Volume **1** (1) 2019 https://doi.org/10.5204/lthj.v1.i1.1220

Technological Innovations Tackling Biodiversity Loss: Solutions or Misdirection?

Kate Wilkinson Cross
De Montfort University, Leicester, United Kingdom

Abstract

Using original data derived from the thematic analysis of three international agreements and the 2016 Conference of the Parties (COP) and Meeting of the Parties (MOP) Decisions, this article examines the incorporation of technology and technological innovation in the biological diversity regime. It finds that that the biodiversity regime incorporates discourses of ecological modernisation and prioritises technological innovation for biodiversity loss, particularly in the 2016 COP and MOP Decisions.

The empirical analysis indicates that themes regarding progress, 'improving' the environment and the role of technology in mediating economic growth and development are embedded in references to technology and technological innovation. Drawing on an ecofeminist perspective, this article examines how these themes highlight the prioritisation of technological innovation to prevent biodiversity loss. The author concludes that this prioritisation inhibits opportunities to fully engage with developing alternative approaches towards resolving environmental problems as these approaches require a re-evaluation of the societal institutions and practices that exploit and destroy the non-human environment.

***Keywords**:* Ecological Modernisation Theory; ecofeminism; biodiversity; technology; international law; feminist theory.

Introduction

Previous technological advances, such as chlorofluorocarbons, leaded petrol and the insecticide dichlorodiphenyltrichloroethane, are now known to cause significant harm to the environment. Increasingly, scientists are beginning to understand the full extent of the harm caused by plastic, the 'wonder material' that is in everything from clothes to mobile phones. Concurrently, scientists, engineers and other epistemic communities continue to portray technological innovation as a self-evident good. State and international actors maintain that innovation can ensure continued economic growth and development without placing additional pressure on the environment.[1] Thus, technology is framed as being the solution to environmental problems that earlier manifestations of technology may have helped create, while supporting continued economic growth.

This perspective of technology is embedded in environmental discourses such as sustainable development (SD) and ecological modernisation (EM). Supporters of these concepts claim that 'environmental goals' can be achieved without necessitating a radical transformation of current economic and social arrangements.[2] They claim that the technological development that underpins industrialisation is the solution to ecological risks.[3] SD also views technology as an inherent good. Commonly

[1] HM Government, Industrial Strategy; UNCTAD, Technology and Innovation Report 2018.
[2] Curran, "Is Renewable Energy Still Green," 3.
[3] Curran, "Ecological Modernisation," 203.

defined as 'development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs',[4] its proponents recognise the 'ultimate limits'[5] imposed by available technologies on the ability of the environment to meet the needs of future generations. Therefore, SD comprises ideas around equity, justice and institutional and governance change. Recent iterations of SD identify technology as fundamental to achieving these changes.[6]

However, critics argue that these discourses prioritise technical, market-based and technological solutions to environmental degradation. This enables the continuation of structural, institutional and conceptual values that devalue the environment and legitimise a political economy predicated on exploitative value dualisms.[7] This is not a conscious process but one that is embedded in the foundational concepts of Western, rationalist thought that recasts human–nature relationships as a series of intersecting dualisms forming these conceptual frameworks. These frameworks shape Western thought, informing political theories, science and other key structures of human society. This means that they shape the way humans understand the world around them, and the concepts, norms and values that inform this understanding. Therefore, should discourses of EM be embedded within the biodiversity regime, this could highlight the continued affirmation of exploitative values, assumptions and beliefs that have shaped the international community's response to environmental problems.

Focusing on the biodiversity regime, this article examines the discourse of EM and its privileging of technology and technological innovation as the solution to environmental problems. Article 1 of the 1992 Convention on Biological Diversity (CBD) confers a central role upon technology to achieve the objectives of the conservation and sustainable use of biodiversity. This prominent role has been reaffirmed in subsequent protocols and decisions by the Conference of the Parties (COP). Because of the prominence of technology within the documents, the biodiversity regime offers an original forum to explore how technology is portrayed within an international environmental institution and what this may reveal about the discourses that inform and shape international responses to environmental problems.

Definitions Of Technology

'Technology' is traditionally associated with military weapons and industrial machinery, and more generally the tools of war and work.[8] This association overlooks other technologies that 'affect most aspects of everyday life', such as those that reduce the burden of domestic labour (e.g., cooking stoves, fridges and water heaters).[9] A simple internet search reveals that definitions and descriptions of technology are cast in terms of traditionally male work activities: war and science.[10]

This view of technology is incorporated in the multitude of definitions of technology in ecological modernisation theory (EMT). Theorists such as Ashford,[11] Mol and Sonnenfeld[12] and Cohen[13] discussed 'science', 'science and technology' and 'technological innovation' in their work on EMT.[14] Similarly, the CBD regime addresses 'technology' in very broad terms.[15] Böhm and Collen proposed that technology under the CBD regime can be understood as 'involving both hard and soft technologies that are relevant to the conservation and sustainable use of biodiversity or make use of genetic resources and do not cause significant damage to the environment'.[16] Drawing from these scholars, technology is understood to include both 'hard' (e.g., the hardware required to accomplish a task) and 'soft' (e.g., the knowledge required to use the hardware appropriately) technologies.

[4] WCED, Our Common Future, 43.
[5] WCED, Our Common Future, 8.
[6] UN General Assembly, Res 70/1, Goal 9; Anadon, "Making Technological Innovation."
[7] Plumwood, Environmental Culture.
[8] Wajcman, "Feminist Theories," 2.
[9] Wajcman, "Feminist Theories," 2.
[10] Wajcman, "Feminist Theories," 2; for example, 'technology … is the collection of techniques, skills, methods, and processes used in the production of goods or services or in the accomplishment of objectives, such as scientific investigation'. Wikipedia, "Technology."
[11] Ashford, "Government and Environmental Innovation."
[12] Mol, "Ecological Modernisation around the World."
[13] Cohen, "Ecological Modernisation, Environmental Knowledge."
[14] Howes, "Adapting Ecological Modernisation."
[15] See definitions: Convention on Biological Diversity (1992), art 2(3), art 2(7).
[16] Böhm, "Toward Equality," 6.

This article defines technology as the application of technological knowledge for practical purposes, including the products resulting from such application.[17] Adopting a materialist ecofeminist perspective, this article examines how technology is framed within the biodiversity regime by analysing the language of the regime's treaty, protocols and COP and MOP Decisions. Conducting a thematic analysis of the documents, the author identifies dominant themes that are consistent with the EM discourse, aligning technology with cooperation, progress, innovation and 'improving' the environment. These themes are then interrogated to examine how technology is portrayed in relation to biodiversity conservation and the role of technology in solving existing and future environmental problems.

This article first presents the key provisions of the biodiversity regime that relate to technology and recent developments concerning technological innovation. EM theory is then introduced, followed by an explanation of the value of adopting a materialist ecofeminist perspective in the analysis of technology. The next section presents the methodology and findings from the analysis. The remainder of the article discusses the themes identified in the close reading of the texts, first considering how they relate to EM discourses and then evaluating the implications of this from an ecofeminist perspective.

The Biodiversity Regime

The CBD provides the 'most comprehensive framework to address biodiversity loss'.[18] Negotiated under the auspices of the United Nations Environment Programme, this framework aims to ensure the conservation and sustainable use of biodiversity. To achieve this, the CBD has three objectives: the conservation of biodiversity, the sustainable use of biodiversity components and the 'fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies'.[19] The objective regarding biotechnology and benefit sharing proved to be highly controversial because of its close relationship to other international legal regimes, such as those involving intellectual property rights and international trade.

Technical and scientific cooperation and technology transfer are identified as 'cross-cutting issues' within the CBD regime.[20] Articles 15–18 of the CBD address technology transfer and improving scientific and technical cooperation. Elements of these provisions were incorporated in the 2000 Cartagena Protocol on Biosafety (Cartagena Protocol) and the 2010 Nagoya Protocol on Access and Benefit Sharing (Nagoya Protocol). Both identify the development of technological capabilities and the transfer of technology as important mechanisms for access and benefit sharing and ensuring the safe use of living modified organisms.

Therefore, the biodiversity regime explicitly connects technology with achieving its objectives. Each legal agreement emphasises the importance of technology in attaining its respective objectives and each supports the transfer of technology to promote cooperation between parties to the regime. This indicates that technology is considered a mechanism for overcoming environmental problems without having to divert from the path of modernisation.[21] Consequently, these international agreements and their subsequent COP and MOP Decisions offer a useful starting point from which to explore EM discourses in environmental agreements.

Ecological Modernisation: Theory And Discourse

According to Hajer, EM is the 'discourse that recognises the structural character of the environmental problematique but none the less assumes that existing political, economic, and social institutions can internalise the care for the environment'.[22] It can be understood as a 'meta-discourse'[23] because it underpins policy practice and academic debates regarding environmental governance and international environmental law (IEL). As such, it can be used at two levels: first, as a theoretical concept with which to analyse changes in central institutions considered necessary to solve the ecological crisis and second, as a pragmatic political programme to direct environmental policymaking.[24]

[17] This is based on the definition of technology in the Oxford English Dictionary.
[18] Sands, Principles, 4th ed, 387.
[19] Convention on Biological Diversity (1992), art 1.
[20] CBD Secretariat, "Technology Transfer"; CBD Secretariat, "Technical and Scientific Cooperation."
[21] Hannigan, Environmental Sociology, 183.
[22] Hajer, The Politics of Environmental Discourse, 25; see also: Howes, "Adapting Ecological Modernisation," 6, "Marrying Strands," 565.
[23] Bäckstrand, "Planting Trees," 52.
[24] Gibbs, "Ecological Modernisation, Regional Economic Development," 12.

EM is explicitly a theory of modernisation wherein technology plays a pivotal role in the process.[25] EM first identifies the distinctions between 'primitive, traditional and modern societies'[26] using criteria such as industrialisation, technological advancement and liberal forms of government and governance. Therefore, 'development', understood as 'modernisation', is driven by technological innovation. Technical expertise is considered 'the key to environmental progress'[27] and enables humanity to advance towards modernity.

As in other discourses, there are different versions of EM. These can be differentiated according to the attention paid to five core strands of EM: technological, economic, social, policy (political and institutional) and discursive change.[28] These versions can be placed along a continuum from the original 'weak' version of EM to the more recent 'strong' EM. Table 1 presents the characteristics of weak and strong EM.

Table 1. Weak And Strong Ecologocial Modernisation

Weak	Strong
Economistic	Ecological
Technological	Institutional/systemic
Instrumental	Communicative
Technocratic/neo-corporatist	Deliberative democratic/open
National	International
Unitary	Diversifying

Source: Christoff, "Ecological Modernisation."

Differences Between Weak And Strong Ecological Modernisation Theory

One of the main distinctions between weak and strong EM is that strong versions allow for 'multiple EM possibilities'.[29] Strong EM is presented as a 'reflexive' approach that encourages a strategic political transition to an ecological democracy, thus adopting a 'critical self-awareness' that involves democratic control and public scrutiny.[30] As part of this process, it addresses political and justice implications raised by environmental risks and envisions a broader participation through societal development, encapsulating the notion of 'ecological democracy'.[31]

Unlike weaker versions of EM, strong EM views technology as part of the solution but goes beyond a 'technological re-tooling of industry'.[32] It recognises that long-term changes require significant economic and political transformation. Therefore, it outlines a substantial role for the state, including intervention, restructuring and reform to the economic systems and institutions of modernity.[33] It also adopts a critical perspective of modern institutions and dominant policy paradigms to address environmental threats.[34] Most importantly, strong EM incorporates discursive change and elevates notions of equity, 'futurity' and ecological imperatives in comparison to narrow economic goals. This means it contemplates the possible limits to modernisation. In this way, strong EM recognises the deeper changes in morality and beliefs, as well as a need to re-embed society in communities, regions and ecosystems. [35]

[25] Bäckstrand, "Scientisation vs. Civic Expertise," 697; Huber, "Pioneer Countries."
[26] Huber, "Ecological Modernisation," 43.
[27] Bäckstrand, "Scientisation vs. Civic Expertise," 697.
[28] Milanez, "Marrying Strands"; Howes, "Adapting Ecological Modernisation"; see also: Pepper, "Ecological Modernisation"; Horlings, "Towards the Real Green Revolution?"; Christoff, "Ecological Modernisation"; Dryzek, Politics of the Earth, 3rd ed; Hajer, The Politics of Environmental Discourse; Berger, "Ecological Modernization."
[29] Glynn, Ecological Modernization, 29.
[30] Curran, "Ecological Modernisation," 204; Gibbs, "Ecological Modernisation, Regional Economic Development"; Dryzek, Politics of the Earth, 3rd ed; Howes, "Adapting Ecological Modernisation."
[31] Bäckstrand, "Planting Trees," 54.
[32] Curran, "Ecological Modernisation," 204.
[33] Christoff, "Ecological Modernisation," 490; Howes, "Adapting Ecological Modernisation"; Dryzek, Politics of the Earth, 3rd ed.
[34] Toke, "Ecological Modernisation," 768; York, "Key Challenges."
[35] Christoff, "Ecological Modernisation," 490.

By contrast, weak EM adopts a narrower approach and focuses on reconfiguring capitalist political economies to enable economic development and environmental protection to proceed simultaneously and reinforce one another.[36] Weaker versions of EM view nature as a provider of resources and services and propose rudimentary changes to the current political ecology arrangements while adopting sustainability and modernisation language.[37] Therefore, weak EM provides reassurances about continuing modernisation and growth and the continued existence of capitalist political economy, doing little to reconceive the broader social, political and economic order in light of the ecological crisis.[38]

Weak EM proposes creating partnerships between governments, business and scientists, who are tasked with managing the transition to an 'environmentally sensitive economic system'.[39] These partnerships have been successful in Western Europe, where government and business relations have moved towards more 'collaborative relationships with industry'.[40] States incorporating EM thus adopt corporatist frameworks that promote a more coordinated approach to environmental problems.[41] Therefore, this version of EM signals a 'receptiveness growing community demands for responsive environmental governance'[42] but avoids upsetting structural interests by moving slowly on sectoral reform.[43]

By maintaining the current political economy arrangements of dominant institutions, weak EM purports that there is no need to make difficult decisions between environmental protection and economic growth, or balance the needs of the present against the long-term future.[44] This strategy is central to weak EM's popularity because the connection between economic growth and environmental protection opens up the possibility of environmental protection as a potential source of growth.[45]

Because weak EM views environmental risks as a management problem, solutions are technical in orientation and focus on three main areas: technological innovation, creating new markets for environmental goods and services and increasing efficiency in material and energy use.[46] This version emphasises the considerable efficiency gains in the ways materials and energy are used in the transport, industrial and domestic sectors. It highlights that efficiencies can be achieved using existing technologies but is also dependent on the continued high levels of technological innovation.[47] This aspect of weak EM is central to its popularity. It ensures that EM is profitable for businesses by facilitating the sale of green goods and services and pollution prevention and abatement products.[48] Therefore, it reflects 'techno-bureaucratic state-led and -initiated "greening" of certain key sectors of the economy'.[49] Because it does little to restrict the political economy, EM has greater political attractiveness and is, therefore, more common.[50]

Relationship Between Ecological Modernisation Theory And Sustainable Development

Scholars such as Hajer, Pepper and Langhelle suggest that SD and EM are closely interrelated. Some scholars argue that EM is an approach to SD, while others argue that SD is 'one of the paradigm statements of ecological modernisation'.[51] This indicates that there is more than a basic resemblance between weak versions of EM and weak and reformist approaches to SD.[52]

[36] Dryzek, Politics of the Earth, 3rd ed, 173.
[37] Christoff, "Ecological Modernisation"; Fisher, "Ecological Modernization and Its Critics"; Bäckstrand, "Scientisation vs. Civic Expertise"; Grunwald, "Diverging Pathways."
[38] Pepper, "Sustainable Development."
[39] Dryzek, Politics of the Earth, 3rd ed, 175; Curran, "Ecological Modernisation," 204.
[40] Buttel, "Environmental Sociology," 324; Spaargaren, "Sociology, Environment"; Gouldson, "Corporations"; Bailey, "Ecological Modernisation and the Governance of Carbon"; Williamson, "Ecological Modernisation."
[41] Dryzek, Paradigms and Discourses, 166–67; Barry, "Globalisation."
[42] Dryzek, Politics of the Earth, 3rd ed, 175.
[43] Curran, "Ecological Modernisation," 203.
[44] Dryzek, Politics of the Earth, 3rd ed, 175.
[45] Langhelle, "Ecological Modernization," 306.
[46] Curran, "Ecological Modernisation," 204; Barry, "Globalisation"; Mol, "Ecological Modernisation around The World."
[47] Barry, "Globalisation"; see e.g., Hawken, Natural Capitalism; Asafu-Adjaye, An Ecomodernist Manifesto.
[48] Langhelle, "Ecological Modernization"; Dryzek, Politics of the Earth, 3rd ed.
[49] Barry, "Globalisation," 768.
[50] Curran, "Ecological Modernisation," 203.
[51] Hajer, The Politics of Environmental Discourse, 26; see also: Pepper, "Ecological Modernisation," 4; Smith, Politics and the Environment, 155; Connelly, Politics and the Environment 3rd ed.
[52] Pepper, "Ecological Modernisation," 4.

Both weak SD and weak EM are inherently anthropocentric and eschew earlier, more radical environmentalist approaches.[53] They both challenge the assumption that there is a trade-off between economic and environmental protection and pay little attention to the limits to growth, albeit to a greater degree in EM.[54] Therefore, they maintain the language of 'neoclassical economic rationality'[55] with its underlying assumptions concerning economic growth. They envisage a process of progressive modernisation of social institutions rather than destruction or dismantlement.[56] Both ascribe a prominent role to science and technology to facilitate innovation and the diffusion of new, efficient technologies into the global market, and both view technology and social organisations as variables that can be manipulated to make economic growth possible within the limits set by nature.[57] However, for EM, social problems can be solved 'with technological means and the hegemonic forms of the production of scientific knowledge',[58] thereby indicating that technology is more central to EM.

Critics highlight the underlying assumptions that inform the benign view of market-driven technological innovation and argue that EM searches for the solution to environmental crises within the paradigm of classical modernity.[59] This means that it rejects the argument that human societies must 'harmonize with nature to avoid economic and ecological collapse'.[60] Instead, EM depicts an ideal human society as one that is 'largely emancipated from the natural world and organises itself independent of natural resources'.[61] Therefore, it decouples human society from nature and argues that humanity should withdraw from nature into 'a synthetic high-tech society'[62] that is disembedded from the material world.

Consequently, many scholars are critical of weak versions EM and its prioritisation of technical, market-based and technological solutions to environmental problems. From an ecofeminist perspective, 'progress' in weak EM discourses seeks to disembed human society from nature and create an entirely synthesised world that is separate and distinct from non-human nature. Should such discourses be embedded within IEL and the subsequent governance surrounding specific environmental regimes, it may encourage the continued affirmation of an exploitative and disembedded worldview that continues to shape the international community's response to environmental problems.

Ecofeminism: Criticisms Of Technology, Ecopolitics And International Law

Ecofeminism is one of many feminist perspectives that explore the gendered interconnections between humanity and technoscience. These different perspectives can be arranged on a continuum from those that express profound ambivalence to technology to those that demonstrate a respect and enthusiasm for technology.[63] At the critical end of the continuum, feminists argue that many of the epistemological ideals informing technoscience have 'androcentric origins' that are in need of reconstruction.[64] They argue that the sciences embody 'deep and systematic gender bias by which women, and any interests, perspectives, or insights associated with them, are disvalued and marginalized'.[65] Conversely, at the other end of the continuum, feminists celebrate the emancipatory potential of technologies to address gender inequalities in society.[66] This paper will provide a brief overview of the different feminist perspectives on technoscience to identify why ecofeminism is a more nuanced perspective to use.

[53] Langhelle, "Ecological Modernization"; Hajer, The Politics of Environmental Discourse.
[54] Pepper, "Ecological Modernisation," 2; WCED, Our Common Future, 45; Dryzek, Politics of the Earth, 3rd ed; Langhelle, "Ecological Modernization."
[55] Pepper, "Ecological Modernisation," 4.
[56] Gibbs, "Ecological Modernisation," 4.
[57] Huber, "Ecological Modernisation"; Mol, "Origins"; Langhelle, "Ecological Modernization."
[58] Brand, "Sustainable Development," 145. This is manifest through the use of objective limits which can hide 'societal dimensions like power relations or symbolic-discursive dimensions.'
[59] Grunwald, "Diverging Pathways," 1856.
[60] Asafu-Adjaye, An Ecomodernist Manifesto, 6.
[61] Grunwald, "Diverging Pathways," 1856.
[62] Grunwald, "Diverging Pathways," 1856.
[63] Crasnow, "Feminist Perspectives on Science."
[64] Whelan, "Politics by Other Means," 540; Code, What Can She Know, 314; Crasnow, "Feminist Perspectives on Science"; Merchant, Death of Nature; Fox Keller, Secrets of Life.
[65] Crasnow, "Feminist Perspectives on Science."
[66] Faulkner, "The Technology Question."

Feminist Perspectives On Technoscience

Early feminist engagements with technoscience focused on the effects of technological change on gender relations and women's lives; much of the scholarship explored emerging reproductive technologies and the role of technology in the home.[67] The literature noted the paradox that the mechanisation of the home had not decreased the time women spent on household chores.[68] Some scholars presented technology as an 'inevitable extension of a male desire to control, and potentially eliminate, women's biological role in reproduction'.[69] However, this early scholarship has been criticised for adopting naive determinism, which treated women as 'passive victims' and dismissed technological developments as patriarchal.[70]

More recent feminist research has problematised the gendered nature of the development and diffusion of technologies.[71] Research into different technologies has revealed that gendering processes 'affect every stage in the life of a technology'.[72] These investigations highlight how the construction of gender and technology are relational processes that are shaped by social interaction.[73] This scholarship argued that the relationship between technological innovation and gender power interests is significantly more subtle and complex than previously understood.

Other scholarship investigated how 'technology as culture is implicated in the construction of subjective gender identities'.[74] Adopting a more positive view of technology, scholars such as Donna Haraway argued that society should embrace the potential of technoscience and its capacity to create new meanings and entities and make new worlds.[75] Some have argued that technology has the potential to fundamentally affect the basic categories of 'self' and 'gender' by enabling the body to be transformed into objects that can be altered, made and remade through technoscience.[76] Others argued that technoscience challenges established notions of the 'human' and consequential ethical norms by building on the 'conceptual disruptions produced by contemporary technoscientific practices such as cloning'.[77] These examples focus on the emancipatory potential of scientific inquiry to understand and change sex and gender inequities.

Building on the abovementioned literature, some scholars have claimed that an outright rejection of technology is not an option and that critical engagement with technoscience can provide 'opportunities to transform, invent, and make decisions about technology'.[78] One line of inquiry investigates the role of information technologies and their emancipatory potential.[79] Some studies posited that technoscience could bridge the widening gap between humanity and nature by developing different communication strategies.[80] These examples highlight how contemporary feminists are approaching technoscience as a 'reservoir' for concepts, models and discourses that could be valuable to feminism and feminist thinking.

However, these critiques have paid little attention to the way nature is valued in technoscience and how the treatment of non-human nature and women are conceptually related. As will be demonstrated below, ecofeminism understands the subordination of women and the environment as a 'framework of domination involving dualisms that represent a cultural institutionalisation

[67] Wajcman, "Reflections on Gender"; Oldenziel, "Of Old and New Cyborgs."
[68] Wajcman, "Reflections on Gender"; Faulkner, "The Technology Question"; Ravetz, "Modern Technology"; Corea, "The Reproductive Brothel."
[69] Faulkner, "The Technology Question," 80; Corea, "The Reproductive Brothel," 39.
[70] Wajcman, "Reflections on Gender," 450; for similar criticisms of early ecofeminist research, see: Biehl, "Problems in Ecofeminism"; Braidotti, Women, the Environment; Leach, "Earth Mother Myths"; Agarwal, "Gender and Environment Debate"; Jackson, "Women/Nature"; Gaard, "Ecofeminism Revisited."
[71] Cockburn, Gender and Technology; Casper, "Making the Pap Smear"; Ferrando, "Is The Post-Human"; Davis, "Reading the Strange Case."
[72] Wajcman, "Reflections on Gender," 455.
[73] Daniels, "Rethinking Cyberfeminism(s)"; Shepherd, "Cyberfeminists Pt 2"; Sikka, Climate Technology.
[74] Wajcman, "Reflections on Gender," 457.
[75] Wajcman, "Reflections on Gender."
[76] Wajcman, "Reflections on Gender"; Haraway, Simians, Cyborgs.
[77] Roberts, "Relating Simply?"; Braidotti, Transpositions.
[78] Whelan, "Politics by Other Means," 540.
[79] The following explore the role of technology in challenging societal constructions of women's sexuality: Wajcman, "Reflections on Gender"; Roberts, "Relating Simply?," 76 fn 50; Carter Olson, "#BringBackOurGirls"; Martin, #FemFuture; McKeown, "My iPhone Changed My Life"; the following explores the potential of social media to strengthen women's activism: Pierce, "Singing at the Digital Well."
[80] Roberts, "Relating Simply?," 76; Haraway, Primate Visions.

of power relations' and depicts these as a 'logic of colonization'.[81] Therefore, it can develop a more nuanced understanding of the social relations of technoscience and its implications for both women and the environment in a globalised world.[82]

Ecofeminist Theory

Ecofeminism is a multifaceted theory that can be summarised as 'a movement and current of analysis that attempts to link feminist struggles with ecological struggles'.[83] This broad definition 'encapsulates the idea of a gendered discourse on environmental issues',[84] which is central to the theory. It adopts a more holistic approach to the construction of women and nature than other feminist theories because it 'features human exploitation of the environment in "its list of interwoven forms of oppression such as sexism, heterosexism, racism and ethnocentrism"'.[85]

Ecofeminism gains strength from the fact that it draws from different theoretical foundations, including socialism, materialism and postcolonialism, and combines the local and global in its perspective.[86] It is inherently interdisciplinary and adopts an intersectional approach.[87] As such, it offers a polycentric and porous perspective through which to analyse the role of technology in mediating the relationship between humanity and the environment, and the gendered implications of such mediations. [88] Therefore, it is more appropriate to refer to 'ecofeminisms'[89] existing 'along a continuum ranging from essentialist to socialist ecofeminism'.[90] The main strength of ecofeminist theory is that it can critique the exploitation of women and nature from the underlying conceptual frameworks informing Western thought through to the effects of technology on women, the environment and SD policies. The following section briefly examines the different layers of ecofeminist critique and how they relate to technology.

Ecofeminist Critiques Of Technoscience

The first layer of ecofeminist critique reveals the 'exploitative and gendered conceptual frameworks that underpin the dominant and rational discourses in western society'.[91] These conceptual frameworks are formed by a 'set of values, attitudes, beliefs, and assumptions that shape and mirror how an entity views itself and the world around it'.[92] Ecofeminists deconstruct the rationalist foundation of Western thought and its dualist logic structures, revealing how these structures intersect to legitimise the exploitation of women and nature by casting both as 'other'.[93] These 'rationalist–dualist' constructs are embedded in many binaries, such as subject–object, male–female, reason—emotion and production–reproduction.[94] They form systems of interlocking structures that serve to 'valorise "masculine", abstract, disembedded and dispassionate characteristics while simultaneously devaluing and embedding "feminine" or subordinate characteristics within the body and the natural world'.[95] These binary concepts have acquired cultural dominance and are evident in science and the 'economic systems that govern the

[81] Plumwood, "Politics of Reason," 443.
[82] Åsberg, "Feminist Technoscience," 300.
[83] Sandilands, Good-Natured Feminist, xvi.
[84] Morrow, "Not So Much a Meeting of Minds," 187.
[85] Wilkinson, "Payment for Ecosystem Services," 172.
[86] Wilkinson Cross, "The Environment as Commodity"
[87] Morrow, "Ecofeminism"; Kings, "Intersectionality."
[88] Braidotti, Women, the Environment, 161; Kao, "The Universal versus the Particular"; Sturgeon, Ecofeminist Natures.
[89] Plumwood, Feminism and Mastery, 36.
[90] Morrow, "Ecofeminism," 371. Mainstream scholarship generally portrays ecofeminism as 'essentialist, biologist, lacking political efficacy, intellectually regressive, and inconsistent'. It presents ecofeminism as a monolithic theory that is wholly located at one end of the spectrum and ignores scholarship incorporating 'materialist and posthumanist analysis of gender and the environment prior to these being popular within mainstream Western academia'. It also silences the internal dialogue among ecofeminists who have engaged with these criticisms. Many ecofeminists have responded to these criticisms. See e.g., King, "Caring about Nature"; Lahar, "Ecofeminist Theory"; Morrow, "Ecofeminism"; Plumwood, Feminism and Mastery; Wilkinson Cross, "The Environment as Commodity"; Cuomo, "Still Fooling"; Davion, "Is Ecofeminism Feminist"; Gaard, "Ecofeminism Revisited"; Moore, "Eco/Feminism"; Plumwood, "Politics of Reason"; Sturgeon, Ecofeminist Natures; Sturgeon, "Ecofeminist Appropriations"; Thompson, "Back to Nature."
[91] Wilkinson Cross, "The Environment as Commodity," 93; Warren, Ecofeminist Philosophy, 46; Plumwood, "Feminism and Ecofeminism"; Plumwood, Feminism and Mastery; Plumwood, "Politics of Reason"; Plumwood, Environmental Culture; Warren, "Taking Empirical Data Seriously"
[92] Wilkinson Cross, "The Environment as Commodity," 93.
[93] Plumwood, Feminism and Mastery; Plumwood, "Politics of Reason"; Plumwood, Environmental Culture.
[94] Plumwood, Feminism and Mastery, 43; Wilkinson, "Payment for Ecosystem Services," 168.
[95] Wilkinson, "Payment for Ecosystem Services," 168.

global economy and economic development'.[96] This is because they are based on the concept of dualism, which privileges certain forms of knowledge and thinking that valorise rationalist faculties as superior to other characteristics of the human condition. These dualisms are part of logical structures that institutionalise and normalise power.[97]

Ecofeminists focus on different dualist constructs as sites of oppression. Materialist ecofeminism reframes earlier socialist and radical positions within an ecological problematique.[98] Like socialist perspectives, this perspective explores the dialectical relationship between production and reproduction, starting from the position that all humans are embodied beings and rooted in nature.[99] This form of politics is an 'existentially grounded analysis, recognising that a "woman's first environment is her body"'.[100] It 'refuses the globalising capitalist patriarchal megamachine'[101] and considers the 'materiality of ecopolitical questions'.[102] Therefore, it is concerned with the role of technology in regulating bodies and non-human nature and changing the relationships between our bodies, minds and cultures; it also addresses the effects of national and economic development and the growth of privatisation, outsourcing and 'flexible' labour, all of which disproportionately affect women and degrade the environment.[103]

Materialist ecofeminists argue that Western society has sought to separate itself from the environment through productive systems in which 'women have been materially associated with human embodiment largely through unpaid or underpaid work',[104] whereas men have disembedded and transcended the material (nature) sphere. Consequently, they dominate the sphere of monetised production that transforms nature through processes that are inherently destructive.[105] This analysis extends beyond mainstream feminisms and contests the 'traditional Eurocentric nature/culture dualism … rather than a "re-invention" of nature blended with man-made machine', which is articulated in postmodern feminist literature.[106] Therefore, ecofeminism enables a multifaceted critique of the underlying philosophy and concepts that inform discourses of technology and their relationship with women and nature.

Ecofeminists argue that technology plays a central role in transforming nature; further, because women are considered to embody nature, they are also ripe for alteration. Carolyn Merchant argued that the narrative of the scientific method from the scientific revolution onwards has advocated 'extracting nature's secrets from "her" bosom through science'.[107] In being recast as female, stripped of activity and rendered passive, nature can be 'dominated by science, technology and capitalist production'.[108] Consequently, nature, humans and society consist of interchangeable parts that can be externally repaired or replaced through technological advances.[109] This worldview allows humanity to exist outside nature as 'intellectual beings who calculate the maximum satisfaction or utility of nature'.[110]

In light of this, ecofeminists have explored the effects of technology on women and nature in the context of globalisation and SD at the local and global levels. In the 1980s, ecofeminists such as Vandana Shiva and Maria Mies highlighted the inverse relationship between technological developments in agriculture, the feminisation of poverty and the limited diversity of food crops. They examined how neoliberal development and its commitment to modernisation through technology, free trade and commodification reinforces the insecurity and vulnerability of small farmers by disrupting informal and local practices of seed storage and co-cropping in favour of monocultures, patent-protected seeds and other socially and ecologically destructive

[96] Wilkinson, "Payment for Ecosystem Services," 168.
[97] Plumwood, Feminism and Mastery, 42.
[98] Salleh, "Dystopia," 202; D'Eaubonne, "Feminism or Death."
[99] Mellor, "Women, Nature," 180; Mellor, "Feminism and Environmental Ethics," 111; Merchant, "Scientific Revolution," 515.
[100] Salleh, "Dystopia," 202; Mellor, Feminism and Ecology; Mellor, "Feminism and Environmental Ethics."
[101] Salleh, "Dystopia," 202.
[102] Salleh, "Dystopia," 202.
[103] Wilkinson Cross, "Ecofeminist Potentials," 205.
[104] Wilkinson Cross, "Ecofeminist Potentials," 205; Mellor, "Feminism and Environmental Ethics," 110; Mellor, Feminism and Ecology, 154; Mellor, "The Politics of Women."
[105] Wilkinson Cross, "Ecofeminist Potentials," 205; King, "Healing the Wounds"; Mellor, Feminism and Ecology; Mellor, "Women, Nature"; Mellor, "Feminism and Environmental Ethics."
[106] Salleh, "Dystopia," 202; Haraway, Simians, Cyborgs, 173.
[107] Merchant, "Scientific Revolution," 515.
[108] Merchant, "Scientific Revolution," 514.
[109] Wilkinson Cross, "Transformative Potentials," 38.
[110] Wilkinson Cross, "Transformative Potentials," 38.

practices.[111] Others have highlighted the relationship between technological innovation, the feminisation of poverty and the north–south divide.[112] Therefore, technology can be used to control and oppress women and nature, particularly when connected to other discourses of power and control, such as free trade and neoliberal development.

Overall, ecofeminism is highly critical of the role of technology within the advancement of human society and the way it reinforces the devaluation of women and non-human nature. Unlike other feminist critiques, ecofeminism considers the connections between the unjustified domination of women and nature central to its analysis.[113] In contrast to other environmental perspectives,[114] ecofeminism argues that the 'gendered nature of the logic of domination in western thought should be central in any environmental philosophy'.[115] By drawing on these two perspectives, ecofeminists develop a nuanced critique of how technology is used to mediate the material and social realms, reinforce the anthropocentric and androcentric worldview regarding the non-human world and legitimise the continued exploitation of women and non-human nature. In doing so, they have adopted a multifaceted and intersectional critique of the ways in which technology interacts with other structural inequalities that can reaffirm the exploitation of women and the commodification of nature.

Methodology And Initial Results

This article examines the provisions for technology in the CBD, Nagoya Protocol and Cartagena Protocol, and the subsequent Decisions adopted by parties to the CBD and its two protocols. Specifically, it examines the Decisions adopted by the 13th Conference of the Parties to the CBD (COP Decisions), the eighth Meeting of the Parties to the Cartagena Protocol (CP-MOP Decisions) and the second Meeting of the Parties to the Nagoya Protocol (NP-MOP Decisions), all held in 2016. In total, the research examined 69 documents, comprising three international agreements and 66 COP and MOP Decisions. The analysis focused on how these documents portray technology and its role in achieving the objectives of the biodiversity regime.

There are important variables that affect references to technology in the documents. These include the type of document, the age of the document and where the reference is included in the document. This is because international agreements intend to create obligations under international law, while COP and MOP Decisions involve a different level of obligation.[116] The COP and MOP Decisions are 'more concrete prescriptions on how to implement the Convention'[117] and can be considered 'expressions of the regime, as they provide explicit principles, norms, and decision-making procedures'.[118] Therefore, references to technology may differ between these two types of documents. References to technology may also differ depending on the age of the document because of developments in other international regimes, such as intellectual property and trade rights. The location of the provision may also affect the language used. This is because preamble paragraphs assist in treaty interpretation whereas operative provisions are legally binding.[119] These variables are considered in the following discussion.

The initial analysis was conducted using the text query function in NVivo. This function searched for the word 'technology' and its specialisations, such as 'technical', 'scientific' and 'mechanism', in all 69 documents. This initial search coded 1118 references relating to technology in the international agreements and the combined COP and MOP Decisions for the CBD, Nagoya Protocol and Cartagena Protocol. Documents containing less than 15 hits for 'technology' and its specialisations were removed at this stage. This ensured that the documents had sufficient content relating to technology for thematic analysis to occur. A total of 39 documents were excluded after the initial sift.

After the initial sift, the results were grouped into themes, which were refined after subsequent reading of the texts. These themes were derived from an iterative reading and grouping of the texts. The texts were initially grouped according to broad

[111] Shiva, Staying Alive; Shiva, "Development"; Mies, The Subsistence Perspective; Shiva, "Biopatents"; Mies, Ecofeminism. Mainstream literature supports this analysis and points to the role of technology in maintaining or reinforcing inequalities: Naudé, "Technological Innovation"; Rotman, "Technology and Inequality"; UNDP, Humanity Divided, 236; Mirza, "Technology Driven Inequality."
[112] Kailo, "Cyber/Ecofeminism," 5.
[113] Sessions, "Deep Ecology," 97–98.
[114] For a critique of other environmental perspectives, such as social ecology and deep ecology, see Plumwood, Environmental Culture; Plumwood, "Ecopolitics Debate"; Plumwood, "Politics of Reason"; Plumwood, "Ecofeminism"; Wilkinson Cross, "The Environment as Commodity."
[115] Wilkinson Cross, "The Environment as Commodity," 84; Kelly, "Women and Power," 115.
[116] Convention on Biological Diversity (1992), art 23(4)(i); Vienna Convention on the Law of Treaties (1969), art 2(1)(a); Sands, Principles, 4th ed.
[117] Henne, "Regime Building," 319.
[118] Henne, "Regime Building," 320.
[119] Vienna Convention on the Law of Treaties (1969), art 31(2); Aust, Modern Treaty Law, 3rd ed, 210–12.

categories such as 'technology and development', 'technology and economy' and 'technology and anthropocentric language'. These broad groups were then refined through an iterative process that identified more specific themes. For example, initial themes of 'technology as a way to obtain value', 'technology making a difference' and 'technology and productivity' emerged from references relating to economic issues in the original group, 'technology and economy'.

These initial themes were subsequently refined after iterative readings of the documents and synthesised into the final themes used in this research. Through reviewing the original broad groups and initial themes, the researcher identified four dominant categories of technology–environment connections. These became the four categories of themes and sub-themes that are presented in Table 2.

Table 1. Research Themes And Sub-Themes

Themes	Documents	References
Relationship between science and technology	**7**	**18**
Discourse of scientific validity	2	3
Limitations of current or future scientific knowledge	4	12
Limitations of technology or science	2	3
Technology and improving the environment	**9**	**21**
Anthropocentric framing	6	14
Technology used to obtain value	5	7
Technology as a mechanism for cooperation	**12**	**33**
Relationship with other agreements	2	3
Technology makes a difference	10	20
Technology as a tool for cooperation	4	10
Technology mediates between economic growth, development and nature	**12**	**38**
Connection between technology, trade and economic development	10	19
Technology contributes to sustainable development	2	2
Technology enables continued growth	2	3
Technology mediates between environment and humanity	4	5
Technology mediates between indigenous peoples and local communities and the commoditisation of knowledge	6	9

The four main themes addressed technology as a tool or mechanism (to improve the environment; to facilitate cooperation; to mediate economic growth, development and nature) and engaged with issues regarding the relationship between technology, science and environmental problems (recognition of limitations; discourses of scientific validity). However, most themes focused on the role of technology as a tool for use in the biodiversity regime, rather than engaging with more nuanced questions surrounding knowledge, validity and the potential limitations of Western epistemology and science.

The analysis found that most themes were present in both the international agreements and the COP and MOP Decisions. Themes emphasising technology as a mechanism for cooperation, making a difference and productivity were found in all three environmental agreements and some COP and MOP Decisions. Themes emphasising the connection between biodiversity, the market and economic growth were present in all the documents. Generally, all documents contained themes framing technology and its specialisations in a positive light and as a vehicle for progress. However, some themes acknowledged the negative role of technology, particularly in light of the limitations of current and future scientific knowledge. These were contained in both types of documents.

The analysis also identified that the language incorporating these themes differed depending on where the theme was found in the document. For example, the excerpts below highlight how the language associating technology as a mechanism for cooperation differed depending on if it was located in a preamble or operational section of the document:

> The Contracting Parties *shall promote international technical and scientific cooperation* in the field of conservation and sustainable use of biological diversity, *where necessary*, through the appropriate international and national institutions.[120]

> *Technical and scientific cooperation to develop capacities in classical biological control, including scientific understanding*, the regulatory process, and the training of skilled staff, *is crucial for the success of biological control* programmes.[121]

> Recognizing the need for a *more integrated and coherent approach to capacity-building and technical and scientific cooperation in supporting the implementation of the Convention and its Protocols* as well as other biodiversity-related multilateral environmental agreements …[122]

These excerpts indicate that the language used in preambles is generally 'soft' and uses passive phrases including 'is crucial for' and 'recognising the need for'. This language differs from the active and precise language used in the operative provisions. These provisions include verbs such as 'shall' and 'shall promote'. This difference indicates that these sections of the agreements intend to create obligations for states.[123] This pattern was repeated in other themes that frame technology in a positive light and as a vehicle for progress.

However, there were some themes that acknowledged the negative role of technology, particularly regarding the limitations of current and future scientific knowledge. Such themes were identified predominately in preambular text across both types of documents. For example, consider the following paragraphs:

> Noting also that *where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures* to avoid or minimize such a threat.[124]

> Also notes that *it is not clear, given the current state of knowledge*, whether or not some organisms of synthetic biology, … would fall under the definition of living modified organisms under the Cartagena Protocol, and further notes that *there are cases in which there may be no consensus on whether the result of a synthetic biology application is 'living' or not.*[125]

> *Lack of scientific certainty due to insufficient relevant scientific information and knowledge* regarding the extent of the potential adverse effects of a living modified organism on the conservation and sustainable use of biological diversity …, taking also into account risks to human health, *shall not prevent that Party from taking a decision*, as appropriate … *in order to avoid or minimize such potential adverse effects.*[126]

The preamble extracts above also use softer language in their recognition of the potential limitations of scientific knowledge and the management of risk. The CBD preamble uses 'should' rather than 'shall' in the above quotation. 'Should' is generally understood to imply non-mandatory action, whereas 'shall' has mandatory connotations.[127] In addition to the passive language within the paragraph, this indicates that the drafters sought to ensure that this provision was as broad as possible.[128] The difference between operative and preamble language and the use of mandatory and non-mandatory language was common across all the texts and will be considered in more detail below.

The following discussion explores three themes that emerged from this analysis. The themes are assessed to identify the extent to which they incorporate weak EM; the presence of such discourses is then critiqued regarding the way in which technology is viewed within the biodiversity regime.

[120] Convention on Biological Diversity (1992), art 1 (italics mine).
[121] CBD, Decision XIII/12 2016, para 13 (italics mine).
[122] CBD, Decision XIII/23 2016, preamble para 2 (italics mine).
[123] Costelloe, "Interpretation of Secondary Instruments."
[124] Convention on Biological Diversity (1992), preamble para 9 (italics mine).
[125] CBD, Decision XIII/17 2016, preamble para 7 (italics mine).
[126] Cartagena Protocol (2000), art 10(6) (italics mine).
[127] D'Acquisto, "The Role of SHALL"; Bodansky, "Legally Binding"; Williams, Tradition and Change.
[128] Williams, Tradition and Change.

Technology Used To Mediate Economic Growth, Development And Environment

The use of technology to mediate economic growth, development and the environment was a common theme across all the documents. This concept is central to weak EMT, which argues that states can continue to grow their economy by encouraging greater economic efficiencies in the use of natural resources and through market corrections.[129] References to technology in the international agreements and COP Decisions reflect the assumption that technology is a marker of modernisation and progress, particularly in the context of technology transfer. Similarly, the COP Decisions reflect the continued reliance on traditional growth models within EMT by incorporating environmental accounting methods to encourage eco-efficiencies and as a solution to environmental problems. Like EM, the biodiversity regime purports that more growth and economic development through technological innovation is the solution to environmental problems.

A key strategy to ensuring continued economic growth through resource and material efficiencies is to create an environment for technology transfer. Under the CBD, participation in the biodiversity regime by developing countries is contingent on access to financial support and technology transfer and establishes that they should have access to technologies under fair and favourable terms:

> Access to and transfer of technology … to developing countries *shall be provided and/or facilitated under fair and most favourable terms,* including on concessional and preferential terms where mutually agreed, and, where necessary, in accordance with the financial mechanism …[130]

> Each Contracting Party shall endeavour to create conditions to facilitate access to genetic resources for environmentally sound uses by other Contracting Parties and not to impose restrictions that run counter to the objectives of this Convention.[131]

By linking technology transfer, the needs of developing countries and the need to facilitate access to technology, these operative provisions emphasise the importance of technology to the success of the regime. This indicates that weak EMT strategies involving economic efficiencies have informed the development of the biodiversity regime.

The Nagoya Protocol similarly affirms technology transfer as a way to enable the economic development of developing countries through the sustainable use of genetic resources while also ensuring biodiversity conservation. Like the CBD, Article 1 of the Protocol identifies the appropriate transfer of relevant technologies through benefit sharing as a component of the main objective of the agreement.[132] Further, the Protocol explicitly connects biotechnology and technology that uses genetic resources as key methods to ensure the sustainable conservation of genetic resources while also enabling parties to conserve biodiversity.[133] This is demonstrated by including the transfer of knowledge and technology under 'fair and most favourable terms' as a form of non-monetary benefit in the context of access and equitable sharing of benefits.[134] 'Non-monetary benefits' are benefits that are negotiated as part of the process to facilitate access to genetic resources based on mutually agreed terms negotiated between the provider granting access to the genetic resources and the entity that seeks to use those resources.[135] Therefore, these provisions use technology as a tool to mediate between economic growth and environmental sustainability by enabling parties to access technologies that mitigate their contribution to environmental degradation.

These examples indicate that EM strategies have been incorporated into the biodiversity regime. The Nagoya Protocol uses technology to mediate economic growth through the sustainable use of genetic resources and to conserve such resources. The Protocol incorporates a dominant assumption within weak EMT that continued economic growth through technological innovation or transfer enables an environment for the conservation and sustainable use of genetic resources. The use of technology transfer to facilitate and incentivise biodiversity conservation incorporates this assumption.

Technology is also proposed as a way to enable development through modernisation. As Vandana Shiva argues, 'development … is taken as synonymous with the introduction of Western science and technology in non-Western contexts'.[136] This understanding shapes how EM and SD discourses approach environmental risks in the context of development. As noted

[129] Asafu-Adjaye, An Ecomodernist Manifesto; Barry, "Bio-fuelling the Hummer?"
[130] Convention on Biological Diversity (1992), art 16(2) (italics mine).
[131] Convention on Biological Diversity (1992), art 15(2).
[132] Nagoya Protocol (2010), art 1.
[133] Nagoya Protocol (2010), art 1.
[134] Nagoya Protocol (2010), Annex I para 2(f).
[135] Nagoya Protocol (2010), art 5, art 23.
[136] Shiva, "Biotechnological Development," 194.

previously, EM views environmental risks as a management problem and proposes technical solutions through technological innovation, market diversification and efficiency gains in energy and material use. Therefore, economic development and environmental protection are interrelated and can occur in the existing capitalist political economy.[137] This feature of EM is criticised because it maintains the assumption that continued economic growth is possible through using economic measures to correct the environmentally damaging actions of industries and states.[138]

The inclusion of economic measures such as ecosystem assessments, environmental economic accounting and cost–benefit exercises indicates a commitment to technical and management-oriented strategies to alleviate environmental risk. For example, Decision XIII/3 'invites Parties and other Governments … to introduce or scale up the use of environmental economic accounting and natural capital accounting'.[139] Decision XIII/5 incorporates a cost–benefit exercise of ecosystem restoration as part of its short-term action plan and makes the connection between restoring ecosystems and supporting the ecological and economic sustainability of other production activities. It provides examples of actions that could be taken in the context of broad-based ecosystem assessments and restoration activities:

> Assess the potential costs and multiple benefits of ecosystem restoration at relevant scales. *Benefits may include those linked to biodiversity and ecosystem services, and socioeconomic benefits, such as water and food security, carbon capture and sequestration, jobs and livelihoods, health benefits, and disaster risk reduction* (e.g., fire and erosion control, and coastal protection). *Identify opportunities for maximizing co-benefits and for reducing or eliminating conflicts among co-benefits*.[140]

Both weak SD and EM discourses propose using economic measures to internalise environmental externalities into the economy. These excerpts highlight how economic measures and their underlying assumptions have been incorporated into the biodiversity regime. Such practices and the models that they inform are criticised by ecofeminists and feminist economists alike. They argue that the economic models that such practices inform are assumed to be objective and neutral and do not reflect the reality of lived experience. Concurrently, the agents and markets modelled in these models are assumed to be perfectly competitive, autonomous, rational and self-interested, seeking to maximise utility or profit.[141] Not only do these models discount the gendered experiences of women in the context of development and the environment but they distance and divorce humanity from nature and frame ecological restoration and non-human nature as an 'economic good' that can be managed and manipulated to maximise 'co-benefits' by incorporating 'eco-efficiencies'. Therefore, they reinforce the status quo by discounting women's experiences and reinforcing the view of nature as an economic good.

These excerpts reflect what Fox Keller refers to as 'objectivism', which is the belief in 'connection-free knowledge from an outside-of-nature, perspective-free viewpoint'.[142] The language used in the documents also reflects this objectivism and highlights how economic and ethical choices are inserted into environmental agreements under the guise of 'neutrality', with little attention to how such choices maintain the status quo of power relations.[143] This obscures the way in which these documents represent a gendered economy that is removed from social and ecological frameworks, and, therefore, disembodied and disembedded from ecosystems.[144]

Technology As Mechanism For Cooperation

The second dominant theme in the documents related to how technology is used to facilitate cooperation between the different actors involved in the biodiversity regime. In particular, the documents emphasised the role of technology in making a difference, both in terms of achieving objectives of the biodiversity regime and enabling capacity-building for parties to the agreements.

One of the main strategies of EM is to improve efficiencies of production through technological innovation, improved governance and policy instruments, and better institutions to provide managerial oversight.[145] These strategies focus on

[137] Dryzek, Politics of the Earth, 3rd ed, 173.
[138] Nelson, "Economists"; Ruder, "Transcending." For examples of this assumption, see: Spaargaren, "Ecological Modernization Theory"; Buttel, "Ecological Modernization."
[139] CBD, Decision XIII/3 2016, para 18(b).
[140] CBD, Decision XIII/5 2016, Annex para 13(4) (italics mine); see also: Annex para 15(2).
[141] Nelson, "Rethinking Development."
[142] Nelson, "Economists," 443.
[143] Lee, "Ecofeminist Perspectives."
[144] Mellor, "Ecofeminist Political Economy," 254; Nelson, "Economists"; Ruder, "Transcending."
[145] Bäckstrand, "Planting Trees"; Baker, "Sustainable Development."

increasing cooperation between different actors across policy, industry, other sectors of the economy and other societal institutions; they use technology as a mechanism to facilitate greater cooperation. They assume that cooperation enables more efficient governance, management and policy coherence and thereby contributes to more efficient use of natural resources and a better space for technological and market innovation. However, this cooperation often occurs along the lines of dominant power relationships and can reinforce existing precarities between actors.

Each of the international agreements include provisions that promote international technical and scientific cooperation to implement the objectives of the agreements. The Cartagena Protocol clarifies that for the purpose of cooperation:

> The needs of developing country Parties, in particular the least developed and small island developing States among them, *for financial resources and access to and transfer of technology and know-how in accordance with the relevant provisions of the Convention, shall be taken fully into account for capacity-building* in biosafety. Cooperation in capacity-building shall … *include scientific and technical training in the proper and safe management of biotechnology* … and the *enhancement of technological and institutional capacities in biosafety*.[146]

Similarly, both the Nagoya Protocol and the CBD associate collaboration, cooperation and capacity-building with technology transfer, development and scientific research as a means to attain or strengthen the objectives of the Convention and the Protocol.[147] This suggests that the parties view technology as a mechanism for international cooperation.

The operative provisions in the international agreements and COP Decisions reinforce the narrative that technology enhances cooperation between states and non-state actors. The CBD identifies information exchange between developed and developing countries as a pathway to cooperation and calls for contracting parties to 'promote technical and scientific cooperation with other Contracting Parties, in particular developing countries, in implementing this Convention'.[148] The Nagoya Protocol also calls for parties to 'collaborate and cooperate in technical and scientific research and development programmes, including biotechnological research activities, as a means to achieve the objective of this Protocol'.[149] These provisions identify technical and scientific cooperation as a key strategy to achieve the objectives of the biodiversity regime.

The COP Decisions similarly identify technological innovation as a pathway to international cooperation. COP Decision XIII/24 explicitly recognises the need for greater cooperation between states, governments and non-state actors. It encourages parties:

> To provide common training and other learning opportunities to the national focal points of the biodiversity-related conventions and other relevant staff to build capacity and mutual understanding of:
>
> …
>
> (iii) Communication methods to *raise awareness on the value of biodiversity and ecosystem services with their respective high-level policy decision-makers*;
>
> (iv) *Technical knowledge on synergy and coordination*.[150]

It also encourages parties to provide training for technical knowledge regarding synergies and coordination between biodiversity-related conventions and to enhance the work of the secretariat in the use of internet technology.[151] These activities identify technology as a mechanism to help strengthen the cooperation between different actors involved in biodiversity conservation.

While states approach technology as a conduit for cooperation and communication, such cooperation can also be a conduit for unsustainable and inequitable practices and the exploitation of gendered resources.[152] For example, these documents include limited recognition of the role of technology in appropriating traditional and gendered knowledge or of how technology is being

[146] Cartagena Protocol (2000), art 22(2) (italics mine).
[147] Convention on Biological Diversity (1992), art 18(1); Nagoya Protocol (2010), art 23.
[148] Convention on Biological Diversity (1992), art 18(2).
[149] Nagoya Protocol (2010), art 23.
[150] CBD, Decision XIII/24 2016, Annex I para 25(b)(iii-iv) (italics mine).
[151] CBD, Decision XIII/24 2016, Annex II para 6; see also: CBD, Decision XIII/12 2016, Annex II para 1.4.
[152] Salleh, "Climate Strategy," 126.

pitted against traditional practices across the globe.[153] Further, the full cost of new manufacturing technologies is rarely considered because the 'material costs are often rendered invisible by externalisation on to other classes, races, genders, or species'.[154] Rather than engaging with a comprehensive restructuring of Western culture, this assumes that human culture, lifestyles and demands on nature are unchangeable.[155] As science and technology are socially constructed, the narratives regarding the role of technology and technological innovation are informed by dominant discourses, such as SD and EM. This can perpetuate the status quo and embedded power relations under the guise of progress and cooperation.

The participation by states and non-state actors in technological innovation is another key feature of EM that is found in the biodiversity regime. Parties are encouraged to develop transnational networks and institutions of technological innovation for the purposes of cooperation. This strategy reflects what Barry and Paterson identify as the 'techno-bureaucratic state-led and initiated "greening" of certain key sectors of the economy'.[156] Following this approach, state policy 'elites' act as 'brokers and prime movers in encouraging interest groups, trades unions, industry, consumer groups and sections of the environmental movement'[157] to accept the EM agenda.

In keeping with this, both types of documents include references supporting greater participation and cooperation between actors involved in technological innovation. The CBD states:

> The Contracting Parties shall promote international technical and scientific cooperation in the field of conservation and sustainable use of biological diversity, where necessary, through the appropriate international and national institutions.[158]

The two Protocols include similar provisions regarding developing human resources and institutional capacity in developing countries through existing public institutions and increased participation by the private sector and civil society.[159]

The COP Decisions also emphasise the importance of 'cross-sectoral' partnerships and the need to support greater cooperation between states to develop technologies. For example, COP Decision XIII/11 states:

> Emerging technologies and sensor development increase the efficiency of this evolving network. There is a need for greater cross-sectoral partnership among government, industry and academia to facilitate the establishment of globally integrated monitoring systems.[160]

The international agreements and COP Decisions also include provisions to support the participation of women and indigenous communities in capacity-building, innovation and technology transfer, in addition to supporting the participation between state and non-state actors.[161] Where such provisions are identified in the operational text, they are often qualified by phrases such as 'subject to its national legislation'[162] and 'in accordance with national legislation and policies'.[163] This leaves how to operationalise such participation to the discretion of state parties.

Nevertheless, some documents include more positive statements concerning participation by indigenous peoples. For example, Decision XIII/12 states:

> [This Decision aims to] *enhance the use of the traditional, scientific, technical and technological knowledge of indigenous peoples and local communities.*

[153] Shiva, "Biopatents"; Isla, "Biopiracy."
[154] Salleh, "Climate Strategy," 129.
[155] Plumwood, Environmental Culture, 8.
[156] Barry, "Globalisation," 768.
[157] Barry, "Globalisation," 769.
[158] Convention on Biological Diversity (1992), art 18(1)
[159] Nagoya Protocol (2010), art 23; Cartagena Protocol (2000), art 22(1).
[160] CBD, Decision XIII/11 2016, Annex I para 14.
[161] Cartagena Protocol (2000), art 26; Nagoya Protocol (2010), preamble para 11, art 22(1), art 22(3); Convention on Biological Diversity (1992), preamble para 13, art 17(2).
[162] Convention on Biological Diversity (1992), art 8(j).
[163] Convention on Biological Diversity (1992), art 18(4).

> Given the unique challenges associated with the use of traditional knowledge, *more work should be done to identify effective ways of including that information* … Training activities could be organized prior to workshops at the relevant scale, *targeting both representatives and experts from indigenous peoples and local communities as well as from scientific institutions*.[164]

However, ecofeminists argue that as the institution and practices of science, technology and economics are distinctly gendered, this can exclude 'non-expert', embodied and lived experiences from receiving the same recognition and authority as 'professional experts'.[165] One of the key features of these documents is the way they assign environmental problems to 'professional experts' who maintain 'technical authority' when 'negotiating environmental risks'.[166] While there are references to the value of women and indigenous knowledge and technologies in the documents, these may not be assigned the same value as Western scientific findings. Therefore, encouraging cooperation between these elite actors and more marginalised communities may reinforce the dominant discourse that environmental problems are purely technical in content, silencing alternative understandings.

This analysis indicates that states have been transformed into brokers who encourage cooperation through different modes, including enforcing state-led regulation, developing different market mechanisms, facilitating market shifts and incentivising technological innovation. However, this focus on the use of technology to support cooperation and increase development benefits must also consider the way in which technology can 'embody specific forms of power and authority'.[167] Technology can act as a conduit for recolonisation practices because it is positioned as the engine for modernisation and development.[168] This is because it has been an 'intimate and inextricable part of the colonial machinery' and 'colonial ontologies have been "rephrased" within the technoscientific frameworks of globalisation'.[169] Therefore, colonial histories and their contemporary legacies should be considered in negotiations regarding technology transfer and its potential for reaffirming hierarchies of power and knowledge.[170]

There are multiple ways in which the biodiversity regime has referred to technology to facilitate greater cooperation between states and non-state actors, incorporating EM strategies that view technology and technological innovation as the solution to environmental problems. Greater cooperation and collaboration between states not only enables greater innovation but ensures that developing countries will benefit from such cooperation and, by extension, benefit from their participation in the biodiversity regime itself.

Technology And 'Making A Difference'

The connection between technology and 'making a difference' is another feature of EMT's underlying commitment to progress and modernisation. 'Making a difference' is constructed in two ways in the documents: making a difference to ecosystems through restoration and conservation and making a difference to human well-being by adding value to, or receiving other benefits from, genetic resources, ecosystem functions and ecosystem services.

These two approaches associate technological innovation with making a positive difference to ecological systems and humanity. The CBD preamble acknowledges that:

> '[T]he provision of new and additional financial resources and appropriate access to relevant technologies *can be expected to make a substantial difference in the world's ability to address the loss of biological diversity*.[171]

This 'substantial difference' is used to support the transfer and provision of new and existing technologies to developing countries. Similarly, the Nagoya Protocol recognises how technology transfer can add value to genetic resources in developing countries.[172] The positive association between 'difference' and monetary or human-centred benefit through technological

[164] CBD, Decision XIII/12 2016, Annex II para 1.5 (italics mine); see also CBD, Decision XIII/3 2016, para 97.
[165] Code, Ecological Thinking; Curtain, "Women's Knowledge"; Lee, "Ecofeminist Perspectives"; Morrow, "Ecofeminism"; Faulkner, "The Technology Question."
[166] Mason, Environmental Democracy, 25.
[167] Winner, "Do Artifacts Have Politics?," 121.
[168] Harding, "Postcolonial and Feminist Philosophies," 412.
[169] Pollock, "Resisting Power," 957.
[170] Harding, "Postcolonial and Feminist Philosophies"; Harding, Is Science Multicultural; Lee, "Ecofeminist Perspectives"; Pollock, "Resisting Power"; Foster, "Decolonizing Patent Law"; Seth, "Putting Knowledge in Its Place."
[171] Convention on Biological Diversity (1992), preamble para 15 (italics mine).
[172] Nagoya Protocol (2010), preamble para 5.

innovation is a feature of EM discourses. The presence of these provisions highlights the way the regime uncritically embeds the assumption that technology is a self-evident good that adds value to inert materials such as genetic resources. Not only does this reaffirm that 'benefit' is primarily understood in terms of monetary value, it also maintains the dominant view that nature (and its associated 'others') is inert and in need of transformation.

The connection between technological innovation and difference is also embedded in provisions concerning the role of technology in facilitating development in developing countries. This was observed in the Nagoya Protocol, which appears to conflate SD and EM when it explicitly adopts a strategy of building research and innovation capacities to add value to genetic resources. The preamble recognises:

> [T]he important contribution to sustainable development made by technology transfer and cooperation to build research and innovation capacities for *adding value to genetic resources in developing countries*, in accordance with Articles 16 and 19 of the Convention.[173]

This paragraph merges technology transfer and innovation with adding value to nature-derived resources, thus revealing the deep-seated view of the environment as a resource that is embedded within Western philosophical traditions and is central to weak EM discourses. This view of nature is also contained in the operational provisions of the Protocol, particularly in terms of technology transfer, collaboration and cooperation.[174] The presence of this theme in the documents suggests that the biodiversity regime has incorporated EM discourses of technology.

This uncritically positive view of technology is reaffirmed in the COP Decisions. Decisions concerning cold-water ecosystems and synthetic biology portray technological innovation as a self-evident good that can overcome existing barriers by attaining the objectives of the biodiversity regime.[175] Therefore, they promote technology as playing a key role in making a positive difference to biodiversity loss, conservation and the sustainable use of biological resources.

Obtaining Benefit By Increasing Biological Productivity

The biodiversity regime promotes the role of technology in restoring damaged ecosystems and improving ecosystem productivity for human well-being. This is evident in the international agreements and COP Decisions that include statements supporting the role of technology in restoring ecosystems and, more importantly, their productivity:

> [This Decision] *encourages* Parties … to promote and support … sustainable agricultural production, that may include increases in productivity based on the sustainable management of ecosystem services and functions, diversification of agriculture [and] agro-ecological approaches.[176]

> In support of the implementation of this Protocol, capacity-building and development may address, *inter alia*, the following key areas:
>
> …
>
> (d) Capacity of countries to develop their endogenous research capabilities to add value to their own genetic resources.[177]

These excerpts reveal an expectation that technology makes a positive difference to human well-being by shaping and improving the non-human environment. In these excerpts, technology is used in two ways: first, to derive value from genetic resources for human benefit and second, to increase the productivity of ecosystem functions and services to improve agricultural output.

Such practices are known to destabilise and undermine the lives of women by transforming traditional practices, products and processes into commodities.[178] As a result these practices can threaten the resources of indigenous peoples and vulnerable

[173] Nagoya Protocol (2010), preamble para 5 (italics mine).
[174] Nagoya Protocol (2010), art 23.
[175] CBD, Decision XIII/5 2016, Annex para 14.10; see also: CBD, Decision XIII/23 2016; CBD, Decision XIII/11 2016; CBD, Decision XIII/17 2016.
[176] CBD, Decision XIII/3 2016, para 30.
[177] Nagoya Protocol (2010), art 22(4)(d).
[178] Braidotti, Women, the Environment.

groups and cause conflicts within communities.[179] In cases in which development agendas are informed by the potential of technology to increase ecological production, technology can also lead to 'maldevelopment' or 'de-development', thus increasing the vulnerability of already marginalised communities.[180] Therefore, not only do these provisions highlight an anthropocentric understanding of the role of technology in improving productivity, they also incorporate a gendered and exploitative understanding.

Adopting An Anthropocentric Perspective Of 'Benefit'

The provisions regarding technology in the biodiversity regime reflect characteristics of dualism that systematically and pervasively construct the 'other'—in this case, the non-human environment—as inferior. These characteristics are incorporated in the provisions regarding role of the environment as a provider of genetic resources and services. By reframing the non-human environment as an object or entity that technology can 'improve', these documents define the needs of the environment in terms of the needs of humanity. They radically exclude and instrumentalise the non-human environment, thereby legitimising the exploitation and manipulation of the environment for human benefit. In this way, the environment is objectified and 'its ends are defined in terms of the master's ends'.[181] This demonstrates the anthropocentric foundation of the biodiversity regime and reveals that the provisions relating to technology approach 'making a difference' from a purely human-centric perspective.

This human-centric perspective is contained in both the international agreements and the COP Decisions. Both types of documents incorporate the narrative that technology is necessary to improve ecological productivity to ensure human well-being. This narrative is embedded in the preamble of the Cartagena Protocol, the operational sections of the Nagoya Protocol and subsequent COP Decisions:

> Recognizing that modern biotechnology has great potential for human well-being if developed and used with adequate safety measures for the environment and human health.[182]

> In support of the implementation of this Protocol, capacity-building and development may address, *inter alia*, the following key areas … [The] [c]apacity of countries to develop their endogenous research capabilities to add value to their own genetic resources.[183]

> Building the capacity of Parties to develop their *endogenous research capabilities to add value to their own genetic resources* and traditional knowledge associated with genetic resources through, *inter alia*, technology transfer; bioprospecting and associated research and taxonomic studies; and the development and use of valuation methods.[184]

In these documents, technology is promoted as a solution for existing or future damage to the environment. Implicit in this promotion is a worldview in which humans and nature are separate and different. Humanity is cast as superior, which legitimises framing the environment in a server or provider role and manipulating it through technology for the benefit of humanity.

These examples reflect an anthropocentric perspective of benefit. They identify technological innovation as the solution to environmental degradation and security as it enables humans to maximise environmental resources for their benefit. They justify environmental protection in terms of likely human benefit by increasing productivity and security.[185] Therefore, they incorporate the dualist characteristic of radical exclusion, which occurs when the centre—in this case humanity—'tries to magnify, to emphasise and to maximise the number and importance of differences and to eliminate or treat as inessential shared equalities'.[186] They demonstrate this by positively connecting technological innovation with making a difference to human lives.

In addition, these documents also obfuscate the gendered nature of such technologies. Biotechnology, for example, is woven into development projects and, consequently, has had profound effects on the lives of rural women and communities.[187] This is

[179] Foster, "Decolonizing Patent Law."
[180] Braidotti, Women, the Environment; Harding, "Postcolonial and Feminist Philosophies"; Shiva, "Bioprospecting."
[181] Plumwood, Feminism and Mastery, 53.
[182] Cartagena Protocol (2000), preamble para 6.
[183] Nagoya Protocol (2010), art 22(4)(d).
[184] CBD, Decision XIII/21 2016, para 23(d) (italics mine).
[185] Lacy, Security and Climate Change, 86.
[186] Plumwood, Feminism and Mastery, 49.
[187] See e.g., Aistara, "Seeds of Kin"; Gonda, "Climate Change, 'Technology' and Gender"; Ezezika, "She Came, She Saw"; Gonda, "Patriarchal Sides of Climate Change."

because development projects can produce and preproduce unequal gender relations among the communities into which they are imported.[188] The uncritical narrative within these documents not only views non-human nature as inert and in need of transformation, it also risks viewing women as 'productive engines to society and … profitable clients to any public or private sector developer'.[189] Therefore, the documents continue to perpetuate the dominant understanding of the relationship between technology, gender, development and the environment within the biodiversity regime.

This section has examined the two interrelated themes that associate technology with making a difference and as a mechanism for cooperation. The analysis found that technology is used as a mechanism to facilitate greater cooperation and participation from multiple state and non-state actors; it is used to develop the closer relationships and partnerships required to support innovation. This is an EM strategy as it encourages cooperation between different state and non-state actors in different societal institutions, such as the global market, the private sector and industries. As such, it reflects the continued commitment to progress and modernisation embedded within EM.

Implicit in this strategy for cooperation is the belief that technology makes a difference by improving the ecological foundation of human society and human well-being more directly. The analysis found that technology is portrayed as one of the main vehicles through which to achieve progress in the biodiversity regime. This was demonstrated by the affirmation of technological innovation as one main vehicle to achieve progress by enabling ecosystem restoration, modification or conservation for human benefit. This approach towards understanding 'difference' highlights the close relationship between technology, making progress and anthropocentrism in EM. In turn, this has been incorporated in the biodiversity regime. It indicates that that 'difference' within the regime is directly connected to two underlying concepts of EM: the optimistic view of technology as a problem solver and the consideration of technology as a mechanism to mitigate environmental damage from economic growth. Underlying both these concepts is the separation and disembedding of humanity from the ecological planet.

Increasing The Productivity And Value Of The Environment

The language contained in the COP Decisions incorporates a connection between technology, improving ecosystems and obtaining value from non-human nature. This indicates that the documents associate technology with improving and adding value to the non-human environment by increasing its productivity.

Decision XIII/3 and Decision XIII/5 both seek to promote the productivity of land and enhance ecosystem services and functions. Decision XIII/3 encourages parties to develop policy frameworks that:

> Promote sustainable increases in the productivity and diversification of production of existing agricultural land and rangeland while enhancing ecosystem services and functions, including those services and functions that contribute to agricultural production (such as pollination, pest control, water provision and erosion control).[190]

Decision XIII/5 invites states to consider 'how ecosystem restoration activities can support the ecological and economic sustainability of agriculture and other production activities'.[191] Decision XIII/22 states that messages should 'clearly show the linkages between diversity and other sustainable development issues',[192] particularly that 'biodiversity, environmental functions and ecosystem services contribute directly to human well-being and development priorities'.[193] The language used in these Decisions frames the environment as a separate and distinct entity that can be improved to become more productive through technological innovation. While these terms are not explicitly incorporated within the Decisions, they manifest themselves in the language of 'sustainable intensification'[194] of agriculture contained in the Decisions.

Sustainable intensification refers to increasing the productivity of agriculture in a sustainable manner by employing technological innovations and technical efficiencies to ensure that agriculture yields can increase with less impact on the natural environment.[195] Strategies include the use of biotechnology, the development of 'smarter' pesticides and fertilisers and the

[188] Gonda, "Climate Change, 'Technology' and Gender," 151.
[189] Falck-Zepeda, Gender Impacts, 5.
[190] CBD, Decision XIII/3 2016, para 28.
[191] CBD, Decision XIII/5 2016, Annex para 15(2).
[192] CBD, Decision XIII/22 2016, para 28.
[193] CBD, Decision XIII/22 2016, para 28(b).
[194] Mahon, "Sustainable Intensification," 74.
[195] Cook, Sustainable Intensification, 1.

development of technology to enable more intensive and efficient agriculture in smaller land areas.[196] These approaches create technology-led solutions for food security and cause agricultural practices to exert a negative impact on the environment. This approach adopts EM strategies to respond to environmental concerns by focusing on improving efficiencies through technological innovation.

Inherent in this approach is the belief that technology can extract value from the environment. This reinforces the view of the environment as valueless until manipulated for human benefit. This view is embedded in the international agreements and the COP Decisions:

> Aware that conservation and sustainable use of biological diversity is of critical importance for meeting the food, health and other needs of the growing world population, for which purpose access to and sharing of both genetic resources and technologies are essential.[197]

> Recognizing that modern biotechnology has great potential for human well-being if developed and used with adequate safety measures for the environment and human health.[198]

> [Recognising] *the role of forest biodiversity for the maintenance of ecosystem services and functions that contribute to sustainable development, poverty eradication and human well-being,* including through the provision of food, feed, water, wood, fibre, fuel, medicine, recreation, as well as the mitigation of and adaptation to climate change.[199]

These excerpts demonstrate a relational understanding of value between humanity and non-human nature, wherein nature is defined in relation to human needs. In the CBD, genetic resources and related technologies are deemed 'essential' to meet the needs of humanity and the Protocols similarly recognise the role of non-human nature and technology for human security.

This relational understanding of non-human nature is reinforced by the definitions of biodiversity in the agreements. The CBD defines 'biological resources' as 'genetic resources, organisms … ecosystems with actual or potential use or value for humanity' and genetic resources are defined as 'genetic material of actual or potential value'[200] These definitions indicate that value is determined in relation to humanity, thereby reinforcing the anthropocentric nature of the biodiversity regime.

The Nagoya Protocol also recognises the 'important contribution' made by technology transfer 'for adding value to genetic resources'[201] and that the 'economic value of ecosystems and biodiversity' are 'key incentives for the conservation of biological diversity and the sustainable use of its components'.[202] This presents technology as a mechanism for optimising or improving efficiencies in using the environment. Therefore, the value of the environment is defined in relation to human benefit.

The assumption that technology confers value to the non-human environment is deeply embedded in weak EMT. This theory adopts a purely instrumental view of value based on an understanding of the environment as the resource base for 'free market capitalism'.[203] Therefore, this discourse disassociates and disembeds humanity from the environment, thus legitimising its exploitation and manipulation.

EM strategies that emphasise the need to increase the productivity of the environment to derive value for human benefit embed value dualisms that reinforce the separation between the human and non-human environment. By defining value in terms of human benefit, these references incorporate an objectified view of the environment since they approach environmental conservation as a means to an end and regard technological innovation as the mechanism to achieve this end. The emphasis on increasing the productivity and efficiency of the environment epitomises this objectified view of nature because it considers that the needs of the environment are defined in terms of human needs.

The references to the environment reduce 'complex ecological systems into discrete components that can be commoditised and utilised for the purpose of economic growth and social development'.[204] Technology is identified as the tool used to derive

[196] Diamond Collins, A Wolf In Sheep's Clothing.
[197] Convention on Biological Diversity (1992), preamble para 20.
[198] Cartagena Protocol (2000), preamble para 6; see also Nagoya Protocol (2010), preamble para 14.
[199] CBD, Decision XIII/3 2016, para 42 (italics mine).
[200] Convention on Biological Diversity (1992), art 2(2), art 2(10).
[201] Nagoya Protocol (2010), preamble para 5.
[202] Nagoya Protocol (2010), preamble para 6.
[203] Mol, "Ecological Modernisation Theory," 22.
[204] Wilkinson Cross, "The Environment as Commodity," 239.

value by manipulating or changing the environment into something that can be used, consumed or sold. In this way, the biodiversity regime incorporates the value dualism of relational definition, which reinforces the separation of humanity from the non-human environment.

Materialist ecofeminists argue that this is indicative of how humanity has attempted to separate itself from nature through productive systems that legitimise the transformation of nature into profit by eroding and polluting it with technological processes.[205] This encapsulates EMT's connection between technology and the environment, whereby technology improves the productivity of the non-human environment by increasing the efficiency with which natural resources and ecosystem services and functions can be used for human benefit.

Conclusion

This article analysed the references to technology contained in the CBD, Nagoya Protocol, Cartagena Protocol and the 2016 COP and MOP Decisions. The analysis found that weak EM commitments to technological innovation are embedded in the objectives of the biodiversity regime. This has implications for the future evolution of the biodiversity regime because this form of EM uses technological innovation to maintain the status quo. This means that the regime does not question the underlying conceptual framework that legitimises 'efficient' harm to the environment. Instead, it remains committed to modernisation and progress based on the production and consumption of natural resources.

This is demonstrated through the continued commitment to the overarching project of modernisation through efficient industrialisation and technological innovation in the biodiversity regime. While the documents support the pursuit of SD, the strategies introduce weak EMT, suggesting that EM has pervasively influenced understandings of the terms 'sustainable' and 'development' in the context of the biodiversity regime.

Ecofeminists criticise interpretations of 'progress' and 'modernisation' in weak EM that disembed humanity from non-human nature. They argue that EM maintains a mechanistic worldview that reduces non-human nature into constituent elements to be reshaped and modified into something of economic value. Instead of adopting this view, society and human institutions should recognise the immanence of humanity and take account of natural limits, conditions and uncertainties. Disembedding and transcending ecological systems in the name of progress marginalises women's embodied work and enables 'dominant groups to live as if they were not embodied and embedded within a limited nature'.[206]

The inclusion of weak EM in the provisions relating to technology and technological innovation indicates that the biodiversity regime has adopted a strategy of maintaining the status quo. This may not have been a conscious decision. EM strategies adopt an explicitly optimistic worldview and have been effective in highly industrialised and developed countries at mitigating and counteracting environmental problems by continuing to do what humans do, but better and with more efficiencies. As such, the strategies are highly persuasive and mobilise many states in support.

Nevertheless, such technocentric solutions do not create a space in which truly alternative approaches to biodiversity loss may occur. Ecofeminists and other critical scholars highlight the flawed assumptions that inform EM, which reinforce dualisms between humanity and non-human nature, legitimising the exploitation and subordination of the environment. Mapped onto these dualisms are societal institutions that reinforce the separation between humanity and non-human nature by disembedding humanity from its material existence through the mode of production. These actions are visible in the biodiversity regime because the regime casts technological innovation as a central pillar of the regime and its strategy to fulfil its obligations.

Therefore, the unwillingness to start conversations about structural inequalities between advanced and developing countries, and the fundamental values that inform the biodiversity regime, may not be a conscious decision. However, until humans acknowledge that such strategies are informed by techno-optimistic visions of the future and are shaped by a fundamentally unequal and exploitative conceptual framework, it may not be possible to consider further revisions to the societal institutions that shape, inform and affect the success of international environmental regimes.

[205] Merchant, "Ecofeminism," 103; Mellor, Feminism and Ecology, 62; Wilkinson Cross, "The Environment as Commodity," 189.
[206] Mellor, "Ecofeminist Economics," 125.

Bibliography

International Agreements and Conference of the Parties Decisions

Cartagena Protocol on Biosafety, 29 Jan. 2000, 226 UNTS 208.
Convention on Biological Diversity, 5 June 1992, 1760 UNTS 79.
Decision XIII/3, Strategic Actions to Enhance the Implementation of the Strategic Plan for Biodiversity 2011–2020 and the Achievement of the Aichi Biodiversity Targets, Including with Respect to Mainstreaming and the Integration of Biodiversity within and across Sectors, 12 December 2016, CBD/COP/DEC/XIII/3. https://www.cbd.int/decisions/cop/13/3.
Decision XIII/5, Ecosystem Restoration: Short-Term Action Plan, 10 December 2016, CBD/COP/DEC/XIII/5. https://www.cbd.int/decisions/cop/13/5.
Decision XIII/11, Voluntary Specific Workplan on Biodiversity in Cold-Water Areas within the Jurisdictional Scope of the Convention, 10 December 2010, CBD/COP/DEC/XIII/11. https://www.cbd.int/decisions/cop/13/11.
Decision XIII/12, Marine and Coastal Biodiversity: Ecologically or Biologically Significant Marine Areas, 17 December 2016, CBD/COP/DEC/XIII/12. https://www.cbd.int/decisions/cop/13/12.
Decision XIII/17, Synthetic Biology, 16 December 2016, CBD/COP/DEC/XIII/17. https://www.cbd.int/decisions/cop/13/17.
Decision XIII/21, The Financial Mechanism, 17 December 2016, CBD/COP/DEC/XIII/21. https://www.cbd.int/decisions/cop/13/21.
Decision XIII/22, Framework for a Communication Strategy, 13 December 2016, CBD/COP/DEC/XIII/22. https://www.cbd.int/decisions/cop/13/22.
Decision XIII/23, Capacity-Building, Technical and Scientific Cooperation, Technology Transfer and the Clearing-House Mechanism, 16 December 2016, CBD/COP/DEC/XIII/23. https://www.cbd.int/decisions/cop/13/23.
Decision XIII/24, Cooperation with Other Conventions and International Organizations, 16 December 2016, CBD/COP/DEC/XIII/24. https://www.cbd.int/decisions/cop/13/24.
Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation, 29 October 2010, UNEP/CBD/COP/DEC/X/1.
UN General Assembly, Resolution 70/1, A/RES/70/1, (25 September 2015). http://undocs.org/en/a/res/70/1.
Vienna Convention on the Law of Treaties, 22 May 1969, 1155 UNTS 331.

Secondary Materials

Agarwal, Bina. "The Gender and Environment Debate: Lessons from India." *Feminist Studies* 18, no 1 (1992): 119–58.
Aistara, Guntra A. "Seeds of Kin, Kin of Seeds: The Commodification of Organic Seeds and Social Relations in Costa Rica And Latvia." *Ethnography* 12, no 4 (2011): 490–517. https://doi.org/10.1177/1466138111400721.
Anadon, L. D., G. Chan, A. G. Harley, K. Matus, S. Moon, S. L. Murthy and W. C. Clark. "Making Technological Innovation Work for Sustainable Development." *Proceedings of the National Academy of Sciences of the United States of America* 113, no 35 (2016): 9682–90. https://doi.org/10.1073/pnas.1525004113, 10.1073/pnas.1525004113.
Asafu-Adjaye, John, Linus Blomquist, Stewart Brand, Barry W. Brook, Ruth Defries, Erle Ellis, Christopher Foreman, et al. *An Ecomodernist Manifesto*, 2015. http://www.ecomodernism.org/manifesto-english/.
Åsberg, Cecilia and Nina Lykke. "Feminist Technoscience Studies." *European Journal of Women's Studies* 17, no 4 (2010): 299–305. https://doi.org/10.1177/1350506810377692.
Ashford, Nicholas A. "Government and Environmental Innovation in Europe and North America." In *Towards Environmental Innovation Systems*, edited by K. Matthias Weber and Jens Hemmelskamp. New York: Springer, 2005.
Aust, Anthony. *Modern Treaty Law and Practice*. 3rd ed. Cambridge: Cambridge University Press, 2013.
Bäckstrand, Karin. "Scientisation vs. Civic Expertise in Environmental Governance: Eco-Feminist, Eco-Modern and Post-Modern Responses." *Environmental Politics* 13, no 4 (2004): 695–714. https://doi.org/10.1080/0964401042000274322.
Bäckstrand, Karin and Eva Lövbrand. "Planting Trees to Mitigate Climate Change: Contested Discourses of Ecological Modernization, Green Governmentality and Civic Environmentalism." *Global Environmental Politics* 6 (2006): 50–75. https://doi.org/10.1162/152638006775991911.
Bailey, Ian, Andy Gouldson and Peter Newell. "Ecological Modernisation and the Governance of Carbon: A Critical Analysis." *Antipode* 43, no 3 (2011): 682–703. https://doi.org/10.1111/j.1467-8330.2011.00880.x.
Baker, Susan. "Sustainable Development as Symbolic Commitment: Declaratory Politics and the Seductive Appeal of Ecological Modernisation in the European Union." *Environmental Politics* 16, no 2 (2007): 297–317. https://doi.org/10.1080/09644010701211874.
Barry, John. "Bio-Fuelling the Hummer? Transdisciplinary Thoughts on Techno-Optimism and Innovation in the Transition from Unsustainability." In *Transdisciplinary Perspectives on Transitions to Sustainability*, edited by Edmond Bryne, Ger Mullally and Colin Sage. Manchester: Routledge, 2016.

Barry, John and Matthew Paterson. "Globalisation, Ecological Modernisation and New Labour." *Political Studies* 52, no 4 (2004): 767–84. https://doi.org/10.1111/j.1467-9248.2004.00507.x.

Berger, Gerald, Andrew Flynn, Frances Hines and Richard Johns. "Ecological Modernization as a Basis for Environmental Policy: Current Environmental Discourse and Policy and the Implications on Environmental Supply Chain Management." *Innovation: The European Journal of Social Science Research* 14, no 1 (2001): 55–72. https://doi.org/10.1080/13511610125074.

Biehl, Janet. "Problems in Ecofeminism." *Society and Nature* 2 (1993): 52–71.

———. *Rethinking Ecofeminist Politics.* Boston: South End Press, 1991.

Bodansky, Daniel. "Legally Binding versus Non-legally Binding Instruments." In *Towards a Workable and Effective Climate Regime*, edited by Scott Barrett, Carlo Carraro and Jaime de Melo. London; Clermont-Ferrand: CEPR Press and Ferdi, 2015.

Böhm, Monika and Ben Collen. "Toward Equality of Biodiversity Knowledge through Technology Transfer." *Conservation Biology* 29, no 5 (2015): 1290–302. https://doi.org/10.1111/cobi.12529.

Braidotti, Rosi. *Transpositions: On Nomadic Ethics*. Cambridge: Polity, 2006.

Braidotti, Rosi, Ewa Charkiewicz, Sabine Hausler and Saskia Wieringa. *Women, the Environment and Sustainable Development: Towards a Theoretical Synthesis*. London: Zed Books, 1994.

Brand, Ulrich. "Sustainable Development and Ecological Modernization—the Limits to a Hegemonic Policy Knowledge." *Innovation: The European Journal of Social Sciences* 23, no 2 (2010): 135–52. https://doi.org/10.1080/13511610.2010.522403.

Buttel, Frederick H. "Ecological Modernization as Social Theory." *Geoforum* 31, no 1 (2000): 57–65. https://doi.org/10.1016/S0016-7185(99)00044-5.

———. "Environmental Sociology and the Explanation of Environmental Reform." *Organization and Environment* 16, no 3 (2003): 306–44. https://doi.org/10.1177/1086026603256279.

Carter Olson, Candi. "#BringBackOurGirls: Digital Communities Supporting Real-World Change and Influencing Mainstream Media Agendas." *Feminist Media Studies* 16, no 5 (2016): 772–87. https://doi.org/10.1080/14680777.2016.1154887.

Casper, Monica J. and Adele E. Clarke. "Making the Pap Smear into the 'Right Tool' for the Job: Cervical Cancer Screening in the USA, circa 1940-95." *Social Studies of Science* 28, no 2 (1998): 255–90. http://www.jstor.org.proxy.library.dmu.ac.uk/stable/285603.

CBD Secretariat. "Technical and Scientific Cooperation." 2018. https://www.cbd.int/tsc/.

———. "Technology Transfer." 2018. https://www.cbd.int/tech-transfer/.

Christoff, Peter. "Ecological Modernisation, Ecological Modernities." *Environmental Politics* 5, no 3 (1996): 476–500. https://doi.org/10.1080/09644019608414283.

Cockburn, Cynthia and Susan Ormrod. *Gender and Technology in the Making*. London: SAGE Publications, 1993.

Code, Lorraine. *Ecological Thinking: The Politics of Epistemic Location*. Oxford: Oxford University Press, 2006.

———. *What Can She Know? Feminist Theory and the Construction of Knowledge.* Ithaca: Cornell University Press, 1991.

Cohen, Maurie J. "Ecological Modernisation, Environmental Knowledge and National Character: A Preliminary Analysis of the Netherlands." *Environmental Politics* 9, no 1 (2000): 77–106. https://doi.org/10.1080/09644010008414513.

Connelly, James, Graham Smith and Clare Saunders. *Politics and The Environment: From Theory to Practice*. 3rd ed. Abingdon; New York: Routledge, 2012.

Cook, Seth, Laura Silici and Barbara Adolph. *Sustainable Intensification Revisited*. 2015. http://pubs.iied.org/17283IIED/.

Corea, Gena. "The Reproductive Brothel". In *Man-Made Women: How New Reproductive Technologies Affect Women*, edited by Gena Corea, Renate Duelli Klein, Jalna Hanmer, Helen B. Holmes, Betty Hoskins, Madhu Kishwar, Janice Raymond, Robyn Rowland and Roberta Steinbacher. Bloomington: First Midland Book, 1987.

Costelloe, Daniel and Malgosia Fitzmaurice. "Interpretation of Secondary Instruments in International Law." *Polish Yearbook of International Law* 35 (2016): 47–82. https://doi.org/10.7420/pyil2015b.

Crasnow, Sharon, Alison Wylie, Wenda K. Bauchspies and Elizabeth Potter. "Feminist Perspectives on Science." In *The Stanford Encyclopedia of Philosophy*, edited by Edward N. Zalta. Stanford: Stanford University, 2018.

Cuomo, Chris J. "Still Fooling with Mother Nature." *Hypatia* 16 (2001): 149–56.

Curran, Giorel. "Ecological Modernisation and Climate Change in Australia." *Environmental Politics* 18, no 2 (2009): 201–17. https://doi.org/10.1080/09644010802682569.

———. "Is Renewable Energy Still Green? Shaping Australia's Renewable Energy Enterprise in an Age of Ecological Modernisation." *Environmental Politics* 28, no 5 (2018): 1–20. https://doi.org/10.1080/09644016.2018.1510215.

Curtain, Dean. "Women's Knowledge as Expert Knowledge." In *Ecofeminism: Women, Culture, Nature*, edited by Karen J. Warren and Nisvan Erkal. Bloomington: Indiana University Press, 1997.

D'Acquisto, Germana, and Stefania D'Avanzo. "The Role of SHALL and SHOULD in Two International Treaties." *Critical Approaches to Discourse Analysis across Disciplines* 3, no 1 (2009): 36–45. https://www.lancaster.ac.uk/fass/journals/cadaad/volume-3-1/.

D'Eaubonne, Francoise. "Feminism or Death." Translated by Betty Schmitz. In *New French Feminisms: An Anthology*, edited by Elaine Marks and Isabelle De Courtivron, 236. Amehurst: The University of Massachusetts Press, 1980.
Daniels, Jessie. "Rethinking Cyberfeminism(s): Race, Gender, and Embodiment." *Women's Studies Quarterly* 37, no 1/2 (2009): 101-24. https://doi.org/DOI:10.1353/wsq.0.0158.
Davion, Victoria. "Is Ecofeminism Feminist?." In *Ecological Feminism*, edited by Karen J. Warren and Barbara Wells-Howe, 8–27. London: Routledge, 1994.
Davis, August Jordan. "Reading the Strange Case of Woman-as-Appliance." *Third Text* 29, no 4/5 (2015): 356–76. https://doi.org/10.1080/09528822.2016.1152091.
Diamond Collins, E. and Kirtana Chandrasekaran. *A Wolf in Sheep's Clothing? An Analysis of the 'Sustainable Intensification' of Agriculture*. 2012. https://www.foei.org/wp-content/uploads/2013/12/Wolf-in-Sheeps-Clothing-for-web.pdf.
Dryzek, John S. *Paradigms and Discourses.* In *The Oxford Handbook of International Environmental Law*, *e*dited by Daniel Bodansky, Jutta Brunnée and Ellen Hey. Oxford: Oxford University Press, 2007.
———. *The Politics of the Earth: Environmental Discourses*. 3rd ed.: Oxford: Oxford University Press, 2013. https://books.google.co.uk/books?id=EJM1OTeZ0sgC.
Ezezika, Obidimma C, Jennifer Deadman and Abdallah S. Daar. "She Came, She Saw, She Sowed: Re-negotiating Gender-Responsive Priorities for Effective Development of Agricultural Biotechnology in Sub-Saharan Africa." *Journal of Agricultural and Environmental Ethics* 26, no 2 (2013): 461–71. https://doi.org/DOI:10.1007/s10806-012-9396-9.
Falck-Zepeda, José Benjamin, Patricia Zambrano and Patricia Biermayr-Jenzano *Gender Impacts of Genetically Engineered Crops in Developing Countries: Final Technical Report*. 2013. https://www.idrc.ca/en/project/gender-and-health-impacts-genetically-engineered-crops-developing-countries.
Faulkner, Wendy. "The Technology Question in Feminism: A View from Feminist Technology Studies." *Women's Studies International Forum* 24 (2001): 79–95. https://doi.org/10.1016/S0277-5395(00)00166-7.
Ferrando, Francesca. "Is the Post-human a Post-woman? Cyborgs, Robots, Artificial Intelligence and the Futures Of Gender: A Case Study." *European Journal of Futures Research* 2, no 1 (2014): 43. https://doi.org/10.1007/s40309-014-0043-8.
Fisher, Dana R. and William R. Freudenburg. "Ecological Modernization and Its Critics: Assessing the Past and Looking Toward the Future." *Society and Natural Resources* 14, no 8 (2001): 701–09. https://doi.org/10.1080/08941920119315.
Foster, Laura A. "Decolonizing Patent Law: Postcolonial Technoscience and Indigenous Knowledge in South Africa." *Feminist Formations* 28, no 3 (2016): 148.
Fox Keller, Evelyn. *Secrets of Life, Secrets of Death: Essays on Gender, Language and Science*. London: Routledge, 1992.
Gaard, Greta Claire. "Ecofeminism Revisited: Rejecting Essentialism and Re-placing Species in a Material Feminist Environmentalism." *Feminist Formations* 23, no 2 (2011): 26–53. http://muse.jhu.edu/article/448630.
Gibbs, David. "Ecological Modernisation, Regional Economic Development and Regional Development Agencies." *Geoforum* 31, no 1 (2000): 9–19. https://doi.org/10.1016/S0016-7185(99)00040-8.
———. "Ecological Modernisation: A Basis for Regional Development?" Seventh International Conference of the Greening of Industry Network: *Partnership and Leadership: Building Alliances for a Sustainable Future*. Rome. 15–18 November 1998. https://www.semanticscholar.org/paper/Ecological-Modernisation%3A-A-Basis-for-Regional-Gibbs/ecee3cb85888dac77a9df467f1e37a5f6a09741a.
Glynn, Peter J., Timothy Cadman and Tek N. Maraseni. *Ecological Modernization: Theory and the Policy Process*. Cheltenham: Edward Elgar Publishing, 2017.
Gonda, Noémi. "Climate Change, 'Technology' and Gender: 'Adapting Women' to Climate Change with Cooking Stoves and Water Reservoirs." *Gender, Technology and Development* 20 (2016): 149–68. https://doi.org/10.1177/0971852416639786.
———. "Revealing the Patriarchal Sides of Climate Change Adaptation through Intersectionality: A Case Study from Nicaragua." In *Understanding Climate Change through Gender Relations*, edited by Susan Buckingham and Virginie Le Masson. Abingdon: Routledge, 2017.
Gouldson, Andrew and Jan Bebbington. "Corporations and the Governance of Environmental Risk." *Environment and Planning C: Government and Policy* 25, no 1 (2007): 4–20. https://doi.org/10.1068/c0614j.
Grunwald, Armin. "Diverging Pathways to Overcoming the Environmental Crisis: A Critique of Eco-Modernism from a Technology Assessment Perspective." *Journal of Cleaner Production* 197 (2018): 1854–62. https://doi.org/10.1016/j.jclepro.2016.07.212.
Hajer, Maarten A. *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process*. Oxford: Clarendon Press, 1995.
Hannigan, John A. *Environmental Sociology: A Social Constructionist Perspective*. London: Routledge, 1995.
Haraway, Donna. *Simians, Cyborgs, and Women: The Reinvention of Nature*. Abingdon: Routledge, 1991.
———. *Primate Visions: Gender, Race, and Nature in the World of Modern Science*. London: Routledge, 1989.
Harding, Sandra. "Postcolonial and Feminist Philosophies of Science and Technology: Convergences and Dissonances." *Postcolonial Studies* 12, no 4 (2009): 401–21. https://doi.org/10.1080/13688790903350658.

———. *Is Science Multicultural? Postcolonialisms, Feminisms, and Epistemologies*. Bloomington: Indiana University Press, 1998.
Hawken, Paul, Amory B. Lovins and L. Hunter Lovins. *Natural Capitalism: The Next Industrial Revolution*. London: Earthscan, 2010.
Henne, Gudrun and Saliem Fakir. "The Regime Building of the Convention on Biological Diversity on the Road to Nairobi." *Max Planck Yearbook of United Nations Law Online* 3, no 1 (1999): 315–61. https://doi.org/10.1163/187574199X00081.
HM Government. *Industrial Strategy: Building a Britain Fit for the Future*. 2017. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/730048/industrial-strategy-white-paper-web-ready-a4-version.pdf.
Horlings, Lummina G. and Terry K. Marsden. "Towards the Real Green Revolution? Exploring the Conceptual Dimensions of a New Ecological Modernisation of Agriculture that could 'Feed the World'." *Global Environmental Change* 21, no 2 (2011): 441–52. https://doi.org/10.1016/j.gloenvcha.2011.01.004.
Howes, Michael, Marteena McKenzie, Bredan Gleeson, Rowan Gray, Jason Byrne and Peter Daniels. "Adapting Ecological Modernisation to the Australian Context." *Journal of Integrative Environmental Sciences* 7, no 1 (2010): 5–21. https://doi.org/10.1080/19438150903478597.
Huber, Joseph. "Ecological Modernisation: Beyond Scarcity and Bureaucracy." In *The Ecological Modernisation Reader: Environmental Reform in Theory and Practice*, edited by Arthur P. J. Mol, David Allan Sonnenfeld and Gert Spaargaren. New York: Routledge, 2009.
———. "Pioneer Countries and the Global Diffusion of Environmental Innovations: Theses from the Viewpoint of Ecological Modernisation Theory." *Global Environmental Change* 18, no 3 (2008): 360–67. https://doi.org/10.1016/j.gloenvcha.2008.03.004.
Isla, Ana. "An Ecofeminist Perspective on Biopiracy in Latin America." *Signs: Journal of Women in Culture and Society* 32 (2007): 323–32. https://doi.org/10.1086/508378.
Jackson, Cecile. "Women/Nature or Gender/History? A Critique of Ecofeminist 'Development'." *Journal of Peasant Studies* 20 (1993): 389–418. https://doi.org/10.1080/03066159308438515.
Kailo, Kaarina. "Cyber/Ecofeminism—From Violence and Monoculture towards Eco-Social Sustainability." 5th European Feminist Research Conference, Lund University, 20–24 August 2003. https://cdn.atria.nl/epublications/2003/Gender_and_power/5thfeminist/paper_803.pdf.
Kao, Grace Y. "The Universal versus the Particular in Ecofeminist Ethics." *Journal of Religious Ethics* 38 (2010): 616–37. https://doi.org/10.1111/j.1467-9795.2010.00455.x.
Kelly, Petra. "Women and Power." In *Ecofeminism: Women, Culture, Nature*, edited by Karen J. Warren and Nisvan Erkal. Bloomington: Indiana University Press, 1997.
King, Roger J. H. "Caring about Nature: Feminist Ethics and the Environment." *Hypatia* 6 (1991): 75–89. https://doi.org/10.2307/3810034.
King, Ynestra. "Healing the Wounds: Feminism, Ecology, and the Nature/Culture Dualism." In *Reweaving the World: The Emergence of Ecofeminism*, edited by Irene Diamond and Gloria Feman Orenstein, 106–21. San Francisco: Sierra Club Books, 1990.
Kings, A. E. "Intersectionality and the Changing Face of Ecofeminism." *Ethics and the Environment* 22 (2017): 63–87. https://doi.org/10.2979/ethicsenviro.22.1.04.
Lacy, Mark J. *Security and Climate Change: International Relations and the Limits of Realism*. Abingdon: Routledge, 2005.
Lahar, Stephanie. "Ecofeminist Theory and Grassroots Politics." In *Ecological Feminist Philosophies*, edited by Karen J. Warren, 1–18. Bloomington: Indiana University Press, 1996.
Langhelle, Oluf. "Why Ecological Modernization and Sustainable Development Should Not Be Conflated." *Journal of Environmental Policy and Planning* 2, no 4 (2000): 303–22.
Leach, Melissa. "Earth Mother Myths and other Ecofeminist Fables: How a Strategic Notion Rose and Fell." *Development and Change* 38 (2007): 67–85.
Lee, Angela. "An Ecofeminist Perspective on New Food Technologies." *Canadian Food Studies* 5, no 1 (2018): 63–89. https://doi.org/10.15353/cfs-rcea.v5i1.226.
Mahon, Niamh, Ian Crute, Eunice Simmons and Md Mofakkarul Islam. "Sustainable Intensification—'Oxymoron' or 'Third-Way'? A Systematic Review." *Ecological Indicators* 74 (2017): 73–97. https://doi.org/10.1016/j.ecolind.2016.11.001.
Martin, Courtney E. and Vanessa Valenti. *#FemFuture: Online Revolution*. 2013. http://bcrw.barnard.edu/publications/femfuture-online-revolution/.
Mason, Michael. *Environmental Democracy*. London: Earthscan, 2012.
McKeown, Janet K. L., Diana C. Parry and Tracy Penny Light. " 'My iPhone Changed My Life': How Digital Technologies Can Enable Women's Consumption of Online Sexually Explicit Materials." *Sexuality and Culture* 22, no 2 (2018): 340–54. https://doi.org/10.1007/s12119-017-9476-0.
Mellor, Mary. "Ecofeminist Economics: Women, Work, and the Environment." *Women and Environments International Magazine*. 2002. http://faculty.wwu.edu/dunnc3/rprnts.ecofemeconomics.html.

———. “Ecofeminist Political Economy and the Politics of Money.” In *Eco-Sufficiency and Global Justice*, edited by Ariel Salleh. London: Pluto Press, 2009.
———. *Feminism and Ecology*. Cambridge: Polity Press, 1997.
———. “Feminism and Environmental Ethics: A Materialist Perspective.” *Ethics and the Environment* 5, no 1 (2000): 107–23. https://doi.org/10.1016/S1085-6633(99)00026-1.
———. “The Politics of Women and Nature: Affinity, Contingency or Material Relation?.” *Journal of Political Ideologies* 1 (1996): 147–64. https://doi.org/10.1080/13569319608420734.
———. “Women, Nature and the Social Construction of ‘Economic Man’.” *Ecological Economics* 20, no 2 (1997): 129–40. https://doi.org/10.1016/s0921-8009(95)00100-x.
Merchant, Carolyn. *The Death of Nature: Women Ecology and the Scientific Revolution*. New York: Harper, 1980.
———. “Ecofeminism and Feminist Theory.” In *Reweaving the World: The Emergence of Ecofeminism*, edited by Irene Diamond and Gloria Feman Orenstein, 100–05. San Francisco: Sierra Club Books, 1990.
———. “The Scientific Revolution and The Death of Nature.” *Isis* 97 (2006): 513–33.
Mies, Maria and Veronika Bennholdt-Thomsen. *The Subsistence Perspective: Beyond the globalised economy*. London: Zed Books, 1999.
Mies, Maria, Vandana Shiva and Ariel Salleh. *Ecofeminism*. London: Zed Books, 2014.
Milanez, Bruno and Ton Bührs. “Marrying Strands of Ecological Modernisation: A Proposed Framework.” *Environmental Politics* 16, no 4 (2007): 565–83. https://doi.org/10.1080/09644010701419105.
Mirza, M. Usman, Andries Richter, Egbert H. van Nes and Marten Scheffer. “Technology Driven Inequality Leads to Poverty and Resource Depletion.” *Ecological Economics* 160 (2019): 215–26. https://doi.org/10.1016/j.ecolecon.2019.02.015.
Mol, Arthur P. J. “Ecological Modernisation and Institutional Reflexivity: Environmental Reform in the Late Modern Age.” *Environmental Politics* 5, no 2 (1996): 302–23. https://doi.org/10.1080/09644019608414266.
Mol, Arthur P. J. and Martin Jänicke. “Origins and Theoretical Foundations.” In *The Ecological Modernisation Reader: Environmental Reform in Theory and Practice*, edited by Arthur P. J. Mol, David A. Sonnenfeld and Gert Spaargaren. London: Routledge, 2009.
Mol, Arthur P. J. and David A. Sonnenfeld. “Ecological Modernisation Around the World: An Introduction.” *Environmental Politics* 9, no 1 (2000): 1–14. https://doi.org/10.1080/09644010008414510.
Mol, Arthur P. J. and Gert Spaargaren. “Ecological Modernisation Theory in Debate: A Review.” *Environmental Politics* 9, no 1 (2000): 17–49. https://doi.org/10.1080/09644010008414511.
Moore, Niamh. “Eco/Feminism, Non-violence and the Future of Feminism.” *International Feminist Journal of Politics* 10, no 3 (2008): 282–98. https://doi.org/10.1080/14616740802185486.
Morrow, Karen. “Ecofeminism and the Environment: International Law and Climate Change.” In *The Ashgate Research Companion to Feminist Legal Theory*, edited by Margaret Davies and Vanessa Munro. Farnham: Ashgate, 2013.
———. “Not So Much a Meeting of Minds as a Coincidence of Means: Ecofeminism, Gender Mainstreaming and the United Nations.” *Thomas Jefferson Law Review* 28 (2005): 185–204.
Naudé, Wim and Paula Nagler. “Is Technological Innovation Making Society More Unequal?” United Nations University. 2016. https://unu.edu/publications/articles/is-technological-innovation-making-society-more-unequal.html.
Nelson, Julie A. “Economists, Value Judgments, and Climate Change: A View from Feminist Economics.” *Ecological Economics* 65 (2008): 441–47. https://doi.org/10.1016/j.ecolecon.2008.01.001.
———. “Rethinking Development and Globalization: Insights from Feminist Economics.” *The Good Society* 14, no 3 (2005): 58–62.
Oldenziel, Ruth. “Of Old and New Cyborgs: Feminist Narratives of Technology.” *Letteratura d’America* 14, no 55 (1996): 95–111.
Pepper, David. “Ecological Modernisation or the ‘Ideal Model’ of Sustainable Development? Questions Prompted at Europe’s Periphery.” *Environmental Politics* 8, no 4 (1999): 1–34. https://doi.org/10.1080/09644019908414492.
———. “Sustainable Development and Ecological Modernization: A Radical Homocentric Perspective.” *Sustainable Development* 6, no 1 (1998): 1–7.
Pierce, Tess. “Singing at the Digital Well: Blogs as Cyberfeminist Sites of Resistance.” *Feminist Formations* 22, no 3 (2010): 196.
Plumwood, Val. “Ecofeminism: An Overview and Discussion of Positions and Arguments.” *Australasian Journal of Philosophy* 64 (1986): 120–38. https://doi.org/10.1080/00048402.1986.9755430.
———. “The Ecopolitics Debate and the Politics of Nature.” In *Ecological Feminism*, edited by Karen J. Warren and Barbara Wells-Howe, 64–87. London: Routledge, 1994.
———. *Environmental Culture: The Ecological Crisis of Reason*. Abingdon: Routledge, 2002.
———. “Feminism and Ecofeminism: Beyond the Dualistic Assumptions of Women, Men and Nature.” *The Ecologist* 22 (1992): 8–13.
———. *Feminism and the Mastery of Nature*. London: Routledge, 1993.
———. “The Politics of Reason: Towards a feminist logic.” *Australasian Journal of Philosophy* 71, no 4 (1993): 436–62.

Pollock, Anne and Banu Subramaniam. "Resisting Power, Retooling Justice: Promises of Feminist Postcolonial Technosciences." *Science, Technology, and Human Values* 41, no 6 (2016): 951–66. https://doi.org/10.1177/0162243916657879.

Ravetz, Alison. "Modern Technology and an Ancient Occupation: Housework in Present-Day Society." *Technology and Culture* 6, no 2 (1965): 256–60. https://doi.org/10.2307/3101078.

Roberts, Celia. "Relating Simply? Feminist Encounters with Technoscience in the Early Twenty-First Century." *Australian Feminist Studies* 23, no 55 (2008): 75–86. https://doi.org/10.1080/08164640701816249.

Rotman, David. "Technology and Inequality." *Technology Review*. 2014. https://www.technologyreview.com/s/531726/technology-and-inequality/.

Ruder, Sarah-Louise and Sophia Sanniti. "Transcending the Learned Ignorance of Predatory Ontologies: A Research Agenda for an Ecofeminist-Informed Ecological Economics." *Sustainability* 11, no 5 (2019): 1479. https://doi.org/10.3390/su11051479.

Salleh, Ariel. "Climate Strategy: Making the Choice between Ecological Modernisation or Living Well." *Journal of Australian Political Economy* 66 (2010): 118–43.

———. "The Dystopia of Technoscience: An Ecofeminist Critique of Postmodern Reason." *Futures* 41, no 4 (2009): 201–09. https://doi.org/10.1016/j.futures.2008.09.003.

Sandilands, Catriona. *The Good-Natured Feminist: Ecofeminism and the Quest for Democracy.* Minneapolis: University of Minnesota Press, 1999.

Sands, Philippe, Jacqueline Peel, Adriana Fabra and Ruth MacKenzie. *Principles of International Environmental Law*. 4th ed. Cambridge: Cambridge University Press, 2018.

Sessions, Robert. "Deep Ecology versus Ecofeminism: Healthy Differences or Incompatible Philosophies?." *Hypatia* 6 (Spring 1991): 90–107. http://www.jstor.org/stable/3810035.

Seth, Suman. "Putting Knowledge in its Place: Science, Colonialism, and the Postcolonial." *Postcolonial Studies* 12, no 4 (2009): 373–88. https://doi.org/10.1080/13688790903350633.

Shepherd, Nicole. "Where Have All the Cyberfeminists Gone? Part 2." *Engenderings*. 10 June 2013. https://blogs.lse.ac.uk/gender/2013/06/10/where-have-all-the-cyberfeminists-gone/.

Shiva, Vandana. "Bioprospecting as Sophisticated Biopiracy." *Signs: Journal of Women in Culture and Society* 32, no 2 (2007): 307–13. https://doi.org/10.1086/508502.

———. "Biotechnological Development and the Conservation of Biodiversity." In *Biopolitics: A Feminist and Ecological Reader on Biotechnology*, edited by Vandana Shiva and Ingunn Moser. London: Zed Books, 1995.

———. "Development as a New Project of Western Patriarchy." In *Reweaving the World: The Emergence of Ecofeminism*, edited by Irene Diamond and Gloria Feman Orenstein, 189–200. San Francisco: Sierra Club Books, 1990.

———. "Special Report: Golden Rice and Neem: Biopatents and the Appropriation of Women's Environmental Knowledge." *Women's Studies Quarterly* 29, no 1/2 (2001): 12–23. https://doi.org/10.2307/40004606.

———. *Staying Alive: Women, Ecology and Development.* London: Zed Books, 1988.

Sikka, Tina. *Climate Technology, Gender, and Justice: The Standpoint of the Vulnerable*. Cham: Springer, 2019.

Smith, Graham and James Connelly. *Politics and the Environment*. Abingdon; New York: Routledge, 1999.

Spaargaren, Gert. "Ecological Modernization Theory and the Changing Discourse on Environment and Modernity." In *Environment and Global Modernity*, edited by Gert Spaargaren, Arthur P. J. Mol and Frederick H. Buttel, 41–72. London: SAGE Publications, 2000.

Spaargaren, Gert and Arthur P. J. Mol. "Sociology, Environment, and Modernity: Ecological Modernization as a Theory of Social Change." *Society and Natural Resources* 5, no 4 (1992): 323–44. https://doi.org/10.1080/08941929209380797.

Sturgeon, Noël. "Ecofeminist Appropriations and Transnational Environmentalisms." *Identities* 6, no 2–3 (1999): 255–79. https://doi.org/10.1080/1070289x.1999.9962645.

———. *Ecofeminist Natures: Race, Gender, Feminist Theory, and Political Action*. London: Routledge, 1997.

Oxford English Dictionary, 'Technology'. Accessed 8 March 2019. http://www.oed.com/view/Entry/198469.

Thompson, Charis. "Back to Nature? Resurrecting Ecofeminism after Poststructuralist and Third-Wave Feminisms." *Isis* 97, no 3 (2006): 505–12. http://www.jstor.org/stable/10.1086/508080.

Toke, David. "Ecological Modernisation and GM Food." *Environmental Politics* 11, no 3 (2002): 145–63. https://doi.org/10.1080/714000632.

United Nations Conference on Trade and Development. *Technology and Innovation Report 2018: Harnessing Frontier Technologies for Sustainable Development*. 2018. https://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=2110.

United Nations Development Programme. *Humanity Divided: Confronting Inequality in Developing Countries*. 2013. https://www.undp.org/content/undp/en/home/librarypage/poverty-reduction/humanity-divided--confronting-inequality-in-developing-countries.html.

Wajcman, Judy. "Feminist Theories of Technology." In *Handbook of Science and Technology Studies*, edited by Sheila Jasanoff. Thousand Oaks: SAGE Publications, 1995.

———. “Reflections on Gender and Technology Studies: In What State is the Art?.” *Social Studies of Science* 30, no 3 (2000): 447–64.
Warren, Karen J. *Ecofeminist Philosophy: A Western Perspective on What it is and Why it Matters.* Lanham: Rowman and Littlefield, 2000.
———. “Taking Empirical Data Seriously: An Ecofeminist Philosophical Perspective.” In *Ecofeminism: Women, Culture, Nature*, edited by Karen J. Warren and Nisvan Erkal, 3–20. Bloomington: Indiana University Press, 1997.
World Commission on Environment and Development. *Our Common Future.* Oxford: Oxford University Press, 1987.
Whelan, Emma. “Politics by Other Means: Feminism and Mainstream Science Studies.” *Canadian Journal of Sociology* 26, no 4 (2001): 535. https://doi.org/10.2307/3341492.
Wikipedia. “Technology.” 2019. https://en.wikipedia.org/wiki/Technology.
Wilkinson Cross, Kate. “Comparing the Transformative Potentials of the FCCC and the CCD: An Ecofeminist Exploration.” *Denning Law Journal* 30, no 1 (2018): 5–54. http://www.ubplj.org/index.php/dlj/article/view/1583.
———. “Ecofeminist Potentials for International Environmental Law.” In *Ecofeminism in Dialogue*, edited by Douglas A. Vakoch and Sam Mickey. Lanham: Lexington Books, 2017.
———. “The Environment as Commodity? An Ecofeminist Analysis of the Extent to Which Associations between Security and the Environment Have Altered the Perception of the Environment in International Law.” PhD thesis, unpublished. University of Sheffield, 2016. http://etheses.whiterose.ac.uk/13772/.
Wilkinson, Kate. “Is this the Future We Want? An Ecofeminist comment on the UN Conference on Sustainable Development Outcome Document.” In *The Public Law of Gender: From the Local to the Global*, edited by Kim Rubenstein and Katherine G. Young. Cambridge: Cambridge University Press, 2016.
———. “Payment for Ecosystem Services and the Green Economy: Green Washing or Something New?.” *Journal of Human Rights and the Environment* 5, no 2 (2014): 168–91.
Williams, Christopher. *Tradition and Change in Legal English: Verbal Constructions in Prescriptive Texts*. Bern: Peter Lang, 2005.
Williamson, David, and Gary Lynch-Wood. “Ecological Modernisation and the Regulation of Firms.” *Environmental Politics* 21, no 6 (2012): 941–59. https://doi.org/10.1080/09644016.2012.724217.
Winner, Langdon. “Do Artefacts Have Politics?.” *Daedalus* 109, no 1 (1980): 121–36. http://www.jstor.org/stable/20024652.
York, Richard and Eugene A. Rosa. “Key Challenges to Ecological Modernization Theory: Institutional Efficacy, Case Study Evidence, Units of Analysis, and the Pace of Eco-Efficiency.” *Organization and Environment* 16, no 3 (2003): 273–88. https://doi.org/10.1177/1086026603256299.