# Networks and Life-worlds: Ends and Endings

### Daphne Dragona

It might, at first, seem arbitrary to relate the ends of networks to the so-called ‘end/s of the world’. The ‘ends’ of a network are its nodes: the points connected through, and bounded by, its lines, forming topologies that usually have the potential to be expanded by the addition of more ends, or nodes, to the system. Originating in graph theory, networks are often understood as the ‘abstract formulation’ of elements that can have social, informational, technological, or biological manifestations.[[1]](#footnote-1) References to ‘theend of the world’ might be metaphorical or literal, depending on era, culture, and/or context. As Gabrys explains,[[2]](#footnote-2) worlds – plural – have always been ending, due to settler colonialism, environmental racism, and ecological exhaustion. Nowadays, the expression ‘world endings’ is mostly used as ‘the default script’[[3]](#footnote-3) of the climate crisis in order to discuss its ‘(anthropic) causes and (catastrophic) consequences’;[[4]](#footnote-4) it implies forms of elimination, power, and dis/possession. Within this context, as one may understand from Gabrys’s work, the role of networks is crucial, and that is because it is the networked, sensing infrastructures that provide environmental data regarding the possible ends of living worlds. However, networks, at their conceptual inception, were not necessarily meant to be associated with endings.

As Fritjof Capra explained, two decades ago, in his book *Web of Life*,[[5]](#footnote-5) network architectures assist us in understanding what holds the living world together. ‘Whenever we see life, we see networks’,[[6]](#footnote-6) he argues. Capra uses the eponymous term ‘web of life’ to refer to ‘networks within networks’, ‘systems nesting within other systems.’[[7]](#footnote-7) A ‘node’, in this case, is an organism which itself constitutes a living network, while having its place in a larger, complex architecture that is nonhierarchical and always in a state of ‘open balance’. Such living networks, for Capra, greatly differ from other technological or social networks in having the capacity to constantly evolve, grow, and self-regulate: these are networks that are able to constantly ‘make themselves’.[[8]](#footnote-8) Capra was convinced that we could learn a lot about the principles of ecology and the ‘language of nature’ from studying what he saw as the self-regulation of the living world and the networks that comprise it. His interest lay in mapping and understanding these networks, their patterns, interdependences and interrelationships. In keeping with systems thinking and cybernetics, Capra turned to networks, as a means to examine and comprehend the Earth’s ecosystems, their architectures and metabolisms.

Rereading Capra’s work nowadays invites us to reflect upon the application of the concept of networks to the Earth’s life-worlds, with the latter understood as ecosystems:[[9]](#footnote-9) the possibility to pass from the parts to the whole manifests the human desire of the human for a holistic vision of the living world.[[10]](#footnote-10) From the 60s on, the Earth came to be understood as a network of networks, the planet as a living body – an object that could be both studied and controlled. Already with the first planetary infrastructures – the satellite systems – as Gabrys reminds us quoting McLuhan, the Earth became programmable, opening the way for ‘new configurations […] across technologies, people, practices and nonhuman entities.’[[11]](#footnote-11) Ever since that time, networked systems have been used to capture information and to render the Earth’s life-worlds not only legible but also sensible and available for attempts at their management and optimization. Thanks to satellites, drones, sensors and robotic entities, acting as nodes of highly complex systems, it has become possible to monitor environmental conditions – the quality of the air, the soil, the waters of the oceans – and, increasingly, to navigate,[[12]](#footnote-12) as new entanglements of machinic and more-than-human entities come into existence.

This approach to the Earth as a ‘pilotable machine’ is defined by Frédéric Neyrat as ‘geo-constructivism’.[[13]](#footnote-13) At the heart of it, he explains, lies the fundamental fantasy that ‘the Earth and everything contained on it, the ecosystems and the organisms, humans and non-humans can and must be reconstructed and entirely remade.’[[14]](#footnote-14) Programming is no longer enough: now the urge is to ‘repair, to reprogram, to reconstruct’ the planet,[[15]](#footnote-15) making use of science and technology to measure climate change, forecast natural disasters and other phenomena. This points to current discussions on ‘terraforming’. Albeit this term is mostly used to refer to how *other* planets could be modified to become habitable for humans, it is also a belief held by many that the Earth itself must undergo such processes in order to remain viable for its own life-forms.[[16]](#footnote-16) Thus, in Neyrat’s terms, a ‘strange topology’ unfolds, with the geo-constructivists speculatively regarding themselves as ‘residing off-planet’, detached from Earth’s ecosystems, so that Earth can be reformatted as an object.[[17]](#footnote-17)

Networks, therefore, as currently related to the understanding, attempted management, and possible remaking of the living world, are thus simultaneously associated with its possible endings and, potentially, its new, human-made beginnings. Within this framework, questions about the actors and the interests involved must come to the fore. In his 2015 book *Capitalism and the Web of Life*, Jason W. Moore highlights the ways in which capitalism has organized what is called now ‘nature’, and opened up the way for forms of exploitation within and between cultures, populations, lands, and territories.[[18]](#footnote-18) Should the claim for a ‘reparation ecology’ arise, then, as Holly Jean Buck reminds us, pointing to Moore’s work with Raj Patel, and the work of Donna Haraway, several other ‘re-s’ must also be taken into consideration – from recognition to redistribution, and from reimagination to recreation or recomposition,[[19]](#footnote-19) all of which would involve very different processes than the attempted remaking, reprogramming and restoration of the climate and the planet which prominent contemporary scientific and technological approaches indicate.

How, then, might networks be reconsidered within the context of the planet’s restoration? Could the web of life be understood, instead – in terms of ‘nature as us, inside us, around us’[[20]](#footnote-20) – as an open process of ‘life-making’, with ‘no basic units, only webs within webs of relations: “worlds within worlds”’?[[21]](#footnote-21) Are there networks that could ‘suggest strategies for sensing, mapping, navigating and inventing worlds otherwise’?[[22]](#footnote-22) Could artistic practices assist in reimagining the role of networks? In addressing these questions, I will now introduce and examine the critical approaches and methodologies of four artistic projects, which, in my opinion, offer grounds for a discussion of different kinds of planetary infrastructures and/or sensory networks, in specific cultural, geographical, and ecological contexts, and which exemplify the ways in which specific technologies influence the understanding and survival of life-worlds.

## Geocinema

## 5.1

Fig. : Geocinema, *Framing Territories*, 2019 (film still).

Asia Bazdyrieva, Alexey Orlov, and Solveig Suess initiated the *Geocinema* project in order to examine how planetary scale sensory networks, such as satellites, surveillance cameras, geosensors, and cell phones, formulate the way that we see the world and its environmental changes.[[23]](#footnote-23) As in Benjamin Bratton’s words, there is a way in which the climate crisis is ‘a figural truth that is composited together from thousands of different kinds of sensing, each drawing a partial image.’[[24]](#footnote-24) It is only by the bringing-together of these infrastructures of different scales and temporalities, and the stitching-together of the raw data, that a representation of the world and its changing climate can be produced. *Geocinema* is the name given by this project’s creators to what they describe as a ‘vastly distributed cinematic apparatus’ which can be used to remind us that there is not one Earth, but many, ‘always composite […] stitched together into a montage of the world’[[25]](#footnote-25) – *Geocinema* comprises multiple angles, edits, and viewings.

For the production of the work the team conducted lengthy field trips and in-depth research, exploring the planetary network of Earth-observatories, with a focus on certain crucial nodes in Asia. One of these is DBAR (Digital Belt and Road) in China – the Big Earth Data counterpart to the Belt and Road Initiative[[26]](#footnote-26) – which aims to operate ‘as a digital nervous system of the globe, providing information about the events happening on (or close to) the Earth’s surface’,[[27]](#footnote-27) while engaging in a continuous rendering process.[[28]](#footnote-28) The artists studied how weather-forecasting is made possible, and how it is intertwined with political and economic agendas, manifesting power asymmetries between territories. As part of their research they also examined the impact on the Earth’s body of the manufacture and construction of infrastructures that are dependent on the extraction of rare-earth materials. Both the locations of the network’s nodes – in this case, Earth-observatories – and the sites of extractivism, relate to the making of pasts, presents and futures.

*Geocinema* also comments on the ‘geopolitics of resolution’, a new form of governance that operates through imaging – and thus allowing us to see – the world as we think we know it.[[29]](#footnote-29) The project affirms the idea that, as T. J. Demos argues, the colonization of nature and the colonization of its representation go hand in hand, making use of anthropocenic imagery to reinforce the position that once ‘we’ have mastered the imaging of nature, ‘we’ have also mastered nature itself.[[30]](#footnote-30) The final work included in the project is a documentary based on imagery drawn from planetary scale sensory networks. Such ‘readymade material’ is reused, repurposed, and stitched together[[31]](#footnote-31) with interviews by the artists with data scientists, activists, and guards from featured sites. With the aim of queering common narratives about the image of the Earth and encourage the viewer to embrace multiple new world-perspectives, the film is to a great extent narrated by a human, or more-than-human, geo-narrator who takes the viewer to locations across the planet.

## Asunder

## 5.2

Fig. : Tega Brain, Julian Oliver, Bengt Sjölén, *Asunder*, 2019 (installation view).

In their project *Asunder,* Tega Brain, Julian Oliver, and Bengt Sjölén address the representation and engineering of the Earth via an examination of the role of machine learning. Vast amounts of the big data now being captured by environmental media are processed by artificial neural networks rather than human brains. *Asunder* takes as its starting point the potential of Generative Adversarial Networks (GANs) to create images from datasets and satellite imagery.[[32]](#footnote-32) In relation to the ongoing discourse about the potential of AI to monitor and manage natural resources, this project’s creators ask: What challenges arise in relation to the use of machine decision-making when it comes to optimizing Earth’s landscapes and ecosystems? Whose interests are served by its use in this context, and what would happen if *human* needs were not in the foreground? Reflecting upon processes of inclusion and exclusion that are now inherent to the design and programming of various systems, Tega Brain talks about the need for a form of ‘eccentric engineering’ whereby existing technologies could be repurposed to include a wider diversity of agendas and perspectives, and to keep in mind life-forms other than the human. This is a call for a rethinking of the ‘biases and scopes’ of what ‘success and failure’ are considered to be, when it comes to technologies of geoengineering.[[33]](#footnote-33)

*Asunder* is a project that, while speculative in character, is based on real data drawn from specific regions, arising from a climate modeling system[[34]](#footnote-34) that is able not only to make forecasts but also to propose specific improvements and modifications. The installation presents original satellite images of regions, provides specific details about environmental conditions there, and presents the landscape modifications proposed by the system. As the artists comment about the work, unexpected scenarios and design strategies appear within the installation: cities are relocated, nations are combined and coastlines are straightened.[[35]](#footnote-35) Thus, the project playfully and provocatively discusses and calls into question approaches to geoengineering, imagining what restoration and/or rewilding could mean, for example; speculating on what worlds might end, and what worlds might proliferate, depending on how the agendas in play are ‘weighted’. In a way, as Buck notes, ‘the hard thing isn’t beginning the project, but ending it: ensuring that what comes *after geoengineering* is livable.’[[36]](#footnote-36) This is of particular relevance to the present moment, at which more emphasis is currently placed on research and far less on deployment.[[37]](#footnote-37) That is to say, that the ends and endings are not quite in view.

## Deep Steward

## 5.3

Fig. 3: Klaas Kuitenbrouwer, Theun Karelse, *DeepSteward* as part of Zoop at Nieuwe Instituut, 2019 (video still).

*Machine Wilderness,* an art and science initiative connected to the *FoAM* network[[38]](#footnote-38)and initiated by Theun Karelse speaks of ‘technologies of loneliness’[[39]](#footnote-39) that ‘violate natural processes, disturb habitats and crush biodiversity’.[[40]](#footnote-40) They ask why design technologies are human-centered in the first place, not taking in mind the complexity, biodiversity and different forms of energy of the living environment.

*Machine Wilderness*, as the name implies, aims to bring wilderness again to the center of attention, a notion that might be thought as incompatible with technology constituting a ‘political free zone where we are able to hide’,[[41]](#footnote-41) or possibly something that in a way ‘no longer exists’ and therefore is tried to be preserved in natural parks or similar.[[42]](#footnote-42) A call for wilderness manifests a return of nature, and the potential to re-inhabit the world in a new way.[[43]](#footnote-43) However, the question remains as to which processes can make this possible.

Karelse argues for a form of ‘machine wilderness’ based on environmental agents; that is, on a form of machine learning that is addressed to, and taught by, the living world – by animals and plants. He draws connections between robotic and biological organisms, and the forms of agency that they have. Karelse and his colleagues work to develop methodologies and projects that are aimed at being of help to living organisms on the one hand, and at improving environmental literacy on the other, helping humans to become aware of the ecosystems to which they belong, and to become conscious participants in them. Their work is conducted via workshops, talks and field trips in different regions, building prototypes of wilderness machines and testing them in specific local situations.

In their explorations of how new forms of more-than-human-oriented environmental AI could inhabit the planet, they embrace ‘practices of environmental solidarity, intimacy, affinity, allegiance, reverence, commitment and kinship’.[[44]](#footnote-44) They take the position that it is possible to realize a synthetic ‘world view’ which acknowledges environmental complexity, once living worlds are given their own voice. This is the specific aim of *DeepSteward* – the project of Ian Ingram and Theun Karelse – which is ‘an unsupervised field agent’, ‘built by humans but left to interpret local trees, local plants, local animals, local geographical features as it sees fit’,[[45]](#footnote-45) as well as the project *Zoöp*,[[46]](#footnote-46) a collaboration between Klaas Kuitenbrouwer, Theun Karelse with support by Bas van Koolwijk, whose name is derived from the words ‘*zoe*’, the Greek word for life, and ‘cooperation’. Here, they speculate about how human, more-than-human and machine entities might possibly all come together on equal terms, in a new entanglement, or assemblage, of wilderness. The project is presented within a floating globe, into which people are invited to insert their head, so as to enter and experience a world of living organisms while it is being captured by infrastructures of different scales and processed by machine intelligence.

## Permaculture Network

## 5.4

Fig. : Gary Zhexi Zhang and Agnes Cameron, *Permaculture Network*, 2019 (screenshot).

The potential of networks to empower wilderness is what drove Gary Zhexi Zhang and Agnes Cameron to develop the *Permaculture Network* project.[[47]](#footnote-47) While they were the artists-in-residence of the pedagogical organization Sakiya, based in the village of Ein Qinyya in Palestine, the artists wanted to explore how a mesh network – a local communication system – could grow along with the landscape itself, while respecting and supporting its needs. Interestingly, the area in question has self-rewilded, an ideal situation in terms of ecological conservation and permaculture, however this is because it is part of Area C of the West Bank, where Palestinians are not allowed to build.[[48]](#footnote-48)

Social and network infrastructures, technological and living systems, political and cultural asymmetries are all featured in this project, in relation to a specific location and its role/s in the emergence of different networks of awareness and resistance. As the artists specifically note, ‘there is a direct correlation between [the] measurement of the land and its qualities and its subsequent requisitioning from Palestinian hands, whether as a natural reserve, an archaeological site or an industrial farm, on the pretext of conservation and resource management.’[[49]](#footnote-49)

Ecological, geological, and topographical features also come together in the project’s eponymous networked-sensors infrastructure, and its web interface.[[50]](#footnote-50) In the former, local sensors are literally planted on site, and supported by external feeds that provide satellite weather data. As for the latter, the web interface operates as a live simulation, or speculative fiction, of interactions in the living environment, wherein different wild and cultivated species are introduced, along with their supposed personalities and characteristics; imagined dialogues between plants, animals, soil, water, the human and the more-than-human world appear to reveal the dynamics of the soil and the land. The attention paid here to the land and the soil can be read as an artistic interpretation of María Puig de la Bellacasa’s writings.[[51]](#footnote-51) The soil, she explains, is not just a container of worlds but a ‘world in itself’, which is not residual: not fixed, but alive, thanks to all the organisms that inhabit it and offer their invisible labor. The soil is a ‘living bioinfrastructure’, and therefore perfectly exemplifies the ‘web of life’, along with the related endangerments. Simulating it and animating it sheds vivid light on its actors and their innumerable valuable movements and interactions.

Having surveyed these four art projects that attempt to reimagine the networked systems that capture changes occurring on the body of planet, affecting its landscapes and ecosystems, what conclusions may be drawn, on the basis of these examples?

The projects here presented address the imbalances of power and agency that characterize environmental media, networks, and infrastructures, whether between territories or between the human and the more-than-human worlds. The projects discuss satellites, artificial neural networks, robotic prototypes and sensory networks in relation to the problematics of monitoring the living world, as well as their potential for being repurposed to build both new forms of awareness and/or actual alternatives.

The creators of all four projects seem to agree that the first step in any strategy of repair must be a much-needed change of perspective. The urge for a more-than-human point of view is expressed in different ways in all of the projects. However speculative these presentations might appear – a story told through a film, a selection of artificially generated images, an environmental AI prototype, a simulation of interactions – each project has taken as their starting point existing resources, real data sets, experiential knowledge. And in all of these projects, the human is decentered; human political and economic interests either have no place at all, or are called into question. This can be understood as a form of ‘doing speculatively’,[[52]](#footnote-52) a necessary practice if we are to imagine anew systemic transformations: as Jussi Parikka notes, models and simulations are ‘technologies of knowing’ that help us to articulate the reality of abstractions.[[53]](#footnote-53)

Seeing and understanding the world from multiple points of view speaks to the need for a new form of literacy that is both environmental and infrastructural. Against the vaunted promise of proposed human-centered interventions on a grand scale, such as climate-engineering, these projects argue for systems and networks of knowledge that can inform us as to how ecosystems operate, how technologies can and do intervene, and which life-worlds are – or are not – well-supported by such interventions. Could it be that the potential for the emergence of what (after Haraway) could be described as ‘kin-making technologies’ might lie here, among these different approaches to the projected reprogramming or remaking of the planet? Any such technologies must acknowledge the preexisting forms of affinity found within the living world, respect the underlying network or web of life and aim to support it, prioritizing the viability of existing habitats. The creation of kin-making technologies involves acts of recuperation as well as acts of effecting sympoiesis between machinic and more-than-human environments:[[54]](#footnote-54) the creator comes in to design and/or repurpose systems to see beyond the interests and needs of the human.

As Déborah Danowski argues, ‘when the end of the world is reached, an entire new world, even if so desired, is impossible.’[[55]](#footnote-55) Reprogramming or remaking the world is not achievable either, and this is most likely a disorientating direction for societies to face in, away from their real responsibilities for effecting change. What is still possible, though, is to invent ‘new ways of living with what we have, in the ruins of the present world.’[[56]](#footnote-56) It is, principally, relationships that need to be repaired, not just landscapes, the atmosphere, the climate.[[57]](#footnote-57) Returning to the network as a model for understanding the world, from this relational perspective, it is not just the nodes, or ends, that need to be taken care of; it is the ‘lines’ as well – the connections that hopefully might prevent the acceleration of the world’s human-made endings.

1. Alexander R. Galloway and Eugene Thacker, *The Exploit: A Theory of Networks*,Minneapolis: University of Minnesota Press, 2007, p. 34. [↑](#footnote-ref-1)
2. Jennifer Gabrys, ‘Ocean Sensing and Navigating the End of this World’, *e-flux* 101 (2019), https://www.e-flux.com/journal/101/272633/ocean-sensing-and-navigating-the-end-of-this-world/. [↑](#footnote-ref-2)
3. Gabrys, ‘Ocean Sensing’. [↑](#footnote-ref-3)
4. Deborah Danowski and Eduardo Viveiros de Castro, *The Ends of the World*, transl. Rodrigo Nunes, Cambridge/Malden: Polity Press, 2017, p. 1. [↑](#footnote-ref-4)
5. Fritjof Capra, *The Web of Life,* New York: Anchor Books, 1996. [↑](#footnote-ref-5)
6. Fritjof Capra, ‘The Web of Life’, 3rd annual Schrödinger Lecture, Trinity College Dublin, Ireland, 9 September 1997, https://pdfs.semanticscholar.org/bfb6/c6a3bdfb66ad7016b6a43e18cc213bb0556b.pdf. [↑](#footnote-ref-6)
7. Capra, *The Web of Life*, p. 5. [↑](#footnote-ref-7)
8. Here Capra refers to the biologists Humberto Maturana and FranciscoVarela, who famously spoke of the process of autopoiesis. Capra, ‘The Web of Life’. [↑](#footnote-ref-8)
9. The term was first coined by the British ecologist Arthur Tansley in 1936, and was further developed by G. Evelyn Hutchinson, and, later, Howard T. Odum and Eugene P. Odum. [↑](#footnote-ref-9)
10. Capra, *The Web of Life*, pp. 18-35. [↑](#footnote-ref-10)
11. This is a reference to the first Earth satellite, Sputnik. Jennifer Gabrys, *Program Earth: Environmental Sensing Technology and the Making of a Computational Planet*, Minneapolis: University Minnesota Press, 2015, p. 4. [↑](#footnote-ref-11)
12. Gabrys, ‘Ocean Sensing and Navigating the End of this World’. [↑](#footnote-ref-12)
13. Frédéric Neyrat, *The Unconstructable Earth: An Ecology of Separation*, trans. Drew S. Burk, New York: Fordham University Press, 2018, p. 1. [↑](#footnote-ref-13)
14. Neyrat, *The Unconstructable Earth*, p. 2. [↑](#footnote-ref-14)
15. Neyrat, *The Unconstructable Earth*, pp. 2f. [↑](#footnote-ref-15)
16. Benjamin Bratton, *The Terraforming*, Moscow: Strelka Press, 2019. [↑](#footnote-ref-16)
17. Neyrat, *The Unconstructable Earth*, p. 5. [↑](#footnote-ref-17)
18. As Moore notes, the rise of capitalism gave us the idea not only that society was relatively independent of the web of life, but also that most women, indigenous peoples, slaves, colonized people were not fully human and thus not full members of society. Jason W. Moore, *Capitalism in the Web of Life: Ecology and the Accumulation of Capital*. London/New York: Verso, 2015. [↑](#footnote-ref-18)
19. Holly Jean Buck, *After Geoengineering: Climate Tragedy, Repair and Restoration*, London/New York: Verso, 2019, p. 245. [↑](#footnote-ref-19)
20. Moore, *Capitalism in the Web of Life*,p. 3. [↑](#footnote-ref-20)
21. Moore, *Capitalism in the Web of Life*, pp. 7f. [↑](#footnote-ref-21)
22. Gabrys, ‘Ocean Sensing and Navigating the End of this World’. [↑](#footnote-ref-22)
23. The *Geocinema* project was developed as part of The New Normal, a speculative urbanism programme at the Strelka Institute of Media, Architecture and Design, Moscow. A section of the project, Geocinema: Framing Territories was commissioned as part of The New Networked Normal (NNN), a 2019 partnership and program co-funded by the EU. The New Networked Normal, https://geocinema.network/. [↑](#footnote-ref-23)
24. ‘Geocinema project presentation’, The New Normal 2018 Final Project Review, Strelka Institute Moscow, June 2018, https://www.youtube.com/watch?v=UXlZdifwolE. [↑](#footnote-ref-24)
25. ‘Geocinema project presentation’, The New Normal 2018 Final Project Review. [↑](#footnote-ref-25)
26. DBAR is part of the Belt and Road Initiative (BRI). BRI is a long-term policy and investment program aimed at infrastructural and economic development along the route of the historic Silk Road, from Beijing to Bangkok and across vast areas of Central Asia and into Europe. [↑](#footnote-ref-26)
27. Asia Bazdyrieva and Solveig Suess, ‘Future Cinema’ (working title), unpublished draft for publication in an upcoming issue of the *e-flux Architecture* journal. [↑](#footnote-ref-27)
28. This vision originates with Clinton’s vice-president Al Gore, who introduced it as another way of understanding the world based on advanced technologies such as geo-information systems, global positioning systems, communication networks, sensor webs, etc. [↑](#footnote-ref-28)
29. Geocinema, ‘Geocinema in conversation with Jussi Parikka’, 2018, https://soundcloud.com/user-406692767/geocinema-in-conversation-with-jussi-parikka. [↑](#footnote-ref-29)
30. T. J. Demos, *Against the Anthropocene: Visual Culture and Environment Today,* Berlin/New York: Sternberg Press, 2017, p. 28. [↑](#footnote-ref-30)
31. Stephanie Hessler, *Prospecting Ocean,* Cambridge,MA: TheMIT Press, 2019. [↑](#footnote-ref-31)
32. Asunder*,* https://asunder.earth/. [↑](#footnote-ref-32)
33. Tega Brain, *Eccentric Engineerin*g *blog*, http://blog.eccentric.engineering/about/. [↑](#footnote-ref-33)
34. The work runs on the CESM model. See University Corporation for Atmospheric Research, ‘Community Earth System Model’, http://www.cesm.ucar.edu/. [↑](#footnote-ref-34)
35. Asunder, https://asunder.earth/. [↑](#footnote-ref-35)
36. Buck, *After Geoengineering*, pp. 26f. [↑](#footnote-ref-36)
37. Buck, *After Geoengineering*, p. 43. [↑](#footnote-ref-37)
38. FoAM, https://fo.am/about/. [↑](#footnote-ref-38)
39. Paraphrastic reference to what Edward O. Wilson terms the ‘age of loneliness’. Edward O. Wilson, *Half-Earth: Our Planet’s Fight for Life,* New York: Liveright Publishing Corporation, 2016, pp. 71, 73. [↑](#footnote-ref-39)
40. Machine Wilderness, http://machinewilderness.net/. [↑](#footnote-ref-40)
41. transmediale, ‘Becoming Earth: Engineering Symbiotic Futures’, transmediale 2017, https://www.youtube.com/watch?v=RvEZB3tmybs&t=1831s. [↑](#footnote-ref-41)
42. Wilson, *Half-Earth*, pp. 71, 73. [↑](#footnote-ref-42)
43. Neyrat, *The Unconstructable Earth*, p. 162. [↑](#footnote-ref-43)
44. Random Forests, http://randomforest.nl/. [↑](#footnote-ref-44)
45. Theun Karelse and Ian Ingram, ‘Deep Steward’, *FoAM blog*, 17 April 2019, https://fo.am/blog/2019/04/17/deep-steward/. [↑](#footnote-ref-45)
46. ‘Ecologies’, *Neuhaus blog,* https://neuhaus.hetnieuweinstituut.nl/en/premises/zoop-research-facility. [↑](#footnote-ref-46)
47. The work was commissioned as part of the ‘Rigged Systems’ Solitude and ZKM Web Residencies, https://schloss-post.com/permaculture-network/. [↑](#footnote-ref-47)
48. ‘Flora, Fauna and Folk Tales – A Permaculture Network. Interview with Gary Zhexi Zhang & Agnes Cameron’, *Schloss Post,* 5 September 2019, https://schloss-post.com/flora-fauna-and-folk-tales/. [↑](#footnote-ref-48)
49. ‘Flora, Fauna and Folk Tales’. [↑](#footnote-ref-49)
50. Schloss Post*,* http://root.schloss-post.com/. [↑](#footnote-ref-50)
51. María Puig de la Bellacasa, ‘Encountering Bioinfrastructure: Ecological Struggles and the Sciences of Soil’, *Social Epistemology: A Journal of Knowledge, Culture and Policy* 28.1 (2014): 26-40. [↑](#footnote-ref-51)
52. Sophie Toupin and Spideralex, ‘Introduction: Radical Feminist Storytelling and Speculative Fiction: Creating new worlds by re-imagining hacking’, *Ada*: *A Journal of Gender New Media & Technology* 13 (2018), https://adanewmedia.org/2018/05/issue13-toupin-spideralex/. [↑](#footnote-ref-52)
53. Jussi Parikka, ‘Abstractions – and How to be Here and There at the Same Time’, *FNG Research* 3.3 (May 2019), https://research.fng.fi/2019/05/24/abstractions-and-how-to-be-here-and-there-at-the-same-time/. [↑](#footnote-ref-53)
54. Donna Haraway, *Staying with the Trouble: Making Kin in the Chthulucene*, Durham: Duke University Press, 2016. [↑](#footnote-ref-54)
55. Déborah Danowski and Krystian Woznicki, ‘Welcoming the Ends of the World: an interview with philosopher Déborah Danowski about the problem that “there are too few people with too much world, and too many people with way too little”’, *Mediapart blog,* 8 April 2019, https://blogs.mediapart.fr/krystian-woznicki/blog/080419/welcoming-ends-world. [↑](#footnote-ref-55)
56. Danowski and Woznicki, ‘Welcoming the Ends of the World’. [↑](#footnote-ref-56)
57. Buck, *After Geoengineering*, p. 44. [↑](#footnote-ref-57)