes are salient for the development and analysis of biogeotechno-power in and of Anthropocene ecologies. First, the working group investigates how particular bio- and geonorms inform the design of new classes of ecological 'devices', such as solar installations, socially assistive robots, or organic cows, and with what effects for everyday practices and gender and capitalist re/production. Second, we examine how bio- and geotechnologies, engineering and reproductive technologies modulate life beyond the human, e.g. in the constitutive norms and regulations of health and reproduction of livestock and its nutritional ecologies. Third, we explore the ecological mattering processes of particular sociotechnical and information technologies through which biogeotechno-power is enacted. Here Parikka (2012) reminds us that the fibres, metals and minerals that compose media technologies and other sociotechnical devices become 'dirty matter' when discarded as noxious waste that leaks into waters, soils and air, affecting the nervous systems and organs of nonhuman animals and workers (often in the global South). These bodies too are open materialities involved in flows of social, economic and political forces (Zekany 2014). Biogeotechno-power acts on them, as they themselves take part in its workings.

Deep-Time Ecologies

At least since the 17th century geological investigations have exposed a 'deep-time' (Hutton 1788) beyond the presence of humans on earth that queried a simple correspondence

between human observations, history and the world (Chakrabarty 2009; 2012). A particular challenge for Anthropocene ecologies is attending to the multiplicities of ecological temporalities, including the *longue durée* of climate, mineralisation, fossilisation and sedimentation, and the genealogies, and modes of future and past survival of species. The mattering of topsoil, for example, has occurred over two thousand years in biogeochemical relations where a number of different agents and practices collaborate. But rather than multigenerational and multispecies commonage, soil in late capitalism is being treated as a commodity, to be owned, used and managed by humans (Dent 2014). And organic materials that decomposed as fossil fuel over hundreds of million years are being burned within a span of a few generations, in ways that effect the planet and its climate for hundreds of thousands of years (Chakrabarty 2012).

Importantly, while practices of classical geology, archaeology and palaeontology have contributed to the creation of linear time, and the ordering cause and effect, through tracing sedimented geological strata, fossils or the remains of human artefacts, they are also troubling ideas of temporal linearity and progress that underpin capitalist ideas of development and underdevelopment. Archaeological activities, for example, are part of ongoing materialization processes, where old objects and substances through excavation are brought into circulation in the present, albeit in new circumstances and contexts (Fredgensen forthcoming). The excavation of a cemetery thus brings the material remains of bodies into being in the present, and enables an altered narrative of the past, which in turn creates alternative presents and futures. Vertebrate bodies themselves are a form of (re)mineralisation in cycles of organisms taking up minerals, the formation of bone and their disintegration in geologic dust (Yusoff 2013).

Anthropocene ecologies examine how both pasts and futures are under constant change, incessantly trickling into each other, where ongoing materialisation processes both structure and emanate in the webs of past-present-future (Fredengren 2013). Particular attention is paid to examining how deep-time materialities work through bodies with ongoing transcorporeal and worlding effects (Yusoff 2013, LeMenager 2014; Fredengren and Åsberg in prep.) and how encounters with deep time might be a way of mobilising for ethical action and constitute vistas of resistance that throw a spanner into the works of late capitalism (Fredengren 2002).

Affective Ecologies

Anthropocene ecologies further examine affect as an entangling force in ecological relations. Here scholarship in material ecocriticism and feminist science studies has developed the concept of posthuman affect, which understands more-than-human nature as sensuous and draws attention to pleasure, play, and improvisation in interspecies relations. In an eco-phenomenological perspective, Abram has pointed out that human awareness and feelings arise from the encounter of the human body with an expressive more-than-human world: 'We live immersed in intelligence, enveloped and informed by a creativity we cannot fathom' (Abram 2010, 129). The nonhuman world is expressive and sentient, highly agentic and alive. In a feminist science perspective, an approach of affective ecology to orchid-bee interactions and their chemical ecology attends to 'the excitability of plant tissues' that actively alter their anatomies in affectively charged, multisensory partnership' (Hustak and Myers 2012, 78). Advocating a 'reading with our senses attuned to stories told in otherwise muted registers' Hustak and Myers show how the chemical communication of plants is 'a kind of vocality, a way of speaking in a chemical vocabulary' (2012, 100), and how scientists like Darwin have entered into sensory partnerships with plants and other organisms.

Affective ecology is further attuned to the role of affect in the circulations and reconfigurations of biogeotechno-power. Here it attends to the hopes, energies and pleasures of ecological interventions such as 'the multiple circulations of desire that frame electronic media devices as part of post-Fordist capitalism' (Parikka 2012). Other new materialist thinkers have suggested the concept *ecologies of sensation* to draw attention to how (information) technologies modulate sensation along gradients of intensity in terms of their capacities to affect and be affected (Rai 2009). This not only provides a new focus on embodied subjectivities, sensorium and sociality, but also enables a refiguration of binary conceptions of class, sexuality or dis/ability in terms of differential affective tendencies and the ability to affect 'switchpoints of bodily capacity' in others (Puar 2012). Hickey-Moody (2015) has explored the potentiality of performative arts to kinaesthetically engender new ecologies of sensation that evoke curiosity, desire, and awe and open up new ways of being.

Affectivity thereby becomes an indicator of lively intra-relations that are constitutive of a specific phenomenon. More precisely, tracing affects in the emergence of phenomena allows a mapping of ecologies of a mutual co-constitution on many scales. In this sense, ecology becomes a concept to think ‘forces, particles, molecules, human and non-human affect, sensations, things that affect these, and more – all in dynamic relations’ (Bell 2012, 114) as the heterogeneous context that co-constitutes elements and their environments.

Etho-Ecologies

Together with the analyses of the processes outlined above, Anthropocene ecologies investigate emerging ecological ethics – or etho-ecologies (Stengers 2005; 2008) – particularly in view of a situated and affirmative posthuman ethics of concern, responsibility and care (cf. Haraway 2011; Neimanis *et al* 2015; Iovino and Oppermann 2012). In a new materialist ecological vein, we consider ethics not primarily as a matter of humans following certain moral principles that stand above or before everyday techno-ecological practices. Rather, practices are ‘always already’ ethical doings (Puig de la Bellacasa forthcoming). Ethicality emerges relationally in and as-intra-action – there is no ‘I’ that precedes the ethical intra-action (Barad 2007; Haraway 2008).

There are different points of departure for examining and que(e)ring posthuman ecological ethics that are creative and even speculative, starting from what is virtually present or emerging, and take into account alterity and unknowability. Tracing ethics back to its etymological origin of *ethos* Stengers has argued for an ‘*etho-ecological perspective*’, that affirms ‘the inseparability of an *ethos*, the way of behaving peculiar to a being, and *oikos*, the habitat of that being, and the ways that habitat satisfies or opposes the demands associated with the *ethos* or affords opportunities for an original *ethos* to risk itself’ (Stengers 2005, 997). This does not entail reductionism, however. ‘We never know what a being is capable of or can become capable of. We could say the environment proposes, and the being disposes, gives or refuses to give that proposal an ethological significance’ (ibid). In the words of Puig de la Bellacasa, ‘what characterises an ecology is that *its world is inseparable from a certain durability of ethics and the practices* at stake ... Thinking ecology brings attention to the consistent durable relations, embedded in territories and cycles, as well as the relative stability of a particular *ethos* that characterise ecological togetherness’ (forthcoming).

In a more processual vein, Haraway has argued that ethical 'responsibility is a relationship crafted in intra-action through which entities, subjects and objects, come into being' (Haraway 2008, 70-1). Her ethics of *learning to become response-able* in multispecies ecologies enacts and builds on *respecere*, 'looking back, holding in regard' (2008, 19) and suggests that 'mattering is always inside connections that demand and enable response' (2008, 71). Responsibility-in-relation can grow and transform but it 'can be shaped only in and for multidirectional relationships, in which more than one responsive entity is in the process of becoming' (ibid.). Responders – and response-ability – are co-constituted in the responding that requires improvisation, experimentation and putting oneself at risk. Importantly, the focus on mutuality does not deny asymmetries of power, and the presence of suffering, killing and death within multispecies ecologies, including differently situated humans (according to class, gender, age, geography, disability or ethnicity). *Respecere* includes a 'non-mimetic sharing of suffering' (2008, 88) that recognises irreducible difference and the limits of recognition in always situated encounters. It also entails mourning the lives and livelihoods that already have been lost and cannot be restored. Sandilands aptly speaks of *a queer ecological sensitivity* of 'learn[ing] to see the scars, defacement, and artificiality ... [and] strengths of a wounded landscape' (Grover 1997, cited in Sandilands 2005, 2), and 'taking responsibility to care for the world as it is' (2005, 28).

Anthropocene ecologies further investigate how response-ability might be enacted in relations with informational, sociotechnical and other nonliving materialities and phenomena that might *not* be close by (spatially and/or temporally) and cannot respond with suffering, death or extinction. This might involve fostering modes of 'geologic intercorporeality' (Yusoff 2013), imagining ourselves a fossil (ibid.) or bodies of water in relation to connate bodies of matter-energy (Neimanis 2012). What forms of ecological becoming (planetary and corporeal) might 'we' learn to unlearn to enable different techno-ecological futures? And what inventive collaborations with the technosciences, social sciences, humanities, and arts and with other ecological actors are necessary to contribute to this endeavour?

By raising these questions, we underline that Anthropocene ecologies as methodology and object of research are situated within technoscientific research practices and initiatives for environmental change, and aim to inform and transform emerging webs of biogeotechnical

ecologies of humans, animals, artefacts, and institutions. Becoming response-able to differentiated and differentiating 'ecologies of concern' (Bell 2012) therefore enacts a practice of collaborative research across disciplinary boundaries between the human, social, natural and technosciences.

References

Abram, David (2010) *Becoming Animal: An Earthly Cosmology*. New York: Pantheon.

Alaimo, Stacy (2010) *Bodily natures: science, environment and the material self*, Bloomington, IN: Indiana University Press.

Åsberg, Cecilia (2014) 'Imagining Posthumanities, Enlivening Feminisms', in I. van der Tuin and B. Blaagaard (Eds.) *The Subject of Rosi Braidotti: Politics and Concepts*, pp. 92-101, London: Bloomsbury Publishing.

Barad, Karen (2007) *Meeting the Universe Halfway. Quantum Physics and the Entanglement of Matter and Meaning*. Durham and London: Duke University Press.

Bateson, Gregory (1972) *Steps to an ecology of mind*, Northvale, NJ and London: Jason Aronson Inc.

Bell, Vikki (2012) 'Declining performativity. Butler, Whitehead and ecologies of concern', *Theory, Culture & Society* 29 (2): 107–123

Blaser, Mario (2013) 'Notes towards a political ontology of "environmental" conflicts', in L. Green (ed.) *Contested ecologies: Dialogues in the South on nature and knowledge*, Cape Town: HSRC Press.

Crutzen, Paul and Eugene F. Stoermer (2000) 'Have we entered the Anthropocene?' *International Geosphere-Biosphere Program Newsletter* 41.

DiChiro, Giovanna (2008) 'Living environmentalisms: Coalition politics, social reproduction, and environmental justice', *Environmental Politics* 17(2): 276–98.

Dent, David (ed.) (2014) *Soil as world heritage*, Dordrecht: Springer.

Foucault, Michel (1990 [1976]) *The history of sexuality, volume I*, New York: Vintage Books.

Fredengren, Christina (2013) 'Posthumanism, the transcorporeal and biomolecular archaeology', *Current Swedish Archaeology* 21: 53-71.

Fredengren, Christina (forthcoming) 'Food for Thor. The deposition of human and animal remains in a Swedish wetland area', *Journal of Wetland Archaeology* 15

Fredengren, Christina & Cecilia Åsberg (in preparation) 'Deep time materialising'

Gibson-Graham, J.K. (2011) 'A Feminist Project of Belonging for the Anthropocene', *Gender, Place & Culture* 18 (1): 1-21.

Guattari, Felix (2000 [1989]) *The three ecologies*, London, New Brunswick, NJ: The Athlone Press.

Haeckel, Ernst (1866) *Generelle Morphologie der Organismen, Vol.II: Allgemeine Entwicklungsgeschichte der Organismen*, Berlin: Verlag von Gerhard Reimer.

Haraway, Donna (2015) 'Anthropocene, Capitalocene, Plantaionocene, Chthulucene: Making kin', *Environmental Humanities* 6: 159-165.

Haraway, Donna (2011) 'Speculative fabulations for technoculture's generations: Taking care of unexpected country', *Australian Humanities Review* 50: 95-118.

Haraway, Donna (2008) *When species meet*, Bloomington, IN: Indiana University Press.

Hickey-Moody, Anne (2015) 'Slow life and the ecologies of sensation', *Feminist Review* 111: 140-148.

Hoel, Sissel A. and Iris van der Tuin (2013) 'The ontological force of technicity: reading Cassirer and Simondon diffractively', *Philosophy & Technology* 26 (2): 187-203.

Holling, C.S (1973) Resilience and stability of ecological systems', in L. Robin, S. Sörlin and P Wade (eds.) *The future of nature: Documents of global change*, pp. 245-256, New Haven and London: Yale University Press.

Humboldt, Alexander van and Aime Bonpland (1807 [2013]) 'Essay on the geography of plants', in L. Robin, S. Sörlin and P Wade (eds.) *The future of nature: Documents of global change*, pp. 209-215, New Haven and London: Yale University Press.

Hustak, Carla and Natsha Myers (2012) 'Involutionary Momentum: Affective Ecologies and the Sciences of Plant/Insect Encounters', *differences: a journal of feminist cultural studies* 23(3): 74-117.

Iovino, Serenella, and Serpil Oppermann (2014) *Material Ecocriticism*. Bloomington: Indiana University Press.

Iovino, Serenella, and Serpil Oppermann (2012) 'Theorizing Material Ecocriticism: A Diptych', *Interdisciplinary Studies in Literature and Environment* 19 (3): 448-76.

Kirksey, Eben S. and Stefan Helmreich (2010) 'The emergence of multispecies ethnography', *Cultural Anthropology* 25 (4): 545-576.

Latour, Bruno (2014) 'Agency at the time of the Anthropocene', *New Literary History*, 45: 1-18.

LeMenager, Stephanie (2014) *Living Oil: Petroleum Culture in American Century* Oxford: Oxford University Press.

Livingston, Julie and Jasbir Puar (2011) 'Interspecies', *Social Text* 29 (1): 3-14.

Lorenz-Meyer, Dagmar (2015) 'Articulating tensions in renewable energy knowledges', paper given at the ESA conference *Differences, Social Inequalities and the Sociological Imagination*, Prague 25-28.12.2015.

Lykke, Nina (2010) 'The Timeliness of Post-constructionism', *NORA*, 18(2): 131-36.

MacKenzie, Adrian (1999) 'Technical materialisations and the politics of radical contingency', *Australian Feminist Studies* 14 (29): 105-118.

Maxwell, Richard, Jon Raundalen and Nina Lager Vestberg (2014) 'Introduction: Media ecology recycled', in R. Maxwell, J. Raundalen and N.L. Vestberg (eds.) *Media and the ecological crisis*, New York: Routledge.

Mitchell, Timothy (2009) 'Carbon democracy', *Economy and Society* 38 (3): 399-432.

Moore, Jason (2014) 'Anthropocene or Capitalocene? Why Nature Matters in the Making and Unmaking of the Modern World, and Not in the Way You Might Think', paper given at the conference *Thinking Crisis*, Free University of Berlin, 22.11.2014. Available online <http://www.youtube.com/watch?v=p2EbJPyyxOU>

Moore, Jason (ed.) (forthcoming) *Capitalocene*, Oakland, CA: PM Press.

Mortimer-Sandilands, Catriona (2005) 'Unnatural passions: Notes towards a queer ecology', *Invisible Culture: An Electronic Journal for Visual Culture* 9.

Munster, Anna (1999) 'Is there life after postfeminism? Tropes of technics and life in cyberfeminism', *Australian Feminist Studies* 14 (29): 119-129.

Neimanis, Astrida (2012) 'Hydrofeminism: Or, On Becoming a Body of Water', in H. Gunkel, C. Nigianni and F. Soderback (Eds.) *Undutiful Daughters: New Directions in Feminist Thought and Practice*, pp. 85-100, New York: Palgrave Macmillan.

Neimanis, Astrida, Cecilia Åsberg and Johan Hedrén 'Four Problems, Four Directions For Environmental Humanities: Toward Critical Posthumanities For the Anthropocene', *Ethics & Environment* 20(1): 67-97.

Nixon, Rob (2011) *Slow Violence and Environmentalism of the Poor*. Cambridge, MA: Harvard University Press.

Odum, Eugene P. (1953) 'Principles and concepts pertaining to the ecosystem and biogeochemical cycles', in L. Robin, S. Sörlin and P Wade (eds.) *The future of nature: Documents of global change*, pp. 233-241, New Haven and London: Yale University Press.

Oppermann, Serpil (2013a) 'Feminist Ecocriticism: A Posthumanist Direction in Ecocritical Trajectory', in G. Gaard, S. Estok and S. Oppermann (eds.) *International Perspectives in Feminist Ecocriticism*, New York: Routledge.

Oppermann, Serpil. (2013b) "Material Ecocriticism and the Creativity of Storied Matter", *Frame* 26(2): 55-69.

Palsson, Gisli et al (2011) *Responses to Environmental and Societal Challenges for our Unstable Earth (RESCUE)*. ESF Forward Look –ESF-COST 'Frontier of Science' joint initiative. Brussels: European Science Foundation.

Parikka, Jussi (2015) *A Geology of Media*, Minneapolis: University of Minnesota Press.

Parikka, Jussi (2012) New Materialism as Media Theory: Medianatures and Dirty Matter, *Communication and Critical/Cultural Studies*, 9(1): 95-100

Plumwood, Val (1993) *Feminism and the Mastery of Nature*. New York: Routledge.

Puig de la Bellacasa, Maria (forthcoming) 'Ecological thinking and materialist spirituality: thinking the poetics of soil ecology with Susan Leigh Star', in G.C. Bowker, S.Timmermans, A. E. Clarke and E. Balka (eds.) *Boundary objects and beyond. Working with Leigh Star*, MIT Press.

Rai, Amit S. (2009) *Untimely Bollywood: Globalization and India's New Media Assemblage*, Durham: Duke University Press.

Rose, Nikolas (2007) *The politics of life itself*, Princeton: Princeton University Press.

Schrader, Astrid et al (2015) 'Querying eco-logics: A collective experiment in affective ecologies and the politics of form and function', available online <https://technoscienceunit.wordpress.com/2015/07/24/querying-eco-logics>.

Sörmus, Maris (2015) 'Environmental Discourse: Spatiality, Power and Non-Human Concerns in Monique Roffey's *The White Woman on the Green Bicycle* and *Sun Dog*', *inquire: Journal of comparative Literature*, 3(2).

Star, Susan L. (1995) 'Introduction', in *Ecologies of Knowledge*, New York: State University of New York Press.

Stengers, Isabelle, Brian Massumi and Erin Manning (2008) 'History through the Middle: Between Macro and Mesopolitics - an Interview with Isabelle Stengers', *INFLExions 3 - Micropolitics: Exploring Ethico-Aesthetics*, available online http://www.inflexions.org/n3_stengershtml.html.

Stengers, Isabelle (2005a) 'The cosmopolitical proposal' in P. Weibel and B. Latour (eds.) *Making things public*, pp. 994-1003, Cambridge, MA: MIT Press.

Tansley, Athur G. (1935) 'The use and abuse of vegetational concepts and terms', in L. Robin, S. Sörlin and P Wade (eds.) *The future of nature: Documents of global change*, pp. 220-232, New Haven and London: Yale University Press.

Treusch, Pat (2015) *Robotic companionship: The making of anthropomatic kitchen robots in queer feminist technoscience perspective*, Linköping: Linköping University.

Vehviläinen, Marja (2013) 'Environmental counselling in a women's organisation: an analysis of practices in tension between diffusion and dialogue', in L. Phillips, M. Kristiansen, M. Vehviläinen and E. Gunnarsson (Eds.), *Knowledge and Power in Collaborative Research: A Reflexive Approach*, pp. 84-102, New York and London: Routledge.

Vehviläinen, Marja (2014) 'Syömisen politiikka arjessa [Mundane politics of eating], in S. Irni, M. Meskus and V. Oikkonen (eds.) *Muokattu elämä: teknotiede, sukupuoli ja materiaalisuus* [Technoscience, gender, and materiality], pp. 305-341, Tampere: Vastapaino.

Verran, Helen (2002) 'A postcolonial moment in science studies: alternative firing regimes of environmental scientists and aboriginal land owners', *Social Studies of Science* 32 (5-6): 729-762.

Yusoff, Kathreen (2013) 'Geologic life: prehistory, climate, futures in the Anthropocene', *Environment and Planning D: Society and Space*, 31: 779-95.

Zekany, Eva (2014) 'The Hauntology of Media Addiction', *Forum: University of Edinburgh Postgraduate Journal of Culture and the Arts*, 19: 2-15.

Žeková, Lucie (2014) 'Mluvit o Alici aneb ukázkový příklad bomorfizace', In T. Stöckelová and Y. Abu Ghosh (eds.) *Etnografie: Improvizace v teorii a terénní praxi*, Prague: SLON.