

**UNCERTAINTY DISCOURSE: CLIMATE MODELS, GENDER, AND
ENVIRONMENTAL LITERATURE IN THE ANTHROPOCENE**

by

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For Joshua.
For all our futures.

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ABSTRACT

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Title: Uncertainty Discourse: Climate Models, Gender, and Environmental Literature in the Anthropocene

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My dissertation, titled “Uncertainty Discourse: Climate Models, Gender, and Environmental Literature in the Anthropocene,” takes a feminist approach to sustainability through the lens of climate science and English-language environmental fiction. I diagnose the appearance of what I call a discourse of uncertainty, which describes new constitutions of thought and social organization emerging in response to the structural uncertainties that characterize climate change. I root this discourse in the scientific practice of climate modeling, by which scientists calculate the probability, or degrees of uncertainty, of future weather scenarios. Though climate models inform socio-political preparations for a climate-changed future, their utility has gone unheeded in the humanities. I fill this gap by placing scientific and literary depictions of uncertainty into conversation to explore their epistemological and ethical implications for a climate-changing future through issues such as gender and representation, politics and sustainability, and knowledge and time. I not only trace how uncertainty is manifested in contemporary environmental literature, such as Ian McEwan’s *Solar* (2010) and Barbara Kingsolver’s *Flight Behavior* (2012), but also consider the drama of South Asian women playwrights alongside the works of feminist scholars, philosophers, and activists.

INTRODUCTION

What interest does probability have for contemporary discussions of literature, theory, and cultural studies in a time of climate change? The question offers a point of departure for this dissertation and buds from Ian Hacking's thesis in *The Emergence of Probability* (1975) that a Western discourse of probability emerged in response to mid-seventeenth-century sociocultural practices and transformations in conceptual systems. Hacking attributes this trend to a waning of belief in determinist causation and a subsequent social and scientific curiosity in exploring phenomena and events according to notions of dispersion, distribution, and chance. His study is a genealogy of probability's preconditions, those practices and statistical ideas that gave rise to today's understanding of probability as the articulation of the relation between a hypothesis and its degrees of uncertainty.¹ Yet the ultimate value of such a project extends beyond historical explanation. "I am inclined to think," Hacking writes, "that the preconditions for the emergence of our concept of probability...determined the space of possible theories about probability. That means that they determined, in part, the space of possible interpretations of quantum mechanics, of statistical inference, and of inductive logic" (9). More recently, they determined the space of possible interpretations of a climate-changed future. In the computerized process of climate modeling, for example, scientists and researchers use warming patterns in the planet's recorded global mean surface temperature to calculate the probability of certain climate scenarios. In fact, probability, is arguably the only way in which climate change *as an emerging reality* is currently known, which

¹ These practices included scientific and philosophical language, the mathematics of gambling, political arithmetic, and new conceptual models for determining and assessing the nature of legal and scientific evidence. Additionally, William Briggs perhaps more accessibly defines probability as "the language of uncertainty" (2), which will become clearer in the below discussion of the IPCC's rhetorical interpretations of probability percentages.

means that it is also the primary source for imagining various possible climate adaptation and mitigation strategies.

I invoke *The Emergence of Probability* to invert its thesis. Whereas Hacking illustrates the sociocultural and epistemological preconditions of probability, I consider probability's potential to newly condition politics, culture, and society so that humanity may evolve in relation to climate change by moving beyond the anthropocentric situation. Probability's productive power resides in its sketching of an ultimately uncertain atmospheric future. Unknown, open to speculation, this future bestows the present with the ability to generate new, even currently unthinkable, conditions of Being—of thought, expression, and action—that alter the field of the possible. I thus argue that probability holds special ethical clout in its ability to reconfigure how the human lives and thinks. Climate model probabilities can both philosophically instruct on the degrees of uncertainty within which life is couched and point towards the practical and conceptual changes necessary to prepare for climate impacts. In this way, they encourage the human to think herself through the specificity of the probability scenarios that climate models present, that is, through the precarity of the planet and the uncertainty of the future. I consequently consider climate models tools that fore-front the present as a witness to an enigmatic history made interesting and fecund precisely because, to borrow from Isabelle Stengers, “one does not know a priori what [such] history is a question of” (170). In its declarations of uncertainty, climate model probabilities declare an infinite multiplicity of possible futures wherein unknown forms of the social and the subjective—forms that are responses to, rather than exacerbators of, the forces of a climate-changing world—lie waiting to emerge.

My task in the following investigation is to theorize the status of knowledge implied in climate modeling and the implications of this knowledge for the furtherance of social justice. I aim

to redress the Anthropocene of the twenty-first century as an articulation of human disconnect from a series of interlinked materialities, including natural resources and the gendered body. The Anthropocene marks the point at which, to use philosopher Michel Serres's succinct formulation, "global history enters nature; global nature enters history" (*Natural Contract* 4), a result of the human's transcendental relation to Earth and impact upon its geology. Yet the general and overwhelming positioning of climate change at the fore of contemporary conceptualizations of the Anthropocene opens the term to a second, perhaps more direct formulation, one that is nested within Serres's own: human bodies condition materialities; materialities condition human bodies. Climate change has ruptured the political and the social as exclusively human states, as ways of being in the world that act themselves out upon natural processes without repercussions. Earth now presents itself, (re)introducing itself into sociopolitical structures and imaginaries.

The intertwining of subject and substance is the interdisciplinary cornerstone of this dissertation and serves as a connective nodal point between climate models, cultural studies, literature, and, as will be seen, the fields of sustainability and women's studies. At its broadest, my overall goal is to blaze a conceptual highway between climate science and the environmental humanities and explore what possibilities for the future arise from their cross-pollination. In the process, I seek to broadly illustrate what I call a discourse of uncertainty, which describes new constitutions of knowledge, social practice, and subjectivity emerging in response to the structural uncertainties that characterize climate change. I choose to use the term uncertainty rather than probability because my chapters call upon authors, activists, theorists, and philosophers whose work and thought evoke unknown futures that have no connection with probability calculus as a form of objective science yet nonetheless consider the ontological ramifications of living in a time of uncertainty.

My use of uncertainty within the context of this dissertation is thus twofold. Uncertainty can be defined as the imbrication of the epistemic uncertainty that climate model probabilities suggest with a philosophical conceptualization of evolution as a movement beyond a given situation or determination and into new ontological spaces. Epistemic uncertainty arises from unavoidable sources of uncertainty in climate modeling and climate projections, which result from both margins of uncertainty in climate data collection and the inability to mathematically know, describe, and simulate real-world atmospheric systems due to their nonlinearity. In more abstract terms, evolution evokes the continued and unprogrammed appearance of the virtual in social, cultural, political, and subjective realities (insofar as the virtual is that which has not been made actual in the world but nevertheless lies latent in normative ideologies and social structures). It names a way of knowing and being courageous enough to diverge from restrictive ideations of power and be vulnerable to continuous transformation and becoming. What results is an ontology of uncertainty, or a way of Being defined by uncertain conditions, that escapes homogenous regulation. Uncertainty emerges as a condition for evolution's very possibility, for the constant proliferation of new modes of thought, expression, and action as life progresses towards unestablished horizons.

I am interested in placing epistemic uncertainty and ontological uncertainty into topological relation with each other. What I mean by this is that I understand these two types of uncertainty as springing from and inhabiting the same conceptual space of non-determinism. If this space is considered from the angle of epistemic uncertainty, it will inevitably take on different features than if it were approached from the perspective of ontological uncertainty. However, regardless of how the conceptual space is characterized and despite the disciplinary lens through which it is engaged, its properties stay the same; that is, it issues the same injunction to the human

race from both perspectives: *evolve*. My general investigation is thus a meditation on conceptual enfoldings and the material movements and possibilities that these react to and offer. I read ontological uncertainty in the existence and implications of climate modeling's epistemic uncertainty and hold that an understanding of the latter can strengthen the environmental and climate change movements by helping to initiate political and social change. My chapters assume these statements as given and explore the nascent beginnings of a climate-change inspired evolution by teasing out, first, the virtual ontologies in cultural and literary productions, and, second, how these re-formulate the landscape of thought and politics through the lens of uncertainty while reweaving the human amidst the materialities of the world. While I do not always use the terms epistemic and ontological uncertainty in my analyses, every mention of uncertainty is an articulation of their enfolding.

The rest of this introduction is dedicated to better illuminating this enfolding through a budding discourse of uncertainty. I provide an overview of climate modeling before briefly considering how uncertainty has been discussed in relation to society, policy, and, finally, feminist struggles, which face new challenges as the globalized economy scrambles to accommodate climate mitigation strategies without abandoning Western, androcentric, and neoliberal sovereignty. I finally discuss the connection between uncertainty and contemporary literature before closing with a summary of my four chapters.

Climate Modeling and Uncertainty

Climate is chaos. Put simply, this means that the states of atmospheric systems are nonlinear rather than deterministic, that their emergence into actuality is a constant divergence from a previous state that cannot quite be described as given because it is always already in the process of changing, of reacting to the proverbial flap of the butterfly's wings. Climate consequently articulates

atmospheric systems' unpredictable, infinite establishment and exceedance of their own thresholds, meaning that the scientific study of climate in relation to climate change takes place at the intersection of the rigorous and imaginary. Indeed, while climate science is empirical, it is also speculative and interested in the concept of evolution since it requires thinking about what cannot be known and what has yet to be actualized.

Climate modeling is the primary means by which climate scientists conceptually interact with climate's nonlinear being. Climate models are systems of differential equations that are programmed through a computer algorithm to calculate, simulate, and visualize the future interactions of select climatological phenomenon. These algorithms place a collection of raw atmospheric data that exhibits a structural pattern—such as the warming pattern in the global mean surface temperature—in relation to data that has been programmed to represent the statistical properties of a given atmospheric system. The structural pattern in question is what climate scientists call a forcing, “a perturbation external to a system, defined in some way that can potentially drive the system out of its range of natural variability and into a new one” (Winsberg, *Philosophy* 42).² Climate modelers are specifically interested in investigating how current or anticipated forcings will impact the atmospheric system, and their experiments with climate models investigate the ways in which the system might respond if the forcing continues, decreases, or increases.

Notably, climate model data is not numbers-in-the-raw, but a statistical summary of past and present atmospheric information inferred by the best available methods of experimental and observational reasoning. Additionally, statistical summaries are not pure; they are not the result of unmediated information. Uncertainty is rife throughout the processes of climate modeling, from

² Other examples of forcings include greenhouse gases, volcanic eruptions, heavier cloud cover, and UV rays.

the ways in which climatological data is and has been gathered to the ways in which this data is programmed to create climate simulations. Data sets stretch back to the nineteenth century, and the historical gamut of data collection methods have varied widely, eliciting different degrees of uncertainty according to the technology available.³ Today, climate modelers gather monthly or yearly data collections via technological instruments (e.g. thermometers, buoys, satellites, or seismographs that measure climate oscillations) stationed at meteorological observing stations across the globe as well as from natural resources known as proxy indicators, which include ice cores, coral, ocean sediment, and tree rings. Technology could be faulty, samples might become contaminated, and scientists must account for uncertainties in instrument calibration, for changes in instrument body temperature, for the evolution of observational techniques, and for the change of measurement bias. More mundanely, data might for some reason be limited, inconsistent, or incorrectly documented somewhere along the line.

Back in the laboratory, uncertainty arises from the fact that models do not always span the full range of known climate system behavior. Climate modelers often build models to speculate only on the behavior of select aspects of the climate system and consequently only need select variables to program the model's algorithm.⁴ Uncertainty thus results from the very structure of

³ Eric Winsberg provides an example: "One controversy about sea temperature records was eventually resolved when researchers realized that the *kind of bucket* that was used to collect the water for temperature measurement had undergone a change in the 1940s that made a significant difference – the same water of the same temperature measured out of each kind of bucket would yield a significantly different measurement. Not surprisingly, when most historical climate data were collected no one envisioned that they would be used to try to reconstruct global, century-long records, and little attention was paid to collecting data that would be intercomparable with other data. Data collection practices varied, and this included variation in the kind of buckets used to sample water for temperature readings. Simple wooden buckets, of the kind you might picture if you were picturing a bucket hanging over a well, were used in the nineteenth century. Later on, special canvas buckets were used, and finally they used insulated buckets that don't look anything like what you probably picture when you think of a bucket. The effect that each of these buckets has on temperature readings can be significant – with the canvas buckets producing readings that are up to 1°C cooler than other buckets" (*Philosophy* 8). Winsberg sources this story from Schmidt.

⁴ Computer programs themselves also introduce unavoidable errors in their calculations, especially since all calculations are based on parameterizations, which means that climate modelers program into the model

the model itself, since the climate system is not—and, due to nonlinearity, ultimately cannot be—represented in its entirety by the statistical summaries selected. Modelers choose to program a model according to specific parameter values and distributions, specific spatial resolutions, and specific programming techniques. Each decision factors out a piece of the climate system puzzle, so to speak, adding even more uncertainty to the simulations. A data set, in other words, can never be pure. Consequently, when climate scientists talk about a global mean surface temperature, for example, they are referring to an estimate that they place in relation to other global annual estimates, and, of course, their uncertainties. As climatologist Gavin Schmidt emphasizes,

We do not have direct measurements of the global mean [temperature] anomaly, rather we have a large database of raw measurements at individual locations over a long period of time, but with an uneven spatial distribution, many missing data point [*sic*], and a large number of non-climatic biases varying in time and space. To convert that into a useful time-varying global mean needs a statistical model, a good understanding of the data problems and enough redundancy to characterize the uncertainties. (Schmidt “NOAA Temperature Record Updates”)

Climate models thus differ from real-world systems. They help us speculate and project climate impacts rather than represent absolute truths or predict single climatic events. As climate modelers run the model scenario, the statistical summaries a climate model calls upon give way to a *statistical future* that is eventually expressed as a probability percentage.⁵ These percentages are

atmospheric processes that are important to the functioning of the atmospheric system but are too small-scale or complex to reflect in the data collections that the computer draws from to simulate a climate scenario.

⁵ In climate modeling, the description “run the model scenario” refers to the process of making the model calculate the given scenario. The resulting output is often visualized through computer simulation, where scientists can see certain sections of a world map change colors to indicate increases or decreases in, for example, temperature, precipitation, or emissions levels.

quantifications of the structural uncertainties embedded in climate model projections. In attempts to get a more accurate output, scientists often use what is called multi-modal ensemble methods to average climate scenario projections across a set of models and calculate their standard deviation, thereby producing a probability distribution for the values these models calculate. For example, and in the words of analytic philosopher Eric Winsberg, “If 80 percent of the results from a space of models and parameter values lie in [a given] range, then the probability of the true result lying in that range is said to be 80 percent” (*Philosophy* 96). Multi-modal ensemble methods are an objective way of thinking about uncertainty because they are calculated mechanically, and so are divorced from the beliefs of experts and the scene of human decision-making. What the presence of a range means, however, is that while the term “objective” might be used there is no stable system that can yield a picture of a dependable statistical future. There is no hypothesis in climate science that is undergirded by a calculation process stable enough to reflect truly objective chances. Climate’s chaos, the way chaos is programed in climate models, and the varying structural uncertainties of a model means that climate projections are not governed by the same laws of chance that, say, forms of gambling have. To give an example, if you bet a friend that if she flipped a coin it would land face-up, you automatically know, according to the laws of chance that govern coin-flipping, that you have a fifty percent chance of being correct. Such knowledge results from the fact that in the entire history of coin-flipping a coin has either landed face-up or face-down but has never, for instance, disappeared entirely or suddenly manifested a third side. Experience—so far—has repeatedly proven that the laws of chance that govern coin-flipping and the probabilities they invoke are statistically dependable. Climate, on the other hand, is only known as a nonlinear system and has not demonstrated any statistical pattern that would guide scientists in predicting a given climate scenario.

Climate model probabilities and the probabilities of multi-modal ensemble methods are thus best thought of as epistemic uncertainties, which describe uncertainties that are mediated by human knowledge because they include “assessing reasonable degrees of belief in propositions quite devoid of statistical background” (Hacking 12). Climate model probabilities are a mediation between, on one hand, natural phenomena, and, on the other, the carefully informed theories and decisions of climate modelers, which depend on technology, mathematical formulization, and language.⁶ To communicate structural uncertainty as effectively as possible to non-expert audiences, the International Panel on Climate Change (IPCC) has attached rhetorical expressions of likelihood and confidence to numerical probabilities. In the Fifth Assessment Report, for example, these expressions are manifested in statements such as, “The net radiative feedback due to all cloud types is *likely* positive” (82), or, “It is *very likely* that regional trends have enhanced the mean geographical contrasts in sea surface salinity since the 1950s” (40). According to Table 1, which appears in IPCC’s Fourth Assessment Report, the first statement is a statement that details a moderately low confidence in the given claim, with “*likely*” expressing scientists’ supposed agreement that cloud-induced radiative feedback has more than a 66% probability of occurring. In the second statement, “*very likely*” signals that scientists have a relatively high degree of belief—more than a 90% probability—that regional climate trends have enhanced changes in sea surface salinity over the past six decades. Importantly, then, the epistemic uncertainty that characterizes the creation and communication of climate model probabilities are human interpretations of, or degrees of belief in, a statistical future.

⁶ For discussions of models as mediators, see Morgan and Morrison.

Table 1 Interpretations of Probability According to the IPCC Reports⁷

Term	Likelihood of outcome
Virtually certain	>99% probability
Extremely likely	>95% probability
Very likely	>90% probability
Likely	>66% probability
More likely than not	>50% probability
About as likely as not	33 to 66% probability
Unlikely	<33% probability
Very unlikely	<10% probability
Extremely unlikely	<5% probability
Exceptionally unlikely	<1% probability

Climate Modeling and the Environmental Humanities

For the environmental humanities, which are deeply engaged with thinking about ethics and justice in relation to a climate-changing world, the idea that climate model probabilities are not statistically objective may seem suspicious.⁸ If probabilities express scientists' degrees of belief in the likelihood of a given climate scenario, and if climate and environmental-related policy-making call upon these probabilities to inform decisions at the level of industry and economy, then could scientists not tweak probabilities to fit political or neoliberal agendas? In their recent book *Climate Change Skepticism* (2019), Greg Garrard and co-authors George Handley, Axel Goodbody and Stephanie Posthumus passingly evoke anxiety over the extent to which programmers' subjective

⁷ While Table 1 is in the IPCC Fourth Assessment Report, its format and wording have been extracted from Winsberg (*Philosophy* 76).

⁸ Despite the role that climate models play in the creation of international policy—and thus despite their potential to impact social, economic, and political patterns—their work and use has gone unheeded in the humanities except for very briefly in Garrard et al. and Tsing's critiques, which are discussed below. C.f. Hastrup and Skrydstrup's edited collection, which considers climate-related models as powerful social objects from an anthropological standpoint. To my knowledge, this is the only text that places climate, models, and cultures in discussion with each other.

identities, values, and beliefs impact the scientific objectivity of their work. In a short section entitled “Don’t trust the models,” they write that ethnographic studies on climate modelers have noted “the ambivalent and flexibly used identity of modelers as to whether they are builders of predictive truth generating machines (their main policy and funding identity), or of heuristic devices for aiding research” (Shackley and Wynne qtd. in Garrard et al. 231).⁹ Similarly, in her well-known ethnography *Friction* (2005), Anna Tsing directly problematizes the use of climate models as tools used in the creation of international environmental policy to stoke the engines of globalization and Western hegemony. Recounting her first experience with climate models at the 1995 “First Open Meeting of the Human Dimensions of Global Environmental Change Community” (HDGECC), Tsing critiques what she sees as the strategic specificity of General Circulation Models’ (GCMs) totalizing representation of the planet, which facilitates policymakers’ easy forgetting of local scales, of the material challenges faced by vulnerable populations in a given area, and of the need for negotiation between international and national, regional, or local decision-making bodies. As climate models that project trends in Global Mean Surface Temperature in response to emissions level output, GCMs are a compilation of atmospheric data taken from different meteorological observing stations around the world to help scientists calculate and decisionmakers visualize the potential effects of future climate impacts. Because the data recorded at each station is input into an algorithm intended to provide an overall understanding of atmospheric changes on a global scale, the specific heterogeneities characterizing geographic regions are incorporated into the so-called big picture of atmospheric trends. Tsing identifies this image of planetary globality as intensely problematic in its erasure of the socioenvironmental realities and relations that individualize localities:

⁹ For the ethnographies they discuss see Shackley and Wynne and Lahsen.

General Circulation Models [GCMs]...simplify and reduce the social and natural world to geophysical laws. In the process, they develop a globe that is unified, neutral, and understandable through the collection and manipulation of information...The global scale is privileged above all others...Local conditions can be predicted from the global model; that is the point of its globality. Local data may adjust the global model but never defy it. Its globality is all-embracing. (102)

Notably, Tsing's critique weakens considerably when read from the perspective and aims of climate science discussed above. GCMs, for example, are exclusively programed to provide climate scientists with a better understanding of, first, the holistic functioning of geophysical laws, and, second, the rate and manner in which these laws are changing in relation to climate change. Additionally, there are technological limits to the scales at which climate models can accurately analyze and probabilize atmospheric dynamics, meaning that models' abilities to assess climate conditions vary according to degrees of locality. However, Tsing's argument nevertheless warrants investigation into the scalar implications of climate modeling when she notes the ease with which GCMs' global images can be utilized to steer policy agendas. She argues that at the HDGECC meeting, under the guise of Science, models were purposefully "tuned to stimulate international dialogue" by modelers who sought to "push potential collaborators to the negotiating table" to develop international "standards and structures of management" that ignored the crucial social needs of vulnerable groups (102; 103; 103). The meeting's organizers—"political scientists, who have their own global agendas" (102)—and presenters—"[climate] modelers...most interested in socioeconomic rather than geophysical data" (102)—therefore seemingly shared two implicit assumptions: that the communication of climate information took place only on the scale of the

“expert, neutral, rational, and empirically grounded” (102); and that policy decisions were made without giving thought to extending the discussion to non-bureaucratic voices.

Under such assumptions, policy is created at the expense of the “pre-existing interests and identities” of “nations, classes, [and] cultures” (Tsing 103). Providing an example for her readers, Tsing specifically evokes the ongoing, contentious discussions in climate policy and governance regarding the fair representation of greenhouse gas emissions and social equity. In their general focus, GCMs obscure the representative differences between the Global North’s luxury emissions and the Global South’s subsistence emissions, the repercussions of which not only include the lessening of developed countries’ sense of responsibility to reform their nation’s energy consumption and acknowledge the historical inequality of emission output, but also enable the smooth bypassing of difficult ethical questions concerning the arrested development of certain nations’ fossil-fuel-based modernization and the equitable distribution of energy. By drawing attention to the insular parameters of climate models as they are established and interpreted around the policy table, Tsing points to the embeddedness of a politics of invisibility in environmental and climate policy that effectively denies the extension of political space and being to certain populaces and governments.

While highly cognizant of the Tsing’s claims, one of the goals of this dissertation is to reformulate the concept of the climate model for the environmental humanities by redefining what it visualizes: not exclusionary holism, but a multiplicity of heterogeneous components in a state of becoming that invite the reader’s attention to the unseen shapes, affects, syntheses, temporalities and, overall, ways of being brought into focus by epistemic uncertainty. These, as will be seen, not only have the potential to open upon social change but also to disclose a radical difference in being, thought, and time. In fact, what is so remarkable about the IPCC’s probability chart is that its wide

dissemination of probability discourse into various media, policy rooms, classrooms, and public forums spells out, in no uncertain terms—no pun intended—the radically new epistemological and ontological modalities up for adoption if ecological systems are to be stabilized and the effects of climate change softened. Being is urged to enter a state of precarity based on the ultimate unknowability of Earth’s nonlinear processes, based on a pervasive epistemic uncertainty that is as promising as it is frightening, and which can be acted upon and translated into sociopolitical action.

Uncertainty, Society and the Primacy of the Body

The argument that uncertainty requires a larger role in sociopolitics is earnestly addressed by philosophers of science Silvio Funtowicz and Jerome Ravetz in *Uncertainty and Quality in Science for Policy* (1990). Labeling policy’s focus on quantitative scientific information as fetishistic, they claim that too much emphasis on a rigorous empiricism is “unrealistic and counterproductive” if it sidelines uncertainty at the risk of economists and policy-makers ignoring the macro-risk of climate change catastrophes (9). Indeed, due to the erroneous association of probabilistic outcomes with faulty methodologies, the authority of climate models as tools through which to analyze and prepare for climate change has been put to question. Unfortunately, to those ignorant to the process of climate modeling, the uncertainty inherent in a probabilistic statement triggers negative reactions and seemingly paints climate modeling as a faulty science, perhaps even as a pseudo- or a non-science. Yet the danger is not in uncertainty’s presence in climate modeling, but in its neglect or restriction by modelers, model analysts, and even non-expert policy-makers, which could skew understandings of model outputs and affect, for example, decisions in regards to new policies or whether or not—and to what extent—to implement mitigative and sustainability initiatives.

Funtowicz and Ravetz consequently call for a conceptual change in twenty-first-century risk management and regulation approaches so that scientific and policy efforts are “based on coping with ignorance at least as much as on the application of knowledge” (1). For Funtowicz and Ravetz, an awareness of epistemic uncertainty is an acknowledgement of the extent of uncertainty in a given scenario, which can help provide scientists and decisionmakers with higher quality information through the effective management, as opposed to the elimination, of uncertainty. While they do not highlight climate change in particular, focusing instead on industrially-derived micro-risks, Funtowicz and Ravetz’s nomination of quality as a guiding principle in risk analysis offers the contemporary political economy a framework for assessing the rising risk of inclement weather. Climate change’s recent entrance into political and economic risk discourse heralds the need for significantly different risk assessment techniques than those which have hitherto been employed.¹⁰ International failures to adequately address the climate crisis have resulted in the prolongation of a business-as-usual industrial scenario that will continue to thicken concentrations of greenhouse gases, raising the probability of weather-related disasters that will have reverberating impacts on local and global scales. The anticipated effects of weather shocks across a wide range of economic and political systems emphasizes the need for the political economy to acknowledge the growing probability of catastrophic macro-risks, such as drastic

¹⁰ Risk management has hitherto focused on micro-risks rather than the macro-risk that is climate change. Micro-risk regulations refer to subject matter – such as “the health effects of hazardous air pollutants in industrial air emissions, maximum contaminant levels in drinking water, effluent limitations for pollutant discharges to navigable waters” (Vandenbergh and Gilligan 408) – that can be addressed by or even left unmanaged and they will not “result in threats to the social fabric or long-term sustainability of the nation or globe. In addition, although uncertainties about costs and benefits often exist for micro-risks, micro-risk decisions are not dominated by uncertainties about extremely unlikely events” (408). Macro-risks, on the other hand, “pose a challenge to the continued viability of cost-benefit analysis as a central component of rational risk regulation. By macro-risks, we mean those risks that have the potential to dramatically disrupt the character of markets and economics on a global scale and for very long times” (409). See Gilligan and Vandenbergh, Kouskey et al., and Wietzman.

temperature and precipitation fluctuations that can result in drought, famine, flooding, and violent storms.

Higher quality information involves understanding that knowledge is not simply a body of objective facts, but that it includes questions of framing, interpretation, narration, and testimony, and thus forefronts modalities of experience in relation to knowledge. The ability to soundly judge data quality includes what Funtowicz and Ravetz call a “‘knowing-how’ experience” that contrasts starkly against the normative scientific practice of “knowing-that” (14), that is, of knowing that something is true. Unlike knowing-that, knowing-how opens upon “subtle and complex” understandings of phenomena in opposition to an epistemological system that mechanically offers a two-dimensional understanding of the world through simple binaries such as true and false, correct and erroneous, legitimate and unfounded (14).

Funtowicz and Ravetz’s use of knowing-how and knowing-that directly evokes Jean-François Lyotard’s discussion of knowledge in *The Postmodern Condition* (1984), from which Funtowicz and Ravetz might have been inspired. Lyotard makes a clear distinction between knowledge [*savoir*], which cannot be reduced to science, and learning [*connaissance*], defined as a set of statements of which science is a subset (18). Lyotard emphasizes that “the term *knowledge* is not only a set of denotative statements, far from it. It also includes notations of ‘know-how,’ ‘knowing how to live,’ ‘how to listen’..., etc. Knowledge, then, is a question of competence that goes beyond the simple determination and application of the criterion of truth” (18, original emphasis). When supplemented by Lyotard’s definition, the modality of knowing-how that Funtowicz and Ravetz highlight deepens into an embodied experience populated by actions such as living, listening, etc. Cognition is created here not through the learning of legitimized information, or even through the performance of legitimizing information, but through an

accumulation of an array of experiences through which matter is interacted with. Ultimately, Funtowicz and Ravetz prompt scientists and policy makers to focus on the materiality of the forms that underlie scientific research, that is, on the manifestation, interaction, and duration of nonhuman organic and inorganic bodies and processes, whether these be physical bodies of species or the more abstract bodies of water or even the global carbon cycle.

Scholarly emphases on conjoining knowledge and experience in relation to risk and climate change have largely occurred in a gender-indifferent context, as if sociopolitical reactions to climate change exist independently of gendered identities. Women's roles in sustainable development and discussions are often uttered in the same breath as the term "participatory" or "gender mainstreaming," suggesting gender as a remedial and externally imposed agenda that has no original place in the everyday conception, organization, and functioning of institutions and initiatives. Irene Guijt and Meera Kaul Shah point out that the use of "participatory" to describe the official involvement of women in sustainability-oriented discussions and practices is sometimes nothing more than a byword "synonymous with 'good' and 'empowering'" (9), and is often "ill-defined and meaningless when it comes to implementation" (9). Similarly, Elizabeth Prügl and Audrey Lustgarten have cited and discussed conceptual confusion over definitions of gender mainstreaming in international organizations such as the United Nations and its specialized agencies. Such confusion limits abilities to effectively address the patriarchal power relations embedded in decision-making bodies. Also notable is the tendency for economic globalization endeavors to erect participatory resource management initiatives as tokenistic fronts for labor efficiency and low-cost supply maintenance.¹¹ The conclusion that can be drawn here is simple and disheartening: within the context of globalization, climate discussions and sustainable action

¹¹ For discussions of women's tokenistic incorporation into resource management programs, see Foskey, Ahlers, and Wallace and Coles.

are divided along sexual lines, an extension of the fraternal social contract that energized early political theory.¹²

One of the goals of this dissertation is to trouble the gender-neutrality of climate-related discourse. The material mingling that I claim climate modeling puts forth argues that knowledge of climate change issues through the sensory body rather than from a logic of—resource—loss. Economic globalization scrambles to counter and even profit from loss through practices that dispossess populations, striate environments, hierarchize sexual difference, widen the split between experience and cognition, and, ultimately, initiate a forgetting of the primacy of the body; that is, of the body as that which interfaces with ecologies and through which the world is filtered into human cognition. Throughout this dissertation, the primacy of the body is connected to women's experiences of the world around them and is upheld as a medium through which climate change becomes known. I thereby emphasize not simply the primacy of the body but the primacy of the body in its sexual difference as a conduit for climate change knowledge. I argue that effective mitigation of climate change and meaningful work in the name of climate justice depends not on an understanding of ecological loss but on a bodily-, sexuate-influenced knowing of the ecological spatiotemporalities humans co-inhabit. My philosophical project described above is thus simultaneously a political one insofar as an uncertainty-inspired intertwining of materialities occurs through a gendered lens with the intention of enfolding sexual difference into climate and sustainability discourse.

¹² Cf. Pateman, especially her discussion of the public and the private in Chapter 1, in relation to Foskey's comment that the "domestic sphere in which most women operate has been defined as 'private' and outside the purview of the civil and political rights given prominence by the North and excluded from the third and second generation of human rights—economic, social and cultural—which are emphasized by Southern governments and non-government organizations" (68).

My sketches of a body-knowledge-environmental matrix are influenced by and expand upon Michel Serres's own discussions of bodies, knowledges, and the space of the world. The human has worked hard to separate and shield the body from the elements. For Serres, this separation contributes to the creation of the Anthropocene, and in *The Natural Contract* (1990) he asks his readers to think about how the spaces they inhabit have built upon and blocked out the environment: "How do [we] live, and, more important, where? In laboratories, where the sciences reproduce phenomena to define them better; in offices or studios. In short, indoors" (28). Unlike its influence on the sailor and the peasant, whose daily existence was affected by the weather and the seasons, climate no longer directly acts upon the human; "the essentials [now] take place indoors and in words, never again outdoors with things. We've even walled up the windows in order to hear one another better or argue more easily. We communicate irrepressibly. We busy ourselves only with our own networks" (29). Consequently, Serres mournfully asserts, "We have lost the world... [and] for almost a half century, now, have been holding forth only on language or politics, writing or logic" (29). Serres's later work can be read as a response to this loss, as an exploration of how an equilibrium can be reestablished between human subject and earthly substance. For example, in *The Five Senses* (1985) and, over a decade later, *Variations on the Body* (1999), the body is revived as a cognitive presence and function—states that have traditionally been ascribed to language—and transformed into a model of knowledge, "receiving, emitting, retaining, transmitting" as it experiences its surroundings (*Variations* 71). As he writes in *Variations*,

This...is what I want to show: that there is nothing in knowledge which has not first been in the entire body, whose in gestural metamorphoses, mobile postures, [its] very evolution imitate all that surrounds it... bearer, certainly, of the five senses,

but with other functions than channeling exterior information towards a central processor, the body recovers in this way a cognitive presence and function of its own[.] (70)

For Serres, the body's cognitive presence and function develops through imitation, which becomes the basis for all knowledge amassed. What if human knowledge developed from the body's imitation of Earth's precarity? That is, what if the human departed from the "walls, cities, and ports, havens from which death keeps its distance" (*Natural Contract* 111), departed from privatized water, the security of supermarkets, the swipe of a credit card? What if she imitated the natural world by exposing herself to the weather, planting in tandem with the seasons, tuning herself to ecological health and variation? In these contexts, knowing would always be an understanding of how to live amidst the precarity of the world, in equilibrium with the planet's fragile ecologies. Knowing, and all forms of identity and action that derive from knowledge, would sprout from the body's visceral experiencing of the planet's precarity as its own. Imitation would equate to learning that the body, in its dependency and effects on natural resources, is itself part of an ecological system and is thus affected by the system's state. Imitation would mean accepting uncertainty as a new ontological dimension, as a new way of Being. What would knowledge in this dimension look like? How might it allow the human to newly comprehend and address climate change?

The body-knowledge-environment matrix is bonded by and connected to climate modeling through the concept of uncertainty. As will be seen below, climate models present a unique challenge: they ask us to confront our own ignorance and accept the uncertainty of climate systems. Within the context of this dissertation, uncertainty is defined as the quantification of the gaps in our knowledge of a given system, which in climate modeling is expressed as a probability

distribution. Climate models involve considerable uncertainties due to a multiplicity of factors, including the limited availability of empirical data, the quality of this data, modelers' imperfect understandings of the processes being modeled, and the very process of model programming itself. Unable to be untangled from these factors, climate models as scientific, educative, and policy-relevant tools can philosophically instruct on the degrees of uncertainty within which human life is—and will be—couched and thus point towards the practical changes that need to be made to prepare for climate impacts, or, more specifically, the practical changes that need to be made to prepare for climate impacts as these might occur within the epistemic uncertainty that is climate change as we scientifically know it. Practical change, in other words, would include challenging ways of traditional knowing that are linear, positivist, and which have been labeled by feminist scholars as patriarchal articulations of power that exclude other ways of knowing, and thus living in, the world. By taking the female body as a physical starting point for both a knowledge *of* and a knowing and living *according to* uncertainty, I extend Serres's discussion of body, knowledge, precarity, and the environment by placing sexual and gender difference at the center of this quadrangle. I posit that to interact conceptually with climate and contemplate mitigative solutions, the parameters of thought and Being must expand beyond a clinging to certitude, beyond the rhythms of socially established normalcy, belief in the inevitable continuation of uninhibited development, and patriarchal formulations of power.

Narrating Uncertainty

Throughout my dissertation, contemporary literature is posited as a primary mode of resistance to modernity's conceptual complicity in androcentric, anthropocentric certitude. I analyze four literary works, two climate change novels and two plays, each of which I argue uniquely reconstitutes ontology through the lens of uncertainty, evolution, and transformation in relation to

climate change. As will be seen, my arguments unintentionally and indirectly respond to Amitav Ghosh's suggestion in *The Great Derangement* (2016) that contemporary literature has yet to seriously tackle the reality of climate change. According to Ghosh, the genre of the novel has so far had little practice in confronting uncertainty as that which urges evolution beyond the current situation rather than suggest change within the parameters of present norms.¹³ He suggests that this is because probability and the modern novel are "twins," born "under a shared star that destined them to work as vessels for the containment of the same kind of experience" (16), that of "conceiving the world...without our being aware of it" (Hacking qtd. in Ghosh 16). Ghosh's use of probability here is vague, but it seemingly echoes aspects of epistemic uncertainty by referring to the moment in which what is inaccessible to knowledge is translated into an object of knowledge used to represent known reality (though notably at the risk of forgetting the actual unknowability of what has just been quantified). For Ghosh, the plot of the modern novel advances in a similar fashion. Its pivotal scenes are "instances of exception" that are controlled by what Franco Moretti calls fillers (17), narrative mechanisms—including a focus on morals and social norms, or realist scenes of modern life and landscapes—that mimic the regularity and style of existence. The uncertainty inherent in such instances of exception are veiled to represent a stable, known social and natural world, though at the risk of the reader and author both forgetting that uncertainty is a constitutive element of reality. Ghosh writes,

¹³ Ghosh phrases this in another way, saying that the novel has "has never been forced to confront the centrality of the improbable" (23). While Ghosh defines the improbable as not "the opposite of *probable*, but rather an inflexion of it, a gradient in the continuum of probability" (16), I prefer to steer away from this usage, since it too easily be misread to say that literature does not deal with climate because it does not deal with low probability. Additionally, the question of climate change itself is not whether it is improbable; rather, the question of climate change has to do with the difficulty of confronting its uncertainty. Despite his wording, however, this is what he seems to suggest in this discussion, so I chose to rephrase his statement.

Why should the rhetoric of the everyday appear at exactly the time when a regime of statistics, ruled by ideas of probability and improbability, was beginning to give new shapes to society? Why did fillers suddenly become so important? Moretti's answer is "Because they *offer the kind of narrative pleasure compatible with the new regularity of bourgeois life*. Fillers turn the novel into a 'calm passion' Or, in other words: fillers are an attempt at rationalizing the novelistic universe: turning it into a world of few surprises, fewer adventures, and no miracles at all." (19)

The modern novel, in other words, in keeping time with a burgeoning anthropocentrism and capitalism, demonstrates a conceptual incapacity to create a narrative and imaginative space that can not only accommodate but also forefront the uncertain.¹⁴ Ghosh ends his discussion suggesting that the climate change genre is currently symptomatic of the continuation of this incapacity. Overwhelmingly populated by novels with apocalyptic settings, climate change literature has yet to narrate the uncertainty of the here-and-now; it prefers to soften climate change as a threat to the regularity of life by outsourcing uncertainty to sci-fi or dystopian worlds.

While there is undoubted merit and strategic specificity to speculative fiction and the apocalyptic trope,¹⁵ the repeated narrative emphasis on what will be rather than what currently is, on catastrophism rather than on the importance of imminent global change, places the following at stake: the acceptance of the fact that, first, the rhythm of reality as we know it is being irreparably ruptured; second, reality will hereafter be woven according to uncertainty; and, third, while uncertainty cannot be controlled it can be acknowledged and adapted to. In this dissertation,

¹⁴ Ghosh's statement that the modern novel does not forefront the uncertainty could certainly be contested. It might be more accurate to say that the modern novel does not deal with the same anxieties regarding uncertainty or even the same concept of uncertainty as that which is connected to climate change.

¹⁵ I discuss the import of the apocalyptic trope to the climate change genre in Chapter Two.

I consequently choose to focus on realist environmental-related fiction that strives to open the reader to a future that is not dystopic but uncertain.

My first chapter, “Scientific Modeling and the Environment: Towards the Establishment of Michel Serres’s Natural Contract,” provides the theoretical groundwork for my literary analyses. Calling upon the work of French philosopher Michel Serres, I theorize climate models as mediums through which to acknowledge and interact with the environment as that which is innately inaccessible to human knowledge. While Serres’s work does not deal with climate models themselves, his meditation on science’s use of analogical models to discover and facilitate accurate descriptions of natural phenomena is useful to me as I, first, theorize the type of knowledge that climate models present, and, second, posit this knowledge as an ethical relation running between the human and nonhuman. Indeed, Serres offers a unique way to consider models and the information they reveal. Acknowledging that models function to “bring the distant to the immediate” (*Natural Contract* 87), he suggests that a technical understanding of models should begin with a meditation on the inaccessible nature of what they make accessible. The model is thus not as much a representation of inaccessible or uncertain information as it is a conceptual exploration of the interstitial space located between the disparate places of the accessible and the inaccessible. Unpacking Serres’s interpretive reading of analogical models, I locate within his discussion a relation between the model and time, which I apply to climate models, themselves temporal entities since their simulations are mathematical formalizations of past and present atmospheric data sets. I conclude the chapter with a discussion of how climate models can help humans conceptualize a temporal reconciliation with nonhuman timescales through the play of accessible and inaccessible knowledge.

Chapter Two, “Welcoming Uncertain Futures: Sustainability and Sexual Difference in Ian McEwan’s *Solar*,” takes the temporal reconciliation discussed in Chapter One and thinks its implications for sustainability and social relations. I thus consider how epistemic uncertainty influences or translates into ontological uncertainty. For temporal reconciliation to take place, a new reality is needed that diverges from that of the present and its predictable, anthropocentric progression of capital logic. I consequently describe temporal reconciliation as a Deleuzian virtuality and unpack the specificities of its possibility through a deconstructive literary analysis of Ian McEwan’s climate change novel *Solar* (2010). A realist critique of the twenty-first century political economy and its halfhearted attempts to accommodate climate change, *Solar* prompts reflection on the sociopolitical changes needed for temporal reconciliation to become an actuality. Both these changes and temporal reconciliation’s specificities are the same: Luce Irigaray’s ontology of sexual difference, which draws a profound connection between the feminine and environmental ethics, and what I call a technological ethic, which offers a way to rethink technological innovation in tandem with ecological and climatological tipping points. I argue that the unique duo neatly come together in *Solar* to offer a virtual vision of temporal reconciliation, of a resulting sustainable society, and of ontological uncertainty

Chapter Three, “Embodied Knowledges: Climate Models, Feminist Climate Communication, and Barbara Kingsolver’s *Flight Behavior*,” addresses the challenge of translating the quantitative nature of probability into a public narrative powerful enough to induce sustainable action. How do we communicate the uncertainty that characterizes climate change in a way that will put the ethical theories discussed in the above chapters into action? Here, I cross into the relatively new field of climate communication studies to think how climate communicators, such as scientists and knowledge brokers, first, need a better understanding of the cultural factors

that lead to the development of climate skepticism, and, second, would benefit from a new strategic approach to communicating climate change—one that shows how the realities of atmospheric and ecological changes can be thought of in harmony with communities’ values, beliefs, and identities. An important factor to initiating this new approach is for scientists to develop an understanding of and patience for the affective elements, including values and emotions, that have and will continue to influence the ways climate information is received. I consequently propose a climate communication strategy that seeks to grow an understanding of climate change from communities’ locally specific knowledges, the possibility of which I find in American author Barbara Kingsolver’s environmental novel *Flight Behavior* (2012). Reading the novel through the lens of feminist theorists such as Val Plumwood and Donna Haraway, I contend that *Flight Behavior* offers a feminist-inspired climate communication practice that situates ecological information and atmospheric data amidst the lived and gendered realities of local communities. Ultimately, my analysis identifies an embodied and locally anchored strategy for climate communication, or, more specifically a feminist discursive logic that replaces the language of science with a different language of kinship, embeddedness, connectivity, and uncertainty.

Finally, Chapter Four, “Engendering Sustainability: Women and Water Justice in Indian Literature,” thinks the activist potential of climate and hydrological models to preemptively aid climate justice groups anticipate caste and gender vulnerabilities in India that will arise from climate-exacerbated water scarcity. This chapter is structured to reveal India’s water scarcity crisis as the crucible of rural, Dalit women’s issues and to culminate in a discussion of the forms of female political agency that a gender-aware sustainability makes possible. The latter half of the chapter considers the role of Indian feminist drama in troubling the gender-blindness of existing water management policies. Employing a feminist and political ecology lens, I read Mahasweta

Devi's play *Jal/Water* (1976) and Dalit, feminist playwright M. M. Vinodini's street play *Daaham/Thirst* (2002) as contesting deeply-rooted inequalities in the social distribution of water. Both plays seek to redefine water rights from gendered and socioecological perspectives in their parallel staging of Dalit women's struggles to ensure their community's equal access to local wells in the face of drought, discrimination, and government corruption. When read through the uncertainty of climate models and gendered sustainability, *Jal* and *Daaham* imbue the Dalit feminist consciousness with a crucial socio-political agency in relation to sustainability endeavors and jumpstart the renegotiation of social constructions of gender and caste in the cultural imaginary. Ultimately, I argue that future water-related climate change injustices can be prevented if rural women and their communities are placed at the forefront of localized and sustainable water management initiatives as political actors. My dissertation concludes by placing the value of uncertainty discourse not in its potential to achieve immediate change but rather in its ability as a generative paradigm to encourage alternative social organizations and new, equitable deployments of knowledge and power.

CHAPTER 1. SCIENTIFIC MODELING AND THE ENVIRONMENT: TOWARDS THE ESTABLISHMENT OF MICHEL SERRES'S NATURAL CONTRACT

Introduction: Introducing Models

In the sciences, the hypotheses driving the exploration of the natural world are often investigated via analogical transfer, meaning that the crux of scientific activity resides in the use and interpretation of models as tools that facilitate an accurate description of natural laws. Whether models are of known objects or for unknown objects, all must be recognizable as metaphoric representations able to reveal specificities regarding the natural world that are otherwise difficult or impossible to be realized by the human senses. Analogy, therefore, plays an essential role in scientific thought and practice in its articulation of a relationship between a phenomenon and a corresponding replica that allows what is inaccessible to be virtually monitored, manipulated, and observed.

The exact status of the model's role and its lasting importance remains a controversial topic among scientists and philosophers. Scientific realists such as Rom Harré, for example, stress the importance of imagination in relation to knowledge and, as is inferable from the title of his seminal book, *Modeling: Gateway to the Unknown*, proposes modeling as a way through which humans learn and are able to imagine what escapes the everyday senses. Theoretical physicist Pierre Duhem, on the other hand, represented a popular viewpoint in his belief that while the model serves as a valuable means to an end, the arrival of a final discovery in the form of a mathematical formula and a neat, factual answer renders the analogy ultimately obsolete. As Duhem once wrote, "all references to analogical models can be dispensed with in the systematic statement of scientific

explanations” (qtd. in Hempel 440). Yet what are the consequences of dispensing with the model? What is lost? Is there value in retaining the analogy?

In his dismissal of the model, Duhem disregards two aspects that makes numeration and fact-making possible: first, the inaccessible thing the model translates, and, second, the very process of translation. As will be discussed below, these are tightly interwoven; to forget one is to forget the other. The process of translation may be imagined as an interstitial space between the inaccessible and accessible that is open and productive as a setting of construction and play between scientific conclusions and interpretations. From this space emerges multiple, rather than singular, answers. It is, in other words, a space of multiplicity that actively asks us to consider and reconsider certain “quite general but problematic concepts” indelible to the scientific project (Herrnstein Smith and Plotnitsky 1), including observation, objectivity, truth, falsity, law, knowledge, proof, and fact. These are concepts that a ‘systematic statement of scientific explanations’ does not question.

Movement from multiplicity to the hard space of monadism results in a metaphysical epistemology that manages the ways in which we think about the planet’s natural processes. When congealed by systematic statements, processes become reduced to theorems, analogies are solidified into mathematical calculation, and matter undergoes an instrumentalized reading through which it is dematerialized, divorced from its physical qualities in order to be rematerialized as objective, factual information. In this process, the natural world is lost to translation, overridden by symbolic, one-dimensional ideograms.

At a historical moment in which present and future ways of knowing “scientifically” will contribute to helping curb the current environmental crisis, the dematerialization of the environment by systematic statements offers a point of departure for the following investigation,

which is interested in exploring the relation between the model, the human, and the environment through the thought of Michel Serres. In response to science's arithmeticization of knowledge, Serres posits an alternative way to consider models and the information they reveal. Acknowledging that models function to "bring the distant to the immediate," he suggests that a technical understanding of models should begin with a meditation on the inaccessible nature of what they make accessible (*Hermes* 87). The model is thus not as much a representation of the inaccessible as it is the exploration of the aforementioned interstitial space located between the disparate places of the accessible and the inaccessible. In unpacking Serres's unique way of reading analogical models, what follows theorizes how scientific technologies might engage with the environment by contributing towards the establishment of what Serres's calls a 'natural contract,' a union of life-giving reciprocity between humans and the planet. In doing so, this chapter proposes that Serres's theoretical reading of the model indirectly characterizes the model in two distinct ways, both of which are crucial to establishing and maintaining the natural contract. First, when used to consider the inaccessible's uncertain nature, models can function as pedagogical tools; second, models have the ability to help implement a reconciliation between human and nonhuman temporalities, becoming platforms on which an intra-temporal politics can unravel.

To address these points, I divide the following into three parts. First, I provide a brief introduction to the natural contract before calling upon the theoretical work of Bruno Latour and Jacques Rancière to argue that an escape from a Duhemian arithmeticization depends upon an ability to learn – and, therefore, to think – differently about Earth. Indeed, the above characterizations of the model derive from a unique way of interpreting model data, the result of an education that teaches the value of interstitial spaces. Serres's position on the model is then

unpacked to demonstrate how thought arising from this space enables a topological reading of the model through which the nonhuman is given new agency. Examining how this plays out in climate models, I conclude by proposing a techno-scientific conceptualization of uncertainty from which a natural contract can begin.

Science and the Natural Contract

Entrance into the natural contract begins with the distinct awareness of a delicate, twofold and interconnected fragility: that of the Earth as an ecosystem tipping increasingly off-balance due to the human's role as consumer and producer; and, in conjunction, that of the human dependent on Earth's ecosystems for survival. These two states – ones of severe distress – must balance each other out, respecting the other's increasing fragility if the immanent destruction of both parties is to be avoided. While Serres's explicit discussion of models is limited to a single meditation on the birth of geometry in *Hermes: Literature, Science, Philosophy* that predates the natural contract, the natural contract might nevertheless be considered a culminating descriptor of various themes, concepts, and ideas that appear throughout Serres's work and include his unique interpretation of the model.¹⁶ Residing behind these is a philosophy of flux and flow that seeks to birth a new understanding of human experience and existence by positing a radical, non-phenomenological subjectivity submerged in a non-anthropocentric temporality. Indeed, entrance into the natural contract requires a leave-taking of what Serres calls the "worldly world" (*Natural* 12), a concrete setting of statics, production, and laboratory-pure perception policed by infallible Reason and managed by the separation of primary and secondary qualities. In contrast, the "worldwide world"

¹⁶ Serres was already describing the natural contract by other names in earlier works, including *Genesis* (1997), in his discussion of noise and love, *The Birth of Physics* (2001), in his discussion of Epicurean physics and fluid dynamics, and his five *Hermes* volumes, published between 1968 and 1980, which include discussions of topology, geometry, and communication.

of natural processes (12), as the setting of the natural contract, opens through the atomistic doctrine of physics. At the heart of Serres's discussions of the worldwide world sits the Lucretian *clinamen*, Serres's most fundamental motif, image, and metaphor. Referring to the erratic swerve of an atom from an orderly elemental flow, the *clinamen* results in a turbulent swirl, or vortex, representative of the topology of world processes.

According to Serres, the challenge humankind urgently faces is how to remake science as a space free from the codifications of human verdicts, often erroneously believed to be direct representations of natural phenomena. Yet, as Serres himself writes, "something is missing" (37). In its current conceptualization, the conventional consideration of quantitative data as scientific knowledge cannot speak to the dual fragility at the heart of the natural contract. Specifically referring to the *logos* that formally legitimizes scientific knowledge, Serres writes that, "At the borders of effective and precise knowledge, and at the limits of rational intervention, we find not only ignorance or error but mortal danger. Knowing is no longer enough" (86). Indeed, in view of the model's dematerialization of nature, that which Serres identifies as 'missing' seems to be something along the lines of a way of learning and, consequently, of knowledge production that includes both the human *and* Earth. This would necessitate that Earth and its processes be present in scientific exploration, experimentation, and observation beyond being the object(s) of study. All must be understood as a participant in science by becoming 'actants,' a term coined by Bruno Latour to describe a source of action that produces effects in the surrounding world according to "the trials it undergoes, the performances it is allowed to display, the associations it is made to bear upon, the sanctions it receives, the background in which it is circulated etc." ("On Actor-Network Theory" 378). If the materialities of the world were understood as actants rather than objects functioning under unifying and deterministic laws, science would become divorced from

its technical meaning as a field of “possible *final* and *stabilized* states” and would instead be conceivable as a fluctuating network of human and nonhuman interactions (378). The work called *science* and the thought, knowledge, and procedures called *scientific* would be built from these meandering, interconnected pathways.

If science were to take on this structure, it would transform into a political project. Here, politics designates what Latour calls “the progressive composition of the common world” (*Politics* 62), which he defines as human-nonhuman interactions that create a democratic collective of worldly entities fostering what Jane Bennett describes as “greener forms of human culture and more attentive encounters between people-materialities and thing-materialities” (x). These interactions, as Latour stoutly states, do not advocate the unification of the human and nonhuman in a harmonious whole, but are the establishment of an alliance that stresses and celebrates the multiplicity of nature and the agency of each actant. Present here is an emphasis on the inaccessibility of entities to each other. Entities are actants through the maintenance of a distance between them that in its emphasis of multiplicity serves as a protective barrier to political modalities that corral multiplicity into a unified whole, eliminating expressions of individual agency. Science’s dematerialization of nature does just this, consequently rendering materiality a-political in the scientific, social, and cultural imaginary. At a moment in which an increasing amount of ecological thinkers are calling for a politicizing of matter to make us more attentive to nonhuman actants, the cultivating of Earth’s political presence in the sciences requires a unique education that provides Serres’s “missing something” and incorporates the above element of distance. What follows will briefly theorize what this education might look like in order to set the stage for understanding a Serrian way of reading models.

Education and Distance Relations

The ability to enter into a political collective with the nonhuman hinges upon how we know the Earth, that is, the very manner in which we learn about and consequently envision, imagine, and interact with our local and global environment according to internalized lessons. In contrast to current forms of education that slide the learner along a spectrum bookended by the statuses of ‘ignoramus’ and ‘expert,’ an education leading to a science and politics that work towards the composition of the common world depends upon an acknowledgement of distance as the inaccessibility, and resulting unknowability, of things. While ‘learning’ typically defines the process of covering the distance between the poles of *not knowing* and *knowing*, a maintenance of distance acknowledges and preserves the Kantian *noumenon*, jumpstarting a political interaction with the inaccessible.

In *The Politics of Nature*, Latour particularly stresses how dematerialization is maintained through education and considers the disjunction that exists between the human and nonhuman as originating from knowledge harvested only from a science that values systematic statements. He particularly critiques the vehicles through which a knowledge of the world is delivered, mainly the law-providing figure of the scientist who transmits the processes of the natural world to the general populace. Using the framework of Plato’s allegory of the cave, Latour substitutes the scientist for Plato’s figure of the philosopher, one who, unlike others, enters and exits the cave as she pleases. Able to break from the human population inside to journey out into nature, and equally able to break from nature to return to the cave and deliver the objective laws of the natural world, the scientist functions as a middle-man between nature and society, evidencing a complete lack of continuity “between the henceforth irrefutable objective [natural] law and the human – all too human – logorrhea of prisoners shackled in the shadows” (*Politics* 11). The worlds inside and outside the cave are not part of the same reality, but are made discontinuous through this particular

transfer of knowledge, which inhibits not only the establishment of a political collective between humans and nonhumans via a strict regulation of knowledge, but also deters the development of a bond between science and society. Indeed, according to Latour, the scientist acts as “the epistemology police” (13), whose duty it is to prescribe how the scientifically uneducated cave-dwellers should know – through the unadulterated and accessible truth of facts – the outside world. This, however, reveals a subtle, insidious hurdle to the formation of a human-nonhuman political collective. The presence of epistemology police reveals the dissemination of knowledge to be the reinforcement of a hierarchical positioning of two intelligences, one that knows the parameters of ignorance and one that does not.

In *The Emancipated Spectator*, Jacques Rancière describes such education as the oppressive maintenance of an endless stultification, stating that, under such circumstances, all that a population might know of the natural world “is stupefying [...] distance transformed into a radical gulf that can only be ‘bridged’ by an expert” (10). What the scientist teaches the cave population, in other words, is not as much the human-interpreted laws of the natural world as it is their own ignorance of the facts, a result of their status as ‘non-experts’: “what the protocol of knowledge transmission teaches the pupil in the first instance, is that ignorance is not a lesser form of knowledge, but the opposite of knowledge; that knowledge is not a collection of fragments of knowledge, but a position” (9). As Rancière explains, the distance that separates the ignoramus from this position has no quantifiable measurement, but is simply enforced by the expert’s status as the expert – a status that the ignoramus will never reach unless she becomes an expert herself and can claim to know, looking at her own pupils, what ignorance consists of. In discrediting the ignoramus’s intelligence, the scientist presents ignorance and legitimate knowledge as polarized positions, directly inhibiting the existence of any way of knowing that does not fall within either

of these categories. The current separation of the human and the nonhuman and the scientist and the natural world thus seems to be a result of a discourse of inequality between forms of knowledge.

Importantly, it is not that the ignoramus is un-knowledgeable, but that her knowledge does not follow the directional, linear thrust that characterizes that of the expert. Rather, her's is like a winding pathway informed by daily experience, "by listening and looking around her, by observation and repetition, by being mistaken and correcting her errors" as she "translates signs into other signs and proceeds by comparison and illustrations in order to [...] understand what another intelligence is endeavoring to communicate to [her]" (9; 10). In other words, her knowledge is the result of random, democratic encounters with the things of the world, unmediated by established logics and accompanying systematic statements. This intelligence knows nothing of the distance between the ignoramus and expert. Consequently, for the former, "Distance is not an evil to be abolished, but the normal condition of communication" (10). The ignoramus's movement between not-knowing and knowing is a nomadological wandering between things that connotes a never-ending experience of discovery and translation. It is a rendering of the inaccessible accessible while simultaneously preserving the distance between herself and what she encounters. Unlike Latour's scientist, the ignoramus does not codify. Her act of translation does not claim lasting legitimacy, but knows itself to be a translation – potentially one among many – as opposed to a truth, thereby becoming a thoughtful *interaction with* nonhuman actants that is far from being *a knowledge of*.

In *Thumbelina*, Serres makes the distinction between 'thought' and 'knowledge,' the former which designates an ever-changing, interdisciplinary, topological process, the latter which describes the institutional knowledge of the expert. Associating distance with thought, Serres describes distance as something livable, a state one can enter and adopt as part of oneself: "I can

think and invent better if I keep [...] knowledge [...] at a distance from myself, if I open a gap between it and myself. I *become* this emptiness, this impalpable air” (*Thumbelina* 26). For Serres, as for Latour and Rancière, knowledge is a taxonomy. In contrast, thought and invention are modalities of distance, with invention referring to “an inventory, in other words, a multiplicity of phenomena and types of knowledge” (Harari and Bell xxix). More specifically, thought and invention are linked to existence itself. As the emptiness of distance, they instigate the becoming-multiple of being, which eliminates the absolutes touted by the expert scientist. Additionally, if distance no longer connotes the existence of an end-point that marks one’s arrival to a state of absolute knowledge, then there is no such thing as an expert. As a result, a knower is opened to the possibility of knowing the world as something whose essence is democratic and unknowable.

Comfortable with this inaccessibility, engaged with thinking and being alongside it, the *ignoramus* finds herself composed of distance, bound up in its perpetual possibility. Her knowledge, as an immediate knowledge of the localities that surround her, is “a truth that is always local, distributed haphazardly in a plurality of spaces” and open to a “cohabitation of different systems of thought (hence multiple [...] truths), which form any number of unique courses” (xiii; xiv). What she learns is not utilized to make determinations, calculate a singular, universal answer, nor map to stabilize. Indeed, if her knowledge maps, it maps passageways between entities and topological landscapes, functioning as Rom Harré’s gateway to the unknown. It is into this space that Serres transports the idea of the model.

Thales’s Theorem and the Inaccessible

The crisis underlying both Serres’s work and the bulk of environmental thought stems from the ousting of natural law from current schemas of knowledge as a result of its translation into human verdicts. If it is to dissipate this crisis, science faces the challenge of reconsidering how it learns

about the environment through fact-providing tools – such as the model – and how these tools can be reconsidered as instruments leading towards the realization that natural law can only be known to the human in its very inaccessibility. Yet since humans cannot escape the subjective reality upon which knowledge is built, the inaccessibility of worldly things must somehow be incorporated into science and human reality. Here, analogous modeling becomes a fundamental necessity, being the only way in which the inaccessible can be conceptualized while retaining its opaque density. In *Hermes: Literature, Science, Philosophy*, Serres considers the intimate relation between the accessible and inaccessible when discussing the origins of Thales’s intercept theorem, an equation resulting from one of the earliest geometric models. According to myth, the Greek mathematician Thales wanted to measure the inaccessible height of Cheops’ Pyramid. Using an accessible object as a reduced model of the pyramid, Thales measured the length of both structures’ shadows at a specific time of day, realized that their ratio corresponded to the ratio between the structures’ heights, and was thereby able to formulate an equation that would solve for the height of the pyramid.

Serres attributes the importance of Thales’s theorem to a specific relation that it articulates between the human and her technological instrument, namely, a relation of distance. While early models were typically designed around a stable constant, Thales’s model and theorem resulted from an acknowledgement of the movement rather than the stability of things.¹⁷ Inverting the variable hierarchy, Thales designed his model to be pendent upon the inconstant sun, “that is, he asks the object in motion to provide a constant flow of information about the object at rest [...] the constant is no longer what gauges the regular intervals of the variable; on the contrary, Thales gauges, within the variable realm, the stable unknown of the constant” (*Hermes* 87). For Serres,

¹⁷ See Rotman, who describes the “set-theoretical rewritings of mathematics” and the ideogrammatic writings of geometry as constants, ideal objectivities full of a “Platonistic rigor” (27).

this emphasis on movement equating to an acknowledgement of natural processes is the essential element of Thales's model. While Thales might decide the appropriate moment during the sun's course in which to measure the shadows, as he progresses through his theorem he ultimately works in tandem with the sun, reading nature rather than congealing it into an arithmetic constant.

Yet, though he reads, Serres states that Thales reads incorrectly. In paying attention to the sun, he forgets the two shadows cast by the model and the pyramid. While he measures these, paying attention to their visible outer lines, he does not read for what Serres's calls the "hidden knowledge," a state in which knowledge is occluded, inaccessible to the human mind:

A shadow adequately designates the folds of hidden knowledge. In the initial technical activity, knowledge is in shadow, and we are also in the dark as acting beings, trying to situate theory in light. [...] Thales failed in this last attempt. [...] Thales's geometry expresses the relationship between [...] that which practice engenders and that which the subject of practice engenders. His geometry says this and measures the problem, but does not resolve it; dramatizes his concept, *but does not explain it* [...]. (90, added emphasis)

If Thales's goal was to know the inaccessible essence of the pyramid's height, his equation fails to be a moment in which such knowledge is gained. As Serres stresses, the equation is only a translation of the pyramid into an accessible medium via calculation. Knowledge of the pyramid and its features continue to remain inaccessible in themselves.

Indeed, the theorem's dramatization describes an equivalency resulting from a relation between ideograms taken for reality, as opposed to a relation between the undetermined, mysterious natures of two real phenomena highlighted by analogy. Thales's mistake resides in the presumption that the model delivers exact knowledge of the real through a logos of metrics,

transforming the reading of the model into a conclusive act concerned with the sole goal of attaining that sought-after logos: the pyramid's height. Thales's calculations only point towards the dancing of projected forms at the back of a cave; they do not confront the inaccessible reality that throws those projections and inspires his theorem. His calculations do not explain the pyramid in its inaccessibility, nor do they explain the relation between the pyramid and the model, but merely dramatize reality as a narration of relations spun according to anthropocentric technique. Rather than articulate a representationalism leading to the traditional triangulation of known, knower, and knowledge, an explanation of dramatized reality includes acknowledging the inaccessibility of what has been made accessible.

For Serres, Thales's theorem sparked an eon-long crisis of technique-induced ichnographical obsession, in which a "first spectral analysis [is read] without analyzing its condition" (92). Such a reading omits an environmental contextualization of anthropocentric practice and knowledge, including an acknowledgement of the situatedness and indebtedness in, and a blindness to, the natural settings practice and knowledge emerge from. It is probable, writes Serres, "that true knowledge of the things of this world lies in the solid's essential shadow, in its opaque and black density, locked forever behind the multiple doors of its edges, besieged only by practice and theory" (94). Arising from these densities is what Serres refers to as an interminable discourse, "That which speaks of an absent object, of an object that absents itself, inaccessibly" (97).

Who can speak this discourse? While Serres does not venture an answer, Rancière does, and we might read his figure of the *ignoramus* as covertly woven into Serres's discussion of Thales. As an explanation of the reality dramatized by technique, an interminable discourse is voiced by an *ignoramus*-modeler who can transform the technological set-up of the modeler, model, and

environment from a space of expected truths to a “scene of knowledge” (89), where knowledge is the interactive knowledge of the non-expert. If the ignoramus-modeler is one who learns by experiencing the surrounding environment, she inevitably takes notice of shadows and thus enters into a distance-relationship with them. This conscious acceptance of inaccessibility lends a sort of accessibility to the shadows themselves by producing a knowledge of the world that fully takes into account that the world is ultimately beyond all knowledge.

Importantly, the shadows composing Thales’s theorem are not simply exterior things manifested in the outside world. In a Serrian context, they are the nonrepresentable essences of tangible forms. Throughout his *oeuvre*, Serres extrapolates the shadow’s obscurity qua the inaccessible into the nonrepresentable origin of all creation, the “unified nappe” from which begins the chaotic cataract of all natural flows and processes (*Birth of Physics* 50). If taken as this origin, a shadow is “no longer here and there, in and for some local object” (50), but is rather integral to all things. The following realizations result: first, in the context of Thales’ theorem, if the shadow is integral to all things, including other shadows, then the pyramid and model’s shadows are integrated within each other, both contributing to the unified nappe of the universe as twin moments of genesis; second, as a cataract from which all else flows, each substance’s shadow, as the unknown essence at the heart of that substance, begets the substance itself; third, if its shadow is accepted as a moment of genesis, the model functions as a starting point from which a reader can begin to consider the shadowy surfaces – both interior and exterior to solid form – that together help constitute a knowledge of an essence’s inaccessibility. The process of thinking-through the model thus becomes an experiencing of the tightly woven relation between the accessible and inaccessible. For Serres, this connotes a bridging of radically different spaces into a topological twisting; it is “to say (*dire*) what takes place between them; to inter-dict (*inter-dire*). The category

of *between* is fundamental in topology and for our purposes here: to interdict in the rupture and cracks between varieties completely enclosed upon themselves” (*Hermes* 45). The model conceived of and read through the inaccessible is this inter-diction. A tool for work, it serves a practical purpose, yet simultaneously is a moment of the in-between, an affirmation of distance as a mechanism of representation. Crucially, then, the model does not designate a single space. Indeed, the seeming simplicity of its geometric construction rather contains multiple spaces, articulating their relation from a topological viewpoint and, in doing so, constructing a reality beyond human law.

Due to its topological state, the modeler must pay close attention to what is recognizable in the variables that constitute the model as a planar projection – the “right angle, the plane, the volume, their intervals and their area” (94). She must learn to see these differently in order to understand the following: “Pure and simple forms are neither that simple nor that pure; they are no longer complete, theoretical knowns, things seen and known without residue, but rather theoretical, objective unknowns infinitely folded into one another” (96). Serres urges the modeler to realize that the variables constituting the planar projection are necessary vehicles to reveal those which remain hidden: those objective unknowns that may hereby be referred to as ‘shadow variables.’ The model as an in-between space thus has multiple layers that an interpreter must dedicate herself to reading fully if she is to help establish a relationship of fragility with the Earth through a natural contract. Yet how are these layers to be read? What method of reading does the model ask for in all its complexity?

In his *Philosophical Instruments*, Daniel Rothbart explains that the drawn design plans of some technological models used in scientific research begin by providing the reader with general details about what is to be constructed. As the reader gets deeper into the specificities of the

illustrations, however, she “unfolds layers of information of increasing complexity [...] A reader explores models within models, representing structures within structures” (Rothbart 43). What these design plans reveal is that, far from being a rendition of a form, the model is a dynamic system of varying complexities with varying degrees of visibility. Variable and shadow variables switch statuses, becoming momentarily occluded or visible in a manner that reflects the ever-changing and unknowable nature of the planet:

Surfaces disappear when the light is turned off, when another object blocks the line of sight, or when an observer moves his or her head in certain ways. Sometimes, when one surface disappears, other surfaces are exposed. [...] An occluding edge has a double life: it hides some surfaces and exposes others. One’s perception of an exposed surface is conjoined with awareness of hidden ones, linking possibilities with actualities. [...] Occlusion is not limited to the experience of an exposed surface but invites attention to a realm of possible, but hidden, surfaces. (43)

The visual experience of the model is not valuable in terms of the constant it describes, but in the way in which it immediately invites the reader’s attention to the unseen shapes and shadowy lines that construct planar vision. The visible form originates in its simultaneous state of occlusion, the “unified nappe” of the shadow, from which all lines – visible and invisible – flow. In this context, Rothbart describes a strategy of model-reading that Serres would agree with, one which centers on and presents occlusion not as a helpless blindness, but as the experience of boundaries. Faced with aspects of the model that remain invisible to her from her point of view, a model-interpreter constructs imaginary facets to fill in the proverbial blank, thereby “anticipat[ing] possible surfaces that might appear from different frames of reference” (47). This perfectly encapsulates the Serrian relation between the accessible and inaccessible: the logos relayed by the model’s accessible

aspects should never be read as absolute, but as a starting point from which the reader can consider the shadowy surfaces that constitute the functioning of world processes and give rise to human reality. Reading the model is thus an exercise in the experience of boundaries as potentialities to be crossed so long as the very moment of crossing does not shed light upon the things of the world, but rather brings to the fore the world's profound obscurity.

The fact that the logos of the model is no longer to be taken as absolute reiterates a model of education in which the status of the expert is nonexistent. A discarding of the poles of expert and ignoramus moves both science and society away from a Modern conceptualization of education that decrees a state of enlightenment – of full disclosure, of clarity – to be the ultimate goal of all learners. Serres considers this education as perpetuating, if not creating, the relentless drive and meticulous charting of Progress, which has come to determine the anthropocentric understanding of time as “an irreversible line, whether interrupted or continuous, of acquisitions and inventions” (Serres and Latour 48). Understood as such, and kept by the correctness of human-identified variables, time perhaps may be more specifically described as the belief in the accessible as a given rather than an interpreted translation. How does the world fit into this anthropocentric temporal configuration? Quite simply, and unsurprisingly, it does not.

Temporal Reconciliation and Climate Models

This chapter took its starting point from Serres's comment that “something” is missing from human thought, society, politics, and science that hinders the establishment of the natural contract. So far, it has offered that the missing factor might be found within an education based on the concept of distance and an awareness of the inaccessible that is present within the accessibility of the model, both which proffer forms of knowledge production that include both the human and the nonhuman and instigate the natural contract. To this, let us add that this knowledge production

necessitates a new understanding of time that, once again, includes the human and nonhuman. Keeping in mind the above discussion of models and their shadow variables, how might climate models prompt this understanding and aid in what might be referred to as the temporal reconciliation between human and nonhuman timescales?

According to Serres, natural time, far from being a linear continuum of past, present, and future, is an infinite progression of beginnings and endings, of births leading to deaths leading to births. It would not be enough to say that natural time depends on an overstepping of boundaries and an introduction to the shadows and occluded lines of the world. Perhaps more accurately, it is the constant inhabitation of shadow through the very performance of overstepping. When boundaries are broken, something new is born. Life springs from composites and assemblages, and time is nothing more than these moments and movements of conjugation that create changes in the natural states of things. It is, in other words, the performance of the transformation from the homogenous to the heterogeneity of the in-between.

In its articulation of multiple spaces and their topological relations, the model is deeply integrated in natural time. On one hand, it would be easy to say that, when considered as a tool prompting the crossing of boundaries and the acknowledgement of the inaccessible, it serves to mirror compounded life. The model's analogous nature, however, does not mean that it passively reflects. If it is understood as a glimpse into the shadows of the world, it participates in natural time and even has the ability to explain, rather than simply dramatize, this temporality to the human user.

The challenge acknowledged by both scientists and ecological thinkers now lies in bringing about a global acknowledgement that human life, time, and production do not comprise a facet apart from the world and its processes, but are part of its patchwork composition. Dipesh

Chakrabarty has described this challenge as resulting from difficulties that arise in attempts to mentally reconcile three supposedly clashing temporal scales that in the era of climate change must be understood as firmly intertwined: “the history of the earth system, the history of life including that of human evolution on the planet, and the more recent history of industrial civilization” (1). As Chakrabarty continues, “from the point of view of human history, [these] are normally assumed to be working at such different and distinct paces that they are treated as processes separate from one another for all practical purposes” (1). Yet an understanding of climate change, the duration of its effects and the implementation of strategies to reduce its continuation all hang pendant on the ability to conceptualize and unite the multiple timeframes of all things involved, including those “that defy the usual measures of time that inform human affairs” (1). What I call the temporal reconciliation of the above three histories would be the integration of three separate timeframes under the banner of natural time. This would be the first – yet an already quite advanced – move towards establishing the natural contract.

Temporal reconciliation refers to the reintroduction of humans to natural time, which includes the multiple timescales of the nonhuman, and is most clearly manifested in climate as the changing of seasons, of temperature, and of weather patterns. In *The Natural Contract*, Serres writes that the industrial knowledge of the modern human has ended her long-standing relationship with weather, one which was crucial to her forefathers, the sailor and the farmer. These two figures lived equilibriously with the elements, attuned to, dependent upon, and living amongst weather patterns; nowadays, “The climate never influences our work anymore” (*Natural* 28). Weather functions as a background to the metropolitan human’s daily routine. Not only does the climate no longer influence the work of a staggering number of individuals whose lives are lived under the roofs of homes, workplaces, gyms, and shops, but, due to the disjunction between ourselves and

our environment, Serres claims that we “don’t know how to think about the relations between time and weather [...]. For do we know a richer and more complete model of global change, of equilibria and their attractors, than that of climate and the atmosphere?” (27). Importantly, the process of thinking through these relations would be a distance of relation, an *interaction with* rather than a *knowledge of* nonhuman timescales. Such an interaction is increasingly brought to the fore by climate fluctuations and climate model predictions.

Earth System Models (ESMs) visually represent temporal reconciliation, providing an example of how the shadowy facet of a model can weave together Chakrabarty’s three histories into the whorl of natural time. ESMs investigating carbon levels bring together multiple temporal scales through their active engagement with ‘carbon time’ in their simulation of future climates as they predict the carbon cycle in the land, ocean, and atmosphere. As opposed to merely simulating the Earth’s current climate, ESMs simulate future carbon cycles, thus working as platforms upon which scientists can project future weather patterns, conceptually interact with carbon’s very lifespan, and consider how it will affect natural processes and biological life. Peter Gent explains:

Only about half the carbon dioxide (CO₂) emitted into the atmosphere over the past 150 years has stayed in the atmosphere; the other half has been taken up by the land and oceans in about equal measure. Climate models need past and future concentrations of CO₂ and other greenhouse gases in order to simulate the past and future climates. For future climate projections, it is currently assumed that the land and oceans sinks will continue to be as effective as in the past in taking up CO₂, so that future atmosphere concentrations will be based on about half of the future emissions staying in the atmosphere. However, there are real concerns that in the future, the ocean especially will not be able to take up the same fraction of CO₂

emissions because it is becoming warmer and more saturated with CO₂. Whether the land will continue to take up the same fraction of CO₂ is also not obvious and strongly depends on future land use practices. (10)

Gent's description of the model implicitly reveals it to be an 'in-between' space created by the union of the past and present. The model's documentation of carbon time tells an ecological history in its unfolding through a computerized charting of human-nonhuman interactions, their intertwined histories are made clear in the prediction of future carbon levels: when the past and present lifespans of carbon and other greenhouse gases are recorded, past, present and future land use practices are considered; when these are considered, plant and animal temporalities can become indicators of land use practice and carbon levels; additionally, the lifespans of modern technologies must also be assessed in their abilities to either negatively or positively effect land use practices and, consequently, the human and nonhuman lives that depend on the land for sustenance. If all these are read in the model as part of its very composition, then the model narrates what Karen Barad so poetically describes as "entangled tales," each "diffractively threaded through and enfolded in the other," contrapuntal as "a cacophony of always already reiteratively intra-acting stories" (206-7).

The entangled information retrieved from natural recorders means that ESMs' empirical outputs are contingent on a multitude of factors, including unprocessed data gathered from measuring instruments such as thermometers, buoys, and satellites, and other climate models that interpolate and create educated estimates of temperature or greenhouse gas records if data is found to be faulty or not directly measurable. Additionally, due to data acquisition being indivisible from uncertainty, ESMs investigating the same climate variable – carbon levels, for example – often conclude with different data projections. When this occurs, scientists often create a multimodal

ensemble to minimize uncertainty, gathering all the projections of similarly focused ESMs and portraying them on a master chart to create an overarching portrait of future climates.¹⁸ In an ethnographic report on global climate models, however, Anna Tsing critiques model representations for their creation of a totalizing global scale, arguing that their portrayals deny “pre-existing interests and identities” at a local level (103). She writes that, rather than describe the planet, global climate models only picture it as a totalized whole: “They simplify and reduce the social and natural world to geophysical laws. In the process, they develop a globe that is unified, neutral, and understandable through the collection and manipulation of information” (102). Such comments seem to stem from Tsing’s belief in the hidden, political agendas of atmospheric scientists themselves. Indeed, she states that some use models to push certain “global standards and structures of management” and survival (103), calling upon the legitimizing, patriarchal figure of Science to stamp their findings as “expert, neutral, rational, and empirically grounded” (102). In short, Tsing is wary of an epistemological policing and an anthropocentric politics that cannot be ignored.

The challenge that this chapter ascribes to readers, however, is to transform climate models from management instruments into potential spaces of human-nonhuman collaboration and reconciliation. This, in turn, would change what it means to describe the planet as a single, functional whole. While environmental thinkers have traditionally decried holistic and mechanistic ways of imaging and imagining the planet, from a scientific standpoint Earth is undeniably a single, dynamic, and ecological system composed of smaller interconnecting systems that allow for the continuation of life. Such a composite, however, does not necessarily need to be understood as neutral and totalizing. The relation of parts to a whole – of each system and entity to a larger

¹⁸ On multimodal ensembles, see Gonçalves, Von Zuben, and Banerjee.

ecological system – might instead be considered what Paul Feyerabend describes as the “relation of a part to an aggregate of parts and not like the relation of a part to an overpowering whole” insofar as the whole (193), according to Gilles Deleuze and Félix Guattari in *Anti-Oedipus*, “is itself a product, produced as nothing more than a part alongside other parts, which it neither unifies nor totalizes [...]. The whole not only coexists with all the parts; it is contiguous to them” (43-44). As a functional whole, a model is composed of fragments that in reality are stochastic and constantly shifting. It is, in other words, a composition of distances pieced together by the climate scientist, who becomes like the traveler on the train in Proust’s *In Search of Lost Time*, unable to see the unity of the landscape that the train zooms past, but nevertheless able to trace it “from one window to the other, ‘in order to draw together, in order to reweave intermittent and opposite fragments’” (Deleuze and Guattari 43). Reweaving describes the very essence of climate modeling, and its realization is key to temporal reconciliation and the instigation of a natural contract.

In the words of Timothy Morton, “Global warming plays a very mean trick. It reveals that what we took to be a reliable world was actually just a habitual pattern – a collusion between forces such as sunshine and moisture and humans expecting such things at regular intervals” (Morton 102). Global warming, in other words, forces humans – so comfortable with and consequently desiring of certainty – to face uncertainty. Climate models ask their interpreters to see this uncertainty and listen to the stories emerging from their shadowy depths. In this case, strategies traditionally used to eliminate uncertainty, such as multimodal ensembles, transform into a celebration and acceptance of multiple inaccessibilities through a reweaving of uncertainties. Climate science, therefore, like general scientific work, “does not just reduce uncertainty; it actively constructs it” (Zehr 4), thereby emphasizing the mysterious, multidimensional realm of the possible that Rothbart describes above. As a result, scientists dealing with climate models work

with, learn of, and learn from the inaccessible itself, a fact that causes scientist Jans Rotmans to point out that, “In view of the accumulation of uncertainties, the interpretative and instructive value of the [...] [climate] model is far more important than its predictive capacity” (3). As stated above, modeling does not portray absolute truths. Its projective capacity instead describes a series of relations, exchanges, and connections drawn from the inconstant variables of nature itself and from human calculation. Taken at face-value, the givenness of projective capacity leaves behind the Serrian hidden knowledge that is the inaccessible. However, if the inaccessible is translated through the givenness of its manifestation via the model, conceived as the initial entry to an Escher-like tangle of beings and temporalities, then the instructive value of the model lies in the knowledge it makes accessible of the inaccessible’s unknowability. The model thus teaches how to see the occluded manifestation –and live by and with its uncertainty – in the occluding givenness of the model’s projections.

At the end of *The Natural Contract*, Serres highlights the action of ‘casting off,’ a forceful propelling away from the concrete discourse of possession and a movement into the unfamiliar, the uncalculated, the unknown: “To go out from this world and enter another, where nothing will be the same: that’s called casting off” (99-100). For Serres, this is the very performance of a contract with the world. Casting-off corresponds to a binding-to, to a gathering together of traditionally disparate beings – subject, object, human, nonhuman – into participants in a community. Etymologically referring to a knotting, joining, or unification, contracts “*comprehend*,” says Serres, “since they join or grasp or seize several things, beasts or men together. [...] A contract, therefore, doesn’t necessarily presuppose language: a set of cords can be enough” (107). So what about sets of lines on a graph or multimodal ensemble that trace a geometry of unstable atmospheric systems? Are the cords of the natural contract not are visually represented by the

peaks and troughs of climate models, which become a powerful web of communication lines that ask us to act and react not simply on the level of philosophical and theoretical speculation, but on the level of analysis and policy as we become participants “in an enormous play of energies” (110)? Analysis itself, as Serres writes, therefore becomes “the set of acts and thoughts that unbind” and transmit “force or information, some kind of reverberation” that projects us into the unknown (110), that forces us to confront and therein learn from the inaccessible. Here we are asked to become an *ignoramus* and understand the model according to Rotmans: as a pedagogical tool that does not bequeath an expert-knowledge, but that that presents itself as a constructor of the uncertainty that is the very act of casting-off.

Serres suggests a new understanding of what it means to know and learn through a technology that could give rise to new attitudes towards the parameters of its use and, more generally, towards scientific methods. As science turns to face the responsibility of developing new innovations to mitigate the oncoming effects of climate change, it is easily imaginable that the continuation of the human race depends on how modeling influences human participation in, via an understanding of, Earth’s processes. As that which brings the distant to the immediate, the model is, in fact, necessary to the establishment of the natural contract, if only in that there is no other way of entering into a balanced relation with Earth unless nature is something reasonably known to the human mind, or, more specifically, *something reasonably known to the human as the inaccessible*. Since subjective reality is the only platform upon which human knowledge can be built, a translation schema of some kind is necessary if an ethical interaction with nature is to take place. Consequently, the question is not one of removing the human filter that allows for subjective consciousness, but, rather, of understanding that such a filter, along with its timescale, is not absolute. Working towards explaining how models could give access to nonhuman histories and

temporalities necessitating acknowledgement and protection, this chapter hopes to serve as a preliminary orientation towards more in-depth projects exploring the heterogeneous spaces of knowledge arising from the practical and philosophical cross-pollination of climate science, its practices, and the environmental humanities.

CHAPTER 2. WELCOMING UNCERTAIN FUTURES: THINKING SUSTAINABILITY AND SEXUAL DIFFERENCE IN IAN MCEWAN'S *SOLAR*

Air is now set upon to yield nitrogen, the earth to yield ore, ore to yield uranium[.]

— Martin Heidegger, *The Question Concerning Technology*

To forget being is to forget the air.

— Luce Irigaray, *An Ethics of Sexual Difference*

Shall there be womanly times, or shall we die?

— Ian McEwan, “Or Shall We Die?”

Introduction: Keeping Time Dangerous

What relevance does Chapter One’s climate model lessons hold for society? The following analysis elaborates on temporal reconciliation as a way of thinking time so that the future remains virtual, beyond the immediatism that characterizes the capitalist present and its imaginings of a sustainable society.¹⁹ I want to interrupt these imaginings, which sketch technicist solutions to the environmental crises and underscore neoliberalism’s attempts to deliver itself from its own ecologically damaging effects. I argue that such attempts are symptomatic of a desire to control natural time as the flows of energy that animate environmental processes. Rather than think alongside the planet’s atmospheric, ecological, and geological changes, politico-economic responses to climate change have been to financially and technologically manage the increase of total entropy, which describes the release and dispersal of energy into a given system. The trend of “incorporating market logics into environmental and conservation policy” through carbon trading, carbon sequestration, and the switch from crude oil to natural gas is an attempt to ease

¹⁹ For scholarly discussions of the immediatism that characterizes society, see Adams, Zylinska, and the works of Paul Virilio, particularly *The Futurism of the Instant* and *The Original Accident*.

environmental externalities related to continued emissions and control the planet's reaction to the continued use of fossil fuels (Corson et al. 1). More precisely, it is a calculated—both in the sense of deliberate and profitable—manipulation of matter's reaction to thermodynamic processes, including the speed at which molecules such as carbon are exchanged in the planet's biogeochemical cycles. Attempts to bring nature into the market are thus attempts to temper these cycles, to figuratively disarm them as a threat to globalized capitalism's smooth functioning. In contrast, this chapter keeps time dangerous through the concept of temporal reconciliation, which reveals the social and environmental relations at stake when energy as the quality of time is divorced from matter.

As the reintroduction of humans to natural time, temporal reconciliation articulates an action: a refusal to treat air, earth, and ore as reserves of energy that can be abstracted from matter and hijacked to sustain anthropocentric timeframes. This refusal acknowledges energy's embodied nature and recasts natural resources in the human imaginary as narratives of material mixtures and expressions of millennia-long entropic rhythm and organic compression. The Anthropocene's management of energy sources is symptomatic of a gross sociocultural misunderstanding of energy systems, wherein resource extraction and the ease and certainty of energy access have resulted in energy's conceptual separation from the materialities it operates within and across. Oil, for example, is more inclined to be associated with the gas pump and cents-per-gallon than with the deep time of geological strata. In contrast, temporal reconciliation expresses human openness to thermodynamic flux, to the chemical creation, storage, and expenditure of energy in bodies as the process of natural time and life itself. Here, materialities are realized as primary to energy's equilibrium in natural systems and the human quickly comprehends her own body as an affected participant in the energy matrix of material mixtures. Temporal reconciliation is the self's

reweaving of her own materiality amidst the substance of the world; it is a conscious setting sail on the seas of Serres's natural contract in readiness to welcome an uncertain future.

The refusal to hijack energy processes is an action that opens to the virtual. For Gilles Deleuze, the virtual is that which has not been made actual in the world but nevertheless lies latent in the current reality. It refers to crystallizations of possibility that sit tangential to what is and emerge in tandem with historical moments and their ideologies. Sustainability *qua* temporal reconciliation, for example, crystalizes as an alternative possibility to sustainability *qua* the usurpation of energy processes; the former appears as an alternative response to climate change in the very moment that the latter becomes a reality. While Deleuze does not invest the virtual with an ethics, such crystallizations are ethically significant in their potential to yield glimpses of what could be and thereby inspire action leading not only to profound social change but also to a radical difference in being and time—and, by extension, new human-ecological relations.

In fact, the transformative power of the virtual lies in its ability to reconfigure the temporal character of reality. While the actual is defined by the passing of the present, described by Deleuze as “a given measured in continuous time, a supposedly mono-directional movement” (Deleuze and Parnet 151), the virtual “appears in a smaller space of time that marks the minimum movement in a single direction” (151). Translated this into the Serrian register introduced in Chapter One, the virtual adopts the erratic swerve of the Lucretian clinamen, veering from the historical continuum like the rogue atom that breaks from the laminar flow. The movement away from the actual opens reality to an uncertain future that gifts the present the ability to generate new, unknowable conditions of thought, expression, and action that alter the field of the possible. In the moment of the swerve, the givenness of normativity—a givenness that notably codes the future and renders it

certain, predictable—is lost. The virtual here becomes understood as the very “principle of uncertainty or indetermination” (148).

Ian McEwan’s climate change novel *Solar* (2010) uniquely challenges its reader to open herself to unknowable conditions and uncertain futures. A winding and satirical portrayal of neoliberal reasoning and Western excess, *Solar* is set in the early two-thousands against the backdrop of peak oil, venture capitalism, and an augmenting discourse of British energy security. Its only protagonist is Professor Michael Beard, a narcissistic, Nobel Prize winning physicist who seeks to capitalize on sustainable energy sources. When Beard plagiarizes a deceased postdoctoral student’s blueprint for how to technologize photosynthesis to rapidly produce energy for the mainstream electric grid, he unashamedly brings the plan to fruition as the creation of his own genius, relishing the possibility that a solar-based energy market “will be even more lucrative than coal or oil” (176). On the surface, *Solar*’s emphasis on market principles as the primary mechanisms of sustainable practice is so exclusive that the consensus amidst its reviewers and literary critics was that it failed to convey, in the words of Greg Garrard, a “sense of urgency about the demise of the world” (*Ecocriticism* 94). Yet *Solar*’s power as a climate change novel becomes clear and poignant when its capitalist commitment is interpreted as an exercise in reading the virtual. The novel issues a sophisticated challenge to its readers to consider the unactualized multiplicities that lie latent within its narrative.

In the following analysis, I highlight two intertwined virtualities in *Solar* that interrupt neoliberal imaginings of sustainability and exemplify temporal reconciliation. I first overview the politico-economic context from which these virtualities emerge. Latent within the neoliberal political economy is what I call a technological ethic, which theorizes a way of conceiving technological innovation while acknowledging the limitations imposed on human action by

climate and ecological tipping points. Here, *Solar*'s refusal to abstract energy from matter becomes evident, and is later augmented when I identify an essential link between the technological ethic and what I recognize as the novel's second virtual element: an ethics of sexual difference. Literary scholars such as Jago Morrison have considered McEwan's earlier novels especially worthy of attention for the way in which time is "interlinked with the rethinking of gender identity" (Morrison 253). *Solar*, however, seems to completely avoid a reconceptualization of women in society; in fact, the novel's representation of its few minor female characters reinforces the cultural problematic of patriarchal power. Finding it curious that *Solar*'s lack of environmental imaging—in the manner expected by ecocritics—coincides with an apparent lack of the feminine in the work of a writer whose past fictions have been described as "ringingly feminist" (Malcolm 13), I suggest that such a lack prompts an investigation into an ethics of sexual difference, particularly as it is represented in the work of feminist philosopher Luce Irigaray. As will be seen, Irigaray herself theorizes the female as a virtuality, one who has yet to become a human subject who exists beyond patriarchal containment but whose being nevertheless constitutes a space of life open to uncertain futures.

When considered from an Irigarayan perspective, *Solar*'s lack of feminine strength is not a lack at all; instead, it is an invitation to realize the virtual presence of the feminine. Rather than speculate on how and where these are being actualized in the present and positing a new ontological norm, *Solar*, in the spirit of becoming, keeps the practice of thinking about the future open-ended. Sensations of lack implied or directly voiced by critics are consequences of what *Solar* seeks to forefront, that is, a removal of what has become expected and remains within the logic of the patriarchal. *Solar* evokes the ontological uncertainty that comes with acknowledging the virtual as the flip-side of the actual, as that which is beyond what is currently known or what

has hitherto been experienced. I argue that *Solar*'s power as a climate change novel comes from its implicit interweaving of the two virtualities together to show, first, what is at stake in dominant representational systems and, second, that temporal reconciliation can be magnificently actualized in the future through a reconceptualization of ontological categories.

Locating Apocalypse in Solar

In this section, I set-up a discussion of the virtual in *Solar* by considering why the novel has failed to garner critics' respect as a serious piece of climate change fiction. I argue that *Solar* has been largely misunderstood because while it deviates from the genre's overt manifestations of the apocalyptic trope, its critiques suggest that it has nevertheless been read with the expectation of these manifestations in mind. The novel's merit, in other words, is being judged according to how easily a preconfigured checklist can be superimposed on its narrative, rather than according to the imaginative possibilities it opens with its unique style. What results is a reductive understanding of the transformative power of literary depictions of climate change that restricts—albeit inadvertently (though this is part of the problem)—interpretation and limits readers' potential to engage with an uncertain future. Since reading the virtual such an engagement with uncertain futures, the ability to access *Solar*'s virtual undercurrents includes considering how the novel thwarts expectations of what climate change fiction ought to be and do, that is, what it ought to include in its narrative and how it ought to educate its reader on the climate crisis.

Climate change novels draw their value from reframing the present from the perspective of an anticipated future. They engage the imagination in a boomerang motion, flinging the reader's perspective out into a speculative future with the intent that this perspective will curve around, return to the present, and inspire the reader to see reality anew through the lens of what might be. Crucial to this inspiration is the author's ability to adequately affect a reader, which is perhaps

most blatantly seen in the climate change genre's use of literary apocalypticism. Ecocritical scholars such as Greg Garrard, Eric Otto, and Ursula Heise have discussed the value of the apocalyptic trope to jumpstarting readers' environmental awareness, with Lawrence Buell even suggesting that apocalypse is "the single most powerful master metaphor that the contemporary environmental imagination has at its disposal" (285).²⁰ For Heise, the power of apocalypse is located in readers' abilities to imaginatively engage in the temporal play apocalypticism connotes. The fictional dystopias and utopias that emerge from envisioning catastrophe are valuable in their ability to not only incite ways "of imagining our future but of [also] understanding our present" ("Introduction" 2), thereby urging readers to reflect on the planet with "a sense of environmental values to be defended and work to be done" (Garrard, *Ecocriticism* 116). Visions of apocalypse thus aim to disrupt readerly assumptions of a given, stable reality by prompting reactions to the extremes they portray and illuminating the extent to which affect can "powerfully, if not always predictably," conduct "individuals from information to awareness and ethics" (Houser 7).

According to ecocritical standards, McEwan's *Solar* fails as a work of climate change fiction due to its seeming lack of apocalypse and consequent inability to spark imaginative projection. In the edited collection *Ian McEwan: Contemporary Critical Perspectives* (2008), Garrard's contributive chapter is pithily titled "*Solar*: Apocalypse Not." The curious allusion to Francis Ford Coppola's film *Apocalypse Now* (1979) reveals Garrard's assumption that when McEwan "made it clear in interviews that he was taking up the challenge of responding to [climate change] in fiction" (122), such a challenge would inevitably continue the clear apocalyptic rhetoric that characterizes much of the environmental movement's touchstone works and rallying cries. Rachel Carson's *Silent Spring* (1962), Paul Ehrlich's *The Population Bomb* (1968), Al Gore's

²⁰ See Garrard, *Ecocriticism* (Chapter 5), Heise, *Imagining Extinction* (Chapter 6), and Otto.

Earth in the Balance (1992), Bill McKibben's *Eaarth* (2010), and the activist literature and visual campaigns of, for example, Earth First!, World Wildlife Fund, and Friends of the Earth all include—whether consciously or unconsciously—the apocalyptic trope. In light of Garrard's reaction, *Solar* was seemingly expected to participate in the dystopian play that characterizes the majority of climate change novels. It proved, however, to be a definitive outlier, contrasting starkly against the futuristic settings and apocalyptic scenarios that characterize much of British climate change fiction.²¹

Particularly perplexing for critics is the irreverence Beard shows towards ecological crises and the idea of apocalypse. Narcissistic and money-hungry, at first glance, Beard is undoubtedly a strange protagonist for a climate change novel. While “not wholly skeptical about climate change” (*Solar* 17), he refuses to believe in the future impacts of melting ice caps, rising sea levels, and changing temperatures, attributing such “wild commentary” to society's “deep and constant inclination, enacted over the centuries, to believe that one was always living at the end of days” (18). In short, for Beard, “the absence of any other overwhelming concern” after the Cold War—and apart from “boring, intransigent global poverty”—caused society's “apocalyptic tendency” to conjure climate change as “yet another [doom-heralding] beast” (18). According to Garrard, Beard's grotesque nature, the quintessence of unbridled and Westernized anthropocentrism, overwhelms the novel to such an extent that it problematically fails “to pinpoint the moral failings that contribute to [climate change] in a way that encourages [readers] to rectify them”

²¹ For example: J.G. Ballard's *The Drowned World* (1962) and Maggie Gee's *The Flood* (2004), for example, tell of disastrous world flooding; John Brunner's *The Sheep Look Up* (1975), Patrick Cane's *Sharp North* (2004) and George Marshall's *The Earth Party* (2009) highlight dystopias that emphasize the destructive hegemony of financial interests; David Mitchell's hefty *The Bone Clocks* (2014), and John Burnside's slim *Havergey* (2017) envision the world after complete environmental destruction and societal collapse; and Jeanette Winterson's *The Stone Gods* (2007) and Paul McAuley's *The Quiet War* (2008) both explore the topic of space colonization when catastrophic climate change causes planets to become uninhabitable.

(“Apocalypse” 123). As a result, Adam Trexler comments that *Solar* “refuses to countenance an alternative future” (194). This is perhaps the ultimate crime a work of climate change fiction can commit. A refusal to countenance an alternative future is a refusal to countenance the end to the current capitalist dynamic, which is presumably why Trexler accuses *Solar* of being “complicit in the flattery of its First World, wealthy, overindulgent protagonist” (194). Indeed, as Richard Kerridge writes, the novel’s plot, “doesn’t bring the best out of anybody. No one rises to the occasion” (156), that is, no character plays the part of an environmentally conscious moral bulwark, an exemplar foil to Beard’s narcissism. According to Jason Cowley, *Solar* consequently wallows in its anti-hero’s failings, resulting in a claustrophobic reading experience devoid of “the sense that people other than Beard are present, equally alive, with something to contribute” to climate change discourse (“*Solar*”).

Yet Beard’s very mocking of the apocalyptic tendencies that Garrard, Trexler, Kerridge, and Cowley seek—in other words, of the desired ecological messianism their criticism evokes and its implications of a cataclysm at hand—is itself the narrative’s apocalyptic element. *Solar* offers the reader a vision of apocalypse through Beard’s dismissal of the very notion. His characterization of humanity as unchangingly and cumulatively embroiled in an everlasting neurosis of end times is a chilling vision of disaster. If the idea of apocalypse in climate change literature opens to uncertain futures and potential for change, for Beard, it is nothing more than a symptom of a deep and unshakable delusion: “The end of the world was never pitched in the present, where it could be seen for the fantasy it was, but just around the corner, and when it did not happen, a new issue, a new date, would soon emerge” (18). For Beard, there are no uncertain futures and thus no alternatives for thought to explore and for being to subsequently work to realize. It is this conceptual stagnancy that *Solar* asks its readers to recognize as the ultimate apocalypse.

In their own deconstructive analyses of McEwan's novel, Robert Marzec and Katrin Berndt similarly recognize *Solar*'s purposeful blunting of a sense of futurity. As if in response to Cowley, Marzec indirectly connects an absence of Others to a sociocultural conceptual stagnancy when he observes that Beard's plagiarized plans for a solar energy plant equate to a "fantasy of a Western developmental project based on the economy of neoliberalism" (91), one that happily blinds itself to human and nonhuman dispossession. Nowhere in the novel "do we see a sense either of the ecocritical concern for the exploitation of nature or of the postcolonial concern for the historical exploitation of the marginalized peoples of Western imperial development" (91). Marzec's analysis reveals that *Solar*'s Western-centrism, far from flattering First World powers, critiques "a certain methodological imperative, a pervasive and aggressive unidirectional pattern of overpowering thought" rooted in the securitization of life through technological development (73). Relatedly, Berndt reads the novel as challenging "the belief in the salvational potential of scientific progress" in order to mockingly expose "the self-referential quality of human knowledge and technological advancement" (86). *Solar* is thus not devoid of apocalypse, as Garrard holds, but rather deterritorializes the scene of apocalypse from the sublimity of ecological degradation and reterritorializes it in the conceptual roots of the environmental crises, in a mono-rationality that will be revealed below as a deterrence to temporal reconciliation.

Marzec's observation regarding the missing Other and Berndt's descriptive use of "self-referential" unwittingly evoke what is at stake in a neoliberal hijacking of energy processes. Their readings, which emphasize *Solar*'s intentional lack of materialities—of bodies, resources, and the relations between these that create new knowledges—suggest that economic globalization has severed the human's ability to experience affect as the influence of radical difference on the body. To be affected, is to enter into temporal reconciliation. It implies that the human has made herself

physically and emotionally vulnerable to be acted on by the energetic multiplicities of the world. It implies that she has entered into a natural contract and has there discovered her body as contingency, as a possibility for thought and action that is yet unknown except for the fact that it will be conditional on uncertainties, on unprogrammed material minglings.²² In these moments of encounter, energy is swapped so that life can be physically sustained—such as during the act of eating, when biochemical energy in food is converted into adenosine triphosphate—as well as nourished through affective energies born of experiences with and among others, including the creative energy translated through the writer’s hand and onto the page that will be disseminated to a readership; the concentrated or unbound energy shared by two bodies dancing; the tangible energy of ideas in discussion and debate; energy as passion in moments of protest, revolution, and advocacy; energy as a shared trust between two bodies, human or nonhuman; energy as a force enabling ecologies and as a common denominator among lifeforms.

If affect describes the imbrication of energies resulting from bodies acting upon each other, and thus names an openness to alterity, then the abstraction of energy from materialities can consequently be encapsulated by Bruno Latour’s use of the term “unaffected” in his article “How to Talk About the Body?” (205). For Latour, unaffected is an antonym of the body, and defines a state in which “there is no life to expect apart from the body,” that is, no other force or materiality by which the body can be affected, can be “moved, put into motion by other entities, humans or

²² For more on the body and contingency, see Serres’s discussion of the skin in *The Five Senses* (2018). He writes: “The skin is a variety of contingency: in it, through it, with it, the world and my body touch each other, the feeling and the felt, it defines their common edge. Contingency means common tangency: in it the world and the body intersect and caress each other.... I mix with the world which mixes with me. Skin intervenes between several things in the world and makes them mingle.... Everything meets in contingency, as if everything had a skin. Contingency is the tangency of two or several varieties and reveals their proximity to each other. Water and air border on a thick or thin layer of evaporation, air and water touch in a bed of mist. Earth and water espouse each other in clay and mud, are joined in a bed of silt. The cold from and the hot front slide over each other on a mattress of turbulence” (80-81).

nonhumans” (205). In this state, the subject is rendered “inarticulate,” transformed into one who “always feels, acts and says the same thing” regardless of “whatever the [O]ther says and acts” (210). To articulate is here an enaction of difference. What is being articulated is the force of difference acting on the body, or, to put it otherwise, is the material body as a synthesis of difference, a scene of energetic minglings. The articulate subject is one “who learns to be affected by others,” who registers differences “in new and unexpected ways” and thus articulates difference in a relinquishing of her own materiality to the forces of the world (210). In contrast, difference goes undetected by the inarticulate subject and therefore has no impact on her behavior. Entombing habits of thought, action, reading, seeing, and speaking are continued mindlessly in what amounts to the ousting of the Other from the purview of reality. Returning to one of the central concerns of this chapter, such ousting relegates the Other to the virtual, something that exists but is not actual because it has no effect on how the subject functions in the world.

In the following section, I illustrate how *Solar* is a response of deep dismay to an inarticulate political economy. The apocalypse it offers is a never-ending vision of the current political, economic, and industrial stagnancy, one in which socioeconomic sustainability is nothing more than the reestablishment of the globalized economy in new form. Adaptation to the planet’s rising temperatures is here deemed necessary, yet only until the workings of neoliberalism are no longer sufficiently protected and guaranteed. The continuous scramble for short-term leases on power—political parties in office, for example—and the spurring of rapid profit rates structurally prevent the constitution of an ecological economy with no fixed horizon. Short-termism and speed are intrinsically destructive of all genuine investment, that is, all investment in the uncertain future of planetary life and, by extension, in temporal reconciliation. Genuine investment in the future is

the dedication to keeping time dangerous, and genuine sustainability as a form of genuine investment requires the work, space, and poetics of articulate bodies.

As a realist critique of the political economy's inarticulate investment, *Solar* chooses not to obviously yield to uncertain futures but to instead prompt the reader's reflection on the sociopolitical changes needed for the potential of these futures to come into their own. I posit that *Solar's* portrayal of sustainability—in league with the question of neoliberal economic production—sends the following message: in the attempt to make sustainability easy, we have made it inarticulate and thus trivial. In other words, if sustainable strategies are capitalist driven and rely on the familiar hum of technology rather than profound human behavioral changes, sustainability loses its power as an ethically-based concept and praxis and is incorporated into the economic structure.

Rather than boomerang imaginations into a speculative future, McEwan's novel asks readers to explore the trappings of their current reality, the very space from which imagination departs towards the speculative. While ecocriticism takes as its core subject the movement towards ecological citizenship and the sociopolitical challenges frustrating the establishment of this citizenship, it has yet to consider—in detail, at least—the question of the current political economy's response to climate change and its ontological ramifications.²³ On one hand, this lacuna is a result of there being few climate change novels that focus with *Solar's* detail on the political economy; on the other hand, if the apocalypticism element in fiction is intended to make readers reflect on the defining anthropocentric features of their present in order to overcome them, then readers and critics alike would benefit from analyzing the conditions of these features, which themselves condition the very notion of the time of the present. In this way, *Solar* is not only a

²³ Perhaps with the exception of Lydia Millet's *How the Dead Dream* (2008).

response of dismay to an inarticulate political economy but can also be interpreted as a warning to ecocriticism itself to not to slip towards an inarticulate critique of the Anthropocene by harboring set expectations for the climate change genre.

Inarticulate Sustainability

Engaging with *Solar* as a novel that keeps time dangerous includes interpreting its fictionalization of the inarticulate political economy as a disclosure of the plot's virtual undercurrents. If there are no easily identifiable scenes in the narrative that open to articulate relations, it is because *Solar* would rather ask readers to conceive of how difference might manifest itself in the future than present a prescribed ethical norm to be upheld.²⁴ It would rather structure the process of reading as an engagement with uncertainty and instability, with what its text does not present, and yet with what nevertheless exists in the narrative as potential. Identifying the virtual in *Solar* consequently entails peeling back the inarticulate surface of a scene to explore the ways in which human-environmental relations might evolve, that is, move “*beyond* a given situation or determination” by “playing out...the excess contained within but undeveloped by [the] present situation or determination” (Grosz, *Time Travels* 81). As such, an articulate sustainability is not a question of creating a method of sustainable living that opposes inarticulate sustainability; instead, it names the very potential of the inarticulate to establish new horizons, function otherwise, and thereby realize the possibility for radical difference in being and time.

The virtual contained within the present situation of the actual is that which overflows the limits of, and thus is currently beyond, what the human intellect has mastered: the technical and

²⁴ Ethics itself, in fact, is virtual, something that will never fully exist until the inarticulate force of the present is abandoned and widens to an ontology of becoming, whereupon that the actual itself would uphold the preeminence of uncertain futures. In this case, ethics as a practice or an attitude would disappear and be replaced with becoming as the maximization of difference.

the technological. In *Creative Evolution*, Henri Bergson writes that long “before there was a philosophy and a science, the role of intelligence was already that of manufacturing instruments and guiding the actions of our body on surrounding bodies” (141). Returning to the technicist, neoliberal imaginings that began the introduction to this chapter, the below literary analysis details how the technical and technological work of the political economy has pushed the labor of intelligence to conceptually divorce energy from matter. Just as inarticulate and articulate sustainability are not opposites, neither the technical nor the technological take combative stances against materialities and the energy flows they depend upon. In fact, the third section of this chapter will offer a way of reconciling them through the concept of the virtual. Recognizing this possibility, however, is dependent upon understanding what exactly the virtual diverges from, which I specifically identify as the modern complex of financial investment, characterized here as both the heartbeat of neoliberalism and the well-oiled mechanism that creates the unaffected state of inarticulate sustainability. As the process in which money is put into financial products with the goal of creating profit, investment names a counterintuitive temporality, a self-filiation of money that, as will be seen, contradicts the forward pull of time as the energy patterns of organic life, including the storing and expending of energy for growth, movement, regeneration, and reproduction. Money begets money begets money is a formulation that contorts how time is thought and world processes are perceived.²⁵ In short, investment disarms the dangerous quality

²⁵ Aristotle’s heavy critique of interest in *Politics* can help unpack this claim. Where money was once exchanged as a mediation of human relations through processes of early retail, the mainstreaming of chrematistics—the exchange of money for money, such as in moments of interest and investment—through interest abstracted money from the physical action of exchange. Aristotle described this as an unnatural mode of attaining wealth: “The most hated sort of trade, and with the greatest reason, is usury, which makes a gain out of money itself, and not from the purposes it was meant to serve. For money was intended to be used in exchange, but not to increase at interest. And this term interest, which means the birth of money...is applied to the breeding of money because the offspring...resembles the parent. That is why of all modes of getting wealth this is the most unnatural. (*Politics* I, 11, 1258 b2ff)

of time as durational becoming, as uncertainty, so that the political economy's present conditions of profit may continue unaffected in a time of climate change.

A technologically-oriented conceptualization of sustainability has become a means of stabilizing and maintaining these conditions. *Solar*'s focus on an investment-fed technological production of alternative energy sources here begins to express the virtual by asking readers to identify what is risked in a myopic prioritization of technology as a silver bullet solution to climate change. At stake are ways of knowing and responding to world processes that articulate uncertainty, differentiation, evolution, and the unknown horizons that enable the ability to think the open system of an articulate sustainability.

In *Solar*, an inarticulate sustainability is what I call a politicized sustainability, which describes the process by which sustainability is incorporated into party politicization and becomes susceptible to neoliberal reframing. The novel's first section, entitled "2000," critiques the British government's inability to create a convincing and stable energy discourse by fictionalizing the "lamentable record" of the UK's market-driven energy politics under the prime ministry of Tony Blair (1997-2007) (Harriss-White and Harriss 76). Beard is introduced to the reader as the incompetent first head of the newly constructed National Center for Renewable Energy (NCRE), a government research facility tasked to invent technologies that would improve clean energy

Traditionally, gain derives from the process of economic exchange, making the act of exchange the metaphorical parental figure in Aristotle's familial imagery and gain its offspring. Yet the transformation of economic exchange—the exchange of money for commodities—into chrematistic exchange jumpstarts what Eric Alliez, in his own discussion of the above extract, calls "counternatural filiation" (9). As he writes, if profit is not created through the act of exchange but is self-engendered in some fashion, "doesn't that invert the Just Relation of Generations? Isn't the child giving birth to the procreator?" (9). This disorienting change in the sequential order of events, of product-byproduct, creation-collapse, begetter-begotten, skews temporal reality. No longer is the byproduct connected to an origin; rather, it takes on a generating capacity of its own as a propagator of non-difference, of inarticulacy, with no sense of relation between bodies. Chrematistics is thus a timeless process. The future becomes a "magnetic pole of value" with no connection to a past (12)—the investor is, after all, only interested in the capital that will be—and with a present that can only be described as a sterile state in which there is no growth, unfolding, or bringing forth of difference, only a hovering emptiness that exists as a herald of future gain.

production. Built to “resemble the National Renewable Energy Laboratory in Golden, Colorado” (*Solar* 17), the NCRE shares its sister laboratory’s “aims but not its acreage or funding” (17) – nor, as will be seen, its dedication to problem-solving. In fact, the NCRE seems a rushed project on behalf of the British government. Initially a “sodden twenty-acre field” needing draining, with asbestos-ridden administrative buildings, and laboratories that “had once been to test noxious materials for the building trade” (17), the NCRE is bitingly described as evidence of the extent to which “the Blair government wished to be, or appear to be, practically rather than merely rhetorically engaged with climate change” (19). The jab references the Labour government’s notorious handling of British energy issues. In October 2000, a long three years after the beginning of his ministry and the signing of the Kyoto Protocol, Blair declared the government’s intentions “to push green issues back up the political agenda” and rapidly shift towards mainstreaming renewable energy (Blair qtd. in “Blair Pledges”). Yet throughout his ministry, Blair was roundly criticized for espousing a renewable energy rhetoric that, while attractive, was ultimately devoid of either the capability or the determination to see proposed energy plans transformed into concrete policy. Britain’s energy priorities and the means by which it would reach its stated carbon reduction goals—continuations of the nation’s commitment to the Kyoto—varied vastly throughout Blair’s years in power, throwing the official position of Britain’s stance on renewables into uncertainty.²⁶ While the Labour government’s 2003 Energy White Paper ambitiously strategized that by 2020 Britain would harness 20% of its power from a “wide range of energy

²⁶ This uncertainty was further complicated by conflict between Labour and the Treasury over inaccuracies in the Paper: “In our report on the 2002 Pre-Budget, we concluded that the Government’s Climate Change strategy was seriously off-course and recommended that current progress and future projections should be reviewed as a matter of urgency. The Treasury hit back, claiming that ‘factual inaccuracies’ in the report masked the government’s environmental successes, and that data published shortly after our report was agreed showed a 3.5 per cent fall in UK carbon dioxide emissions in 2002 putting the UK firmly on course to meet climate change targets” (*Select Committee on Environmental Audit Tenth Report*).

sources” (3) —including wave and tidal power technology, local windfarms, photovoltaics, and solar heating, nuclear fusion (18) —its 2007 Energy White Paper saw the focus controversially change from renewables to nuclear under the pretense that wind and solar energy had too many technical problems to quickly reduce grid-based energy demand.²⁷

Solar fictionalizes this lack of technical expertise. In the attempt to procure more funds for the NCRE, Beard, ever money-oriented, suggests that the center create an “eyecatching” renewable energy project “that would be comprehensible to the taxpayer and the media” (27). The result is WUDU, or “Wind turbine for Urban Domestic Use, a gizmo the householder could install on his rooftop to generate enough power to make a significant reduction in his energy bill” (27). While WUDU notably evokes the UK’s recent heavy investment and pioneering advancement in harnessing wind energy, it quickly falls stagnant as Beard’s team encounter difficulties surrounding the construction of “an optimal design for wind-turbine blades in turbulent conditions” (27).²⁸ As the months go on, the project begins to fall apart due to the team’s incapability and lack of initiative: “no one had really addressed the turbulence problem much, and no one was thinking much about what might happen when the wind did not blow, because no one had the first idea about storing electricity cheaply and efficiently” (33-34). Beard, whose “interest in technology was even weaker than his interest in climate science” (27), is described as having “little patience” with the “intricate math and aerodynamics” needed to put WUDU back on track (27). Eventually abandoning the project as a “pointless quest” (34), Beard, in an overt gesture towards Blair’s nuclear ambitions, anthropocentrically muses that it would be far “better to build a boutique nuclear reactor on the Dorset Jurassic Coast than to wreck a million roofs with the...twist and

²⁷ See Wintour and Adam.

²⁸ *Solar* continues to keep parallel with the Blair government here. In 2005, Blair announced plans for £50m from the New Opportunities Fund to support off-shore wind and biomass. See Renewable Energy Association.

torque of some worthless gadget for which the wind was rarely strong enough to motivate a useful current” (34).²⁹ Far better, in other words, to foster a market for investors and a system of sure profit than to work to understand the dynamic of wind energy—that is, to work with and be affected by wind energy—and take the first steps towards an impactful and zero-carbon renewable energy plan for Britain.

Indeed, covertly sitting at the heart of Beard’s daydream is the statement that inarticulate sustainability is perpetuated by the process of investment. Blair’s controversial intentions to forefront nuclear energy solidified popular opinion that he was interested in pursuing alternative energy strategies as add-ons to economic policies and business deals.³⁰ Such assumptions were reinforced by the government’s 2007 White Paper, which plainly stated that nuclear power would not only fast-track ambitious carbon emission cuts but would also be opened to private investment with the aim of creating a market for investors to engage in carbon trading (16).³¹ For Bernard Stiegler, investment is a denial of the imbalance of energies spurring the ecological crises. He consequently writes that “this ‘investment’ is not an investment [at all]: it is on the contrary a *disinvestment*, an abdication which consists in doing no more than *burying one’s head in the sand*” (*Critique* 4). Stiegler writes that the goal of investment policy is to reconstitute modernity’s

²⁹ Beard’s impatience—or inability—in regard to the technoscientific knowledge WUDU requires and his quick mental retreat to nuclear as a more hassle-free energy source echoes what Barbara Harriss-White and Elinor Harriss have identified as an unsettling crisis in Blair-run Britain’s technoscientific knowledge. As the pair argued in 2006, shortly before the end of Blair’s ministry, “The British government has either actively destroyed – or has passively agreed to lose – the in-house technical knowledge base necessary for devising systematic, stable [energy] policy...This knowledge-base and every component of the policy process is being systematically commodified. It has also lost the in-house capacity to devise regulatory infrastructure or ‘management technology’” (84). Harriss-White and Harriss go on to state that wind and solar were politically marginalized by the state’s industrial interests under the poor pretext of being, first, too technologically complex to develop, and, second, too inefficient to rapidly reduce carbon emissions.

³⁰ Conservative leader William Hague, for example, said Blair’s policy was “all talk, no action,” and Democratic leader Charles Kennedy stated that Blair’s speech was “void of any real vision or leadership” (“Blair Pledges”)

³¹ Though the paper’s discussion of energy is notably devoid of cost-benefit analysis, Blair wanted an astonishing 60% emission cuts by 2050. See Ball.

complex of consumerism. As the latter comes to an end, exhausted by the scarcity of natural resources, investment policy enacts consumerism at an elite, industrial, and supranational level as organizations and companies buy and sell nuclear power stocks and carbon credits so that the globalized economy can try, “for as long as possible, to maintain the colossal profits that can be accrued by those capable of exploiting” the opportunities (5).

If consumerism schematizes matter, investment decomposes it. I use decomposition in Elizabeth Grosz’s sense of the term, as a calculated sundering of the things of the world from the cohesive and affective composition that is becoming (*Time Travels* 141). The interconnectivity and flux of planetary relations results from the fluidity of energy flows, which gather organic matter together in an ecological articulacy, in a dynamic system of affect and differentiation and through the play of energy accumulation and discharge. Solar energy, for example, is stored as potential energy in plants through photosynthesis, converted into kinetic energy when planets are ingested by organisms, and then continues to be distributed up the food chain. These energy streams speak to evolution and disclose biodiversity, their currents engendering genetic variability and change; if certain currents cannot be accessed by living things, new ones must subsequently be found and adapted to if life is to continue. Investment renders the world malleable for anthropocentric use by extracting matter from energy flows, reducing the continuous to calculatable, digitized, tradable units so that “the pure difference out of which [things] are cut” is lost (140).

In *Solar*, such extraction becomes a clear denial of energy as a durational, shared, and creative force linking natural systems. When Beard finds himself distractedly thinking of investing in ocean fertilization as a way of cornering the carbon offset market, his financial mapping of phytoplankton occurs under an inarticulate logic that siphons uncertain futures—as the dangerous

element of time—out of the political economic system so that present conditions of profit may continue unaffected:

The idea was to dump many hundreds of tons of iron filings in the ocean, enriching the waters and encouraging the plankton to bloom. As it grew, it absorbed more carbon dioxide from the air. The precise amount could be calculated in order to claim carbon credits, which could be sold on through the scheme to heavy industry. If a coal-burning company bought enough, it could rightfully claim that its operations were carbon-neutral. The idea was to get ahead of the competition before the European markets were fully established. Boats and iron filings needed to be sourced, the proper locations established, and all the legal footwork completed.... Some marine biologists, no doubt with secret plans of their own, had heard rumors of his scheme and had been arguing in the press that interfering with the base of the food chain was dangerous. They needed to be blasted out of the water with some sound science. (218)

Beard's misplaced scoffing at the marine biologists reveals a deep misunderstanding of how life constitutes and is constituted by the rhythms of the planet's energy flows. The closed functioning of his investment scheme within its standards of calculability seems to be under the assumption that the problem of carbon output, and thus its solution, is itself a closed issue, able to be understood, anticipated, technically schematized, and duly addressed with no ramifications to the wider world. The phytoplankton are here imagined as a stand-alone technology, their hungry bodies vehicles of production that, as a whole, become a prosthetic extension or rendering of the arm of the Anthropocene's industrial empire. Programmed into terms of investment and

conceptually isolated from the larger ocean ecosystem, they are forgotten as bodies, energy conductors, and food sources.

The result is a lack of affective relations between materialities, which, within the energy-matter framework of this chapter, chillingly refers to a complete absence of bodies—as the affectable structures of things—altogether. Beard’s actualizing of artificial photosynthesis, for example, is a direct perversion of the vital, natural energy crucial for the continuation of life into a mechanical energy that no longer finds its regulating principle in the becoming that is the ecological economy. This technological usurpation of a physical process “perfected by evolution during three billion years of trial and error” amounts to a direct severing of energy from matter (119). Indeed, the novel describes the process as “*taken* from the lives of plants” (*Solar* 119, added emphasis), with photosynthesis being mimicked in a technological combining “of carbon dioxide from the atmosphere with sunlight and water to make an all-purpose liquid fuel” (199). Ultimately, and in another distracted daydream, Beard envisions this transformed into a technological process spreading out, tentacular-like, across the face of the earth. Energy itself would be disembodied, decomposed from material interconnections by the technical and technological, and regulated by industry and investment:

One day, glass panels angled at the sun, packed with coiled transparent tubes, would cover the grasslands in a shining sea, making hydrogen and oxygen out of light and water for virtually nothing. Compressors would store the hydrogen in massive tanks.

Oxygen and hydrogen would recombine to drive the fuel-cell generators. (218)

The workings of the world here become predictable, and consequently can take part in, and, more specifically, not pose resistance to, what Max Weber calls the Western market’s “rationalization of capitalistic calculation” by hijacking the planet’s carbon cycle (xxxiii). The programed

investment of inarticulate sustainability links this chapter's abstract environmental concerns, that is, the manipulation of matter in manners that frustrate temporal reconciliation, to social justice concerns in contemporary politics. The disembodied thought that results from peeling energy away from materiality means that there can be no ethics.

Neoliberalism's hijacking of the energies of the world through inarticulate sustainability unsurprisingly projects sociopolitical consequences. When Beard delivers the keynote speech at an energy conference, where he pitches his solar energy plans to a room of oil, gas, coal, and timber investors, he prepares to persuade them that, first, "what they currently made profitable would one day destroy them" (139), and, second, that mainstreaming artificial photosynthesis would be a highly logical answer to the following question: "How do we slow down and stop while sustaining our civilization and continuing to bring millions out of poverty?" (172). Beard stoutly states that responses to the ecological crises must move "beyond virtue," to "the ordinary compulsions of self-interest...[and] the satisfaction of profit" (173). Virtue, apparently, has an operative limit and is therefore an inadequate driver of sustainable progress. Indeed, Beard declares it a "weak" motivating force at the level of groups, societies, and nations: "For humanity en masse, greed trumps virtue" (172). However, this does not occlude an ethics, but only signals its redefinition. As Beard announces towards the end of his speech, "I spoke of poverty at the start – some of the poorest countries in the world are solar-rich. We could help them by buying their megawatts" (178). Here, under the politicization of sustainability, the definition of equity and ethics are corrupted. The wellbeing of the disadvantaged is no longer a concern in and of itself but rather a delightful monetary bonus accompanying the production and appropriation of capital. The result is the mathematization of forms of justice—environmental, climate change, distributive, or otherwise—

by the politicization of sustainability.³² Ethics, ecology, and economy are thus underlined by and find common measure in the mechanics of utility and self-interest that characterize the modern market. Inarticulate sustainability consequently contributes to a long genealogy of enlightenment rationality and its principle of commensurability, under which matter becomes controlled through standards of calculability that strip it bear of mystery and uncertainty.

As a climate change novel, *Solar* asks its readers to acknowledge that the processes and methods by which we develop and negotiate sustainability, political, and ethical issues are intimately connected to the relation between, or to the disconnect of, life and knowledge. Generally latent within Beard's sustainability schemes and the sociopolitical structures that condition them is an articulate sustainability that keeps time dangerous, in which human bodies, thoughts, actions, and modes of production are saturated with the energies of the natural world. *Solar*'s fore-fronting of technology and investment as primary responses to climate change—and the resulting decomposition of the world into capitalistic calculation—suggests that temporal reconciliation between human and ecological systems includes placing the technical and the technological in conversation with the uncertainty of a future in which humans co-exist with, rather than regulate, the planet. More precisely, the novel suggests that temporal reconciliation is a question of thinking technological invention and application as part of evolution, of that headlong movement into the flux of difference wherein the virtual moves from shimmering potential to a very real possibility. One of the challenges in thinking and planning a sustainable future is reformulating technology so that it might contribute to rendering the human immanent in rather than extraneous to her environment. For Elizabeth Grosz, this would include that the means and ends of technology

³² The “mathematization of justice” has been adopted from Wai Chee Dimock's discussion of justice in *Residues of Justice* (144). Dimock's use of the phrase is embedded in a discussion of justice as a moment of equalization based in arithmetical proportion. However, when adopted for the context of this chapter, the phrase forefronts the mathematization, or monetization, of justice.

acknowledge a “forgotten debt” to the materialities of the world for being the ultimate provokers, cultivators, and inspirers of knowledge (*Time Travels* 5). It would include deterritorializing the practices of knowledge-production from the modern spirit of calculation and reterritorializing them amidst the energy play of materialities to give thought and technology genuine meaning. Rather than be what Husserl called “a mere art of achieving results...through technical rules” (46), the technical and the technological would be a form of human participation in the world.

The reformulation of technology into an acknowledgement of and form of participation amongst materialities is the first of the two specific latencies I identify in *Solar*. I describe this reformulation as a technological ethic and in the following section momentarily depart from the novel to compose a vision of this ethic before considering how it opens to sexual difference, which comprises *Solar*’s second virtuality. Before doing so, however, I want to make preliminary connections between *Solar*’s treatment of sustainable technology, its portrayal of women, and Luce Irigaray’s concept of sexual difference, which will help emphasize the import of a technological ethic. *Solar* profiles the human-nonhuman temporal crisis through a social crisis evidenced in Beard’s sexist treatment of women, which the narrative voice neither praises nor condemns. As feminist philosophers have argued, the way that we treat the earth is inherently bound with the way that we treat each other, particularly the differences between sexes. So far, the novel’s sexism, while commented upon, has managed to escape the critical attention of scholars and critics. Perhaps this is because analyzing the feminine in *Solar* is equally as frustrating as attempting to excavate from its pages an image of an articulate sustainability. *Solar*’s female characters are subject to Beard’s sexism, vulgar masculine fantasies, and his infidelity. They are “talked into” terminating pregnancies (200), have their sexuality deemed irrational, have their “women’s ways” of knowing the world “treated dismissively” (240), and, in general, are abstracted

into figures of desire in the “realm of sensation” rather than knowing subjects in the real world (194). Yet the fact that every female character is subject-less in herself, appearing exclusively in sexual relation to Beard—either as a sexual fantasy, fetish, potential consequent, or past or present partner—suggests a very deliberate imaging of the woman. McEwan’s reinforcement of woman’s historical position as nothing more than a lack, compliment, or sexual accessory to man illuminates that which is in existence as a virtuality but has yet to be actualized in the social sphere: the acknowledgement of woman herself as a human subject beyond patriarchal containment.

As Irigaray argues in *An Ethics of Sexual Difference* (1993), despite the ongoing feminist movement(s), sexual difference has yet to take place. Irigaray’s feminist thought leaves the sphere of the present for the beyond. Deviating from feminist explorations of the phenomenology of sexual difference, which have been concerned with the experience of living as a woman in a patriarchal society, Irigaray considers the materiality or ontological weight of sexual difference, including its residence in time and space. For Irigaray, sexual difference is crucially an ontological difference, not a different way of living in or experiencing the world, but a different way of being, in which the only relation to man is one of radical otherness. According to Irigaray, there has never been a historical space in which the female sex has been given a proper existence uncontained from her relation to man as his sexual counterpart. Irigaray’s ethics of sexual difference is a complete rethinking of the ontological category of women, in which women are not given equality to men but are given their own time and space far beyond the masculine time and space that has currently characterized history. For Irigaray, this requires that woman find herself within man’s history by looking for moments of sexual injustice in the past still unacknowledged by the present:

I [as a woman] ought to reconstitute myself on the basis of a disassimilation.... Rise again from the traces of a culture, of works already produced by the other.

Searching through what is in them—for what is not there... Woman ought to be able to find herself, among other things, through the images of herself already deposited in history and the conditions of production of the work of man, and not only the basis of his work, his genealogy. (9-10)

When found, these moments disrupt the present as virtualities acting upon the actual. Time here becomes privileged as the repressed, feminized condition of the world, looked for in the injustices of the past in order to weave a future that is undeterminable specifically because there is no patriarchy, no governing norm, but only difference.

Irigaray's virtual feminine is a timely concept in the context of an androcentric, sustainability and political economy. As *Solar* illustrates, neoliberal imaginings of a relatively painless technological "fix" to climate change bring forth the image of what feminist and media scholar Joanna Zylinska identifies as a chilling new ontological dimension wholly unique to the Anthropocene, "a temporarily wounded yet ultimately redeemed Man who can conquer time and space by rising above the geological mess he has created" (15).³³ This notion of survival through transcendence—insofar as survival is here the maintenance of sovereignty through masculinist, technicist solutions—has caused minority and feminist theorists to claim that gendered Man has been "elevated back to the center point of both investigation and action" (16). Claire Colebrook has resultantly and ominously observed that after "years of theory that contested every naturalization of what was ultimately historical and political, 'man' has returned" (89).³⁴ A

³³ Zylinska does not talk about the ontology in connection with neoliberalism and the political economy, as I do here, but instead heavily critiques imaginings of a climate change techno-fix as androcentric while evincing its emergence and existence in a broad set of cultural scripts, including scientist and science writers' approach to communicating climate change.

³⁴ In his famous "The Climate of History: Four Theses," Dipesh Chakrabarty claims that "certain scientific propositions" in relation to climate change have transformative "implications for how we think about human history" that challenges "analytic strategies that postcolonial and postimperial historians have deployed in the last two decades in response to the postwar scenario of decolonization and globalization"

technological ethic, in contrast, shifts the human perspective from transcendence to humility by troubling an inarticulate sustainability with a way of thinking technological production that includes Irigaray's sexual difference.

The Technological Ethic

The task of the feminine and the task of sustainability are the same: "to go on living and creating worlds" through ontological uncertainty (Irigaray, *Ethics* 127). In this section, I explore how these two virtualities interact with and enrich each other in ways that urge the human to think of herself "more complexly and less clearly" in relation to the following challenge climate change issues (Grosz, *Time Travels* 175): *evolve, like the materiality that you are*. As will be seen, when taken together, sustainability and an Irigarayan sexual difference complicate the notion of temporal reconciliation. Keeping time dangerous is not simply a question of acknowledging that Beard's geoengineering methods synthesize and disturb the planet's natural cycles, nor is it a subsequent agreement that a less mechanical management of the ecological crises can be achieved. Keeping time dangerous is instead what Serres calls casting-off, a self-initiated process that deterritorializes the subject from the transcendence of the Anthropocene and renders her imminent in—that is, vulnerable and exposed to, as well as in dialogue with—the world. My notion of a technological ethic brings sustainability and sexual difference together under the process of evolution. While this evolution begins from the space of technology to clearly present itself as that which diverges from the hijacking, technological spirit of *Solar*'s inarticulate sustainability, the "technological"

(198). Kathryn Yusoff makes this the departure point for her *A Billion Black Anthropocenes Or None*, where she points out how a discourse of the Anthropocene and its origins cohere exclusively around Whiteness: "it was the question of the very Whiteness of geology itself as a material practice that snagged for me" (17). Her book is a project to write "toward a darker Anthropocene" by via their "interlinked material and conceptual architectures of slavery and industrialization and their interlocutors, humanism and race, to argue that geologic origin stories function as identity politics that coheres around an exclusive notion of humanity (coded white)" (24).

aspect of the ethic quickly widens to refer to instances of disclosure, of producing, of bringing forth, moments in which sexual difference and sustainability are tightly woven and the human newly conceptualized through ontological uncertainty.

The technological ethic contextualizes technology within evolutionary flux. My understanding of a technological ethic develops from Bernard Stiegler's discussion of pre-capitalist states of innovation in *The Fault of Epimetheus* (1998), the first volume of his series *Technics and Time*, where he describes the act of technological innovation as once having been intricately entwined with the patterns of human and ecological systems. Quoting André Leroi-Gourhan, Stiegler relates technological evolution to zoological evolution by conceptualizing a genealogy of tools that ultimately stresses the influence of environmental factors on technological-creation:

Everything seems to happen as if an ideal prototype of fish or of knapped flint developed along preconceivable lines from the fish to the amphibian, to the reptile, to the mammal, or to the bird, from form-undifferentiated flint to the polished knapped tool, to the brass knife, to the steel sword. This should not lead us into error: these lines render only an aspect of life, that of the inevitably and limited choice that the milieu proposes to living matter. (qtd. in Stiegler 45)

Flint, knapped tool, knife, and sword each exemplify a coupling of human ingenuity and matter's unique materiality by the contextual qualities of the inventor's surrounding environment, such as the types of resources available to her. Pre-modern technological progression, in other words, expresses the relation between the human and her environment, and thus emerges from the temporal rhythms and energies of natural processes. The concept of invention as a human practice delineated not by industrial-economic incentives but by the materialities of the inventor's

immediate environment offers the contemporary engineer an ethic of technological praxis informed by ecological. As Aldo Leopold famously wrote in his *A Sand County Almanac* (1966), an ethic, “ecologically, is a limitation on freedom of action in the struggle for existence” (238). A technological ethic would therefore encapsulate the practice of innovation and the continuance of technological evolution insofar as this continuance was accompanied by an acknowledgement and understanding of the limitations imposed on human action by climate and ecological tipping points.

The value of a technological ethic thus resides in its initiation of a two-fold disclosure. As a form of production, technology is a way of revealing. It is that which presents—or presences—something, bringing it forth into appearance from where it was once concealed. As Heidegger famously explains in his essay, “The Question Concerning Technology,” this occasioning, or unconcealment, is a moment that serves less as a synonym of creation than as a reference to a type of partnership that arises between that which occasions and that which is occasioned. Heidegger refers to the example of a smith, who does not forge a chalice but rather assists the idea of a chalice out of silver with her tools. She makes the chalice appear by bringing it forth as a potentiality residing within the metal, as opposed to understanding her actions as nothing more than the manipulating of metal into determined thinghood. In a technological ethic, this relation between the human, her tools, and the occasioned product expresses a larger relation between the human and her environment. The disclosure of the product is itself the disclosure of the environment. It brings forth in the innovator an awareness of the materials at hand and the ecology in which these materials are couched, thereby keeping the state of the environment at the forefront of technological thought and production. As Heidegger writes, “the energy concealed in nature is unlocked, what is unlocked is transformed, what is transformed is stored up, what is stored up is, in turn, distributed, and what is distributed is switched about ever anew... The revealing reveals to

itself is own manifoldly interlocking paths, through regulating their course” (16). The moment of disclosure maintains an awareness of evolution as that the zoological evolution of the environment and as a continuous movement of the human and knowledge-production beyond the stockpiling and regulation of energy. Evolutionary paths here remain open, free from order and regulation.

A technological ethic is beyond method. It is primarily an ontology, a way of existing within and through the world according to an ever-evolving matter-energy matrix. Only by extension does it describe a mode of producing, conceiving, and imagining technical and technology processes as evocations of temporal reconciliation and sustainable living. In fact, to think of a technological ethic as anything other than ontology is to render it trivial as a theory or utopic idealization that might circulate in environmental or climate change discourse but that has no real chance of emerging into reality through human action, where it would reformulate culture to correspond to and enable the growth and unfolding of all life. Such reformulation has begun to emerge at the micropolitical level in the United Kingdom, where a technological ethic has appeared in small “energy cultures” (Butler et al. 122), communities that have reorganized themselves to locally produce renewable energy and challenge dominant energy security framings. In 2008, for example, the residents of Scotland’s Isle of Eigg commissioned a community-inspired and community-owned hydroelectrification scheme to replace the individual diesel generators that served as their previous sources of power with small wind generators and photovoltaic panels.³⁵ Additionally, recent community land trust, ecovillage and co-housing projects, such as the 2013 Lilac project in Leeds, England, have begun to reconfigure local infrastructure and energy needs with cohousing projects that foreground “environmental concerns with mutualism, economic

³⁵ See Butler et al.

equality and deliberative decision making” (Chatterton 1655).³⁶ Rob Hopkins’ Transition Movement, perhaps the most rapidly growing post-carbon movement worldwide, adheres to a similar ethos. Referencing the transition between a carbon and post-carbon lifestyle, it describes “an emerging and evolving approach to community-level sustainability” through the practice of localization, or the action taken by a community to shorten the distance between production and consumption (Hopkins 136). In these examples, a technological ethic is a reconceptualization of the technical and technological as concern for the human and the environment. Unlike in *Solar*, the latter is not subordinated to the former; sustainability is not implemented for the continuance of an energy security that would allow for a business-as-usual scenario. Rather, a technological ethic is the realization—and the subsequent living of life in awareness of—the connection between human and non-human struggles. It names a politics of human and non-human relations (that is notably spontaneous, that is not activism or personal consciousness change but a direct seizing of the virtual and a dragging it into the present).

A technological ethic describes an ecological politics over an environmental ethics. It names the engagement or interaction of human and nonhuman materialities through the play of disclosures and concealments, through a pure system of relations in which there is no place for the emergence of injustice because the human is immanent in, rather than transcendent to, natural resources and their energy flows. In this way, a technological ethic’s disclosure of the environment

³⁶ Founder Paul Chatterton describes Lilac—Low Impact Living Affordable Community—as a “20-home scheme, based around a central common house” (1658), which includes a communal kitchen and dining house (1658). According to Chatterton, all houses are owned by their residents, making Lilac a mutual co-ownership initiative that accentuates “economic equality among residents, permanent affordability, demarketization, nonspeculation and mutual coownership” (1662). Numbering 44 people as of mid-2012, the Lilac members are a tightly-knit community who share meals twice a week, share objects such as washing machines, lawnmowers and cars, and grow food on community allotments. Such an extension of the concept of the commons is typical of co-housing projects and emphasizes the extent to which initiatives such as Lilac are valuable social innovations in their efforts to restructure the social institutions of housing.

simultaneously becomes a disclosure of the human to herself as a life within the ecological dynamic. She realizes herself not as an exceptionalism but as a specific materiality that relates to others through her material composition, through her body as an organism that lives in relation to other organisms. For Irigaray, this would mean that the human no longer considers herself a “neuter individual” but finally celebrates her sexual identity as part of her materiality (“Starting from Ourselves” 103). In the short essay, “Starting from Ourselves as Living Beings,” Irigaray claims that behaving in an “ecological way” includes acknowledging sexual difference as the “first biodiversity that we must take into account” (103). In other words, sexual difference conditions the human’s ability to situate herself in the ecological economy. More precisely, it introduces the human to the concept of multiplicity, alterity, and radical difference by disclosing other ways of being in the world and yet keeping these veiled, initiating the understanding that they cannot be revealed or fully understood but only lived amongst and interacted with. A recognition of biological multiplicity precedes a recognition of ecological multiplicity insofar as it initiates a realization within the human that she “cannot represent the entire world because [she] embodies only a part of the world” (103). As Irigaray writes, “The particularity of sexual individuation entails respect for the other part of the individuation of the species, which forms with it the living environment of this species” (103), only then can the human even begin to imagine herself as part of a larger ecological relation. Understanding the self from the standpoint of biological situatedness thus triggers the transition from transcendence to immanence.

Irigaray’s first biodiversity prompts readers to consider whether there is something missing from mainstream understandings of sustainability, which perhaps focus on social-ecological relations at the risk of remaining ignorant of the crisis of sexual difference internal to the social. Indeed, despite how forward thinking the sustainability strategies that seek to break from the

models and practices of the current capitalist framework, the human is often characterized as a singular entity that must be put into relation with a larger ecological whole. Ecological economists Fikret Berkes and Carl Folke, for example, whose work is a careful and conscientious movement to conserve human and ecological diversity while also emphasizing the need for resource management practices to result from ethical social-ecological relations between a resource user, whether an individual or institution, and the resource itself. Inherent in this idea is the realization that such a shift would instigate and be accompanied by a change in social organization that triggers a radically different practice-based approach to the environment. Rich and varied scholarship emerging from the social sciences over the past twenty years have traced the emergence of myriad post-carbon grassroots initiatives determined to reorganize social life around a commons system where participants create cultures of “stewardship and co-responsibility for commons resources while at the same time defending [their] livelihoods” (Bollier and Helfrich xv).³⁷ However, to Irigaray scholars, this valuable movement towards co-existence is counter to the tenets of an ethics of sexual difference. Grosz, whose own scholarship is deeply influenced by Irigaray, writes that she disassociates herself with environmentalism and ecofeminism because the ecological models they emphasize present nature as a closed system whose equilibrium must be maintained to ensure its “cohesive and totalized structure, which is unified and all-encompassing, and which thus contains a normative force of unification and balance” (*Time Travels* 220n4). For Grosz, anxiety regarding the maintenance of present environmental conditions preclude an ontology of becoming, “whose central concern is the re-elaboration of time and space, in which time is privileged as a repressed or feminized condition of the world” (178). As she writes, “If an ecology that values not only the living—the present—but also the future could be possible... [it

³⁷ See, for example, Walker and Salt, Ostrom, and Chapter Two in Marzec’s *Militarizing the Environment*.

would be one] which mourns no particular extinction and which waits, with surprise, to see what takes the place of the extinct” (221n4).

Yet much of contemporary environmental thought in the humanities does not mourn extinction and environmental degradation in and of themselves but as the result of modalities of patriarchal oppression. Sustainability is valued as the possibility of a future in which environmental change occurs on its own accord, unmolested by ideologies of mastery and the effects of capital, industry, and technoscience. In the environmental humanities, sustainability is a vision of the future in which social, economic, and political relations are embedded in the natural evolution of materialities. Indeed, these movements seek to ground subjects and societies not in the static preservation of environmental conditions but in an acknowledgement that life is an ongoing negotiation between basic human needs and the state of global ecologies. Ecology does not equate to a flat equilibrium but rather a continual negotiating of thresholds concerned with the right of life as a process and the flow of forces, what Serres calls “the free movement of living beings” (*Physics* 3).

Sexual difference is similarly fluid and interested in pluralities. Grosz writes, sexual difference is “not enumerable, countable, and...the distinction between one organ, or orgasm, and another is always artificial or imposed from without” (*Nick of Time* 287n9). Furthermore, in a culture that acknowledged sexual difference, sexual difference itself would not be limited to the number two, to *man* and *woman*, but would itself remain a multiplicitous, fluid, virtuality, that because of its acknowledgement would more easily, or perhaps continuously, rupture the actual and thus would repeatedly redefine the sexual beings of man and woman. If sustainability describes the action of keeping time dangerous by cultivating the evolution, or continuous variation, of material and energetic processes, then it would seem that such an act would find its source in the

cultural acknowledgement of first biodiversity. The possibility for an ecological economy consequently seems to lie “in the faithfulness to our sexual belonging as a predisposition and a framework, starting from which we can work out our culture and our relations with ourselves, with the world, and with the other(s)” (Irigaray, “Starting from Ourselves” 103). For Irigaray, then the division between nature and culture is attributable to a human culture that cannot think, speak, or live out biological inheritance.

I interpret McEwan’s *Solar* as heavily echoing Irigaray’s position in “Starting from Ourselves,” and in the following section illustrate the novel’s critique of a sexual indifferent culture by identifying its implicit yielding to the virtual feminine. *Solar* asks its readers to acknowledge the climate and ecological crises as originating in a crisis of sexual difference. Rather than inspire its readers to reflect on their own lifestyles and become faithful to an ecological ethic—as its critics seemingly expected—*Solar* asks readers to find within its pages the challenge it issues to conceptual systems that refuse to acknowledge their own limitations and interests. Its lack of an ecological ethic and portrayals of feminist strength are not coincidences, but intertwined lacunae that the reader is urged to acknowledge in order to subsequently develop conceptual schemas and frameworks that reveal the problem of climate change in its ontological complexity. *Solar* asks readers to think about how the climate crises originated through containments of human identity by patriarchal structures and the extent to which contemporary discussions of sustainability rethink, or even notice, this containment. Far more than a tragically realistic funhouse mirror that reflects the Anthropocene’s qualities in the androcentric excess of Beard’s character, *Solar* seeks to undermine the cultural legitimacy of modes of gender representation that Beard’s very excess serves to uphold.

The Virtual Feminine

As it calls attention to the virtual feminine, *Solar* asks for readers to consider how sexual indifference effects cultural structures and threatens the functioning of an inarticulate sustainability. Halfway through the novel, Beard finds himself appointed the “titular head” of “Physics U.K.” (149; 153), “a government scheme” steered by the Institute of Physics “to promote physics in schools and universities” and to generally “make intellectual heroes out of physicists” (149). Though communicated in the dry wit that characterizes *Solar*’s narrative tone, the last goal can be interpreted as the desire for the continuation, even an augmentation, of the masculine imaginaries, methodologies, and subjectivities that have traditionally constituted scientific theory and governed its practice. In fact, it soon becomes evident that Physics U.K. automatically presumes prospective physics students and, by extension, future intellectual heroes to be male. The outreach program itself, for example, is revealed as entrenched in a patriarchal organizational culture when Nancy Temple, a professor of science studies and member of the Physics U.K. committee, observes at the first committee meeting that “she was the only woman in the room and that the committee reflected one of the very problems it might want to address” (151). On the surface, such textual moments posit the need for an evaluation of the history of physics, including an account of the social and rhetorical dynamics that have contributed to sustaining its historic preeminence as one of “the most powerful agent[s] of change to come out of the entire corpus of scientific knowledge” (Keller 76). However, as a climate change novel, *Solar* is more interested in constructing a socio-historical, as opposed to simply disciplinary, critique. Physics is a symbolic and strategic vehicle with which McEwan illustrates the patriarchies that undergird sustainability endeavors at the governmental and national level. His association of the fictive Physics U.K. with the nonfictive Institute of Physics and, later, London’s historic Royal Society, suggests that the goal of making intellectual—and thereby cultural—heroes out of physicists illustrates a social-wide entrenchment of the

dereliction of the feminine, revealing Beard's misogyny to be a social norm. Earlier in the novel, a physics-based intellectual heroism is even recognized by the arts. When Beard accompanies "twenty artists and scientists concerned with climate change" to the Arctic to witness the melting glaciers (53), an "impassioned statement" one evening from an installation artist named Stella Polkinghorne reveals an implicit acceptance of physics' disciplinary predominance in sustainability endeavors and an unquestioned lauding of the physicist-as-intellectual-hero. Presumably praising Beard's work at NCRE to combat climate change, "She said that Beard was the only one here doing something 'real' at which the whole room warmed to him and applauded loudly" (87). More disturbing than her smooth denigration of her own work and, more generally, of the non-scientific disciplines is Polkinghorne's denigration of her own sex. Her gender makes her comment and its acceptance particularly disconcerting, especially when reflected upon in light of Beard's "unexamined belief in the importance of his work, in his objectivity, and in rationality itself" (240), which, according to his first wife, Maisie, causes him to "dismissively" treat "women's ways" of "knowing the world" (240). When interpreted in conjunction with an Irigarian lens, such scenes and comments become strategic mechanisms that continuously prompt readers to read past the surface of the text to the virtual feminine.

Polkinghorne and her companions are not the only characters to emphasize a widespread norming of a sexual indifference to the feminine. When the Physics U.K. committee attends a press launch at London's Royal Society, Beard is asked by a female journalist the "routine" question of women's underrepresentation in physics (153). His offensive answer, quoted at length below, is not initially registered by his audience:

It was true, women were underrepresented in physics and always had been. The problem had often been discussed, and...his committee would be looking at it again

to see if there were new ways of encouraging more girls into the subject. He believed there were no longer any institutional barriers or prejudices...he added that it might have to be accepted one day that a ceiling had been reached...There was a consensus in cognitive psychology, based on a wide range of experimental work, that in statistical terms the brains of men and women were significantly different. This was emphatically not a question of gender superiority, nor was it a matter of social conditioning, though of course it played a reinforcing role. These were widely observed innate differences in cognitive ability...from early on in life, girls tended to be more interested in people, boys more in things and abstract rules. And this difference showed in the fields of science they tended to choose: more women in the life sciences and the social sciences, more men in engineering and physics...Beard pressed on toward his conclusion. There was surely much to be done to get more women into physics and to make them feel welcome there. But in one possible future, it might be a waste of effort to strive for parity when there were other branches of study that women preferred. (153-54)

More notable than Beard's sexism, which is unsurprising at this point in the novel, is the apathy that permeates his audience: "The journalist who had asked the question was nodding numbly. Behind her, someone else was starting to ask an unrelated question" (155). Described as "slumped over their recorders and notebooks," the journalists in attendance are seemingly "depressed by the seriousness of their assignment, its scandalous lack of controversy. The whole project was lamentably worthy" (153). Though an easy sentence to overlook, once considered from the standpoint of Irigaray's thought, this once again attests to *Solar*'s devious, tongue-in-cheek style and its attempt to actively engage a reading of an ethics of sexual difference.

Far from being lamentably worthy, the project, as represented by Beard, is simply lamentable. Beard's discussion of sexual difference, and his audience's blind acceptance of it, is an affirmation of sexual indifference. This is not an exclusion of the feminine as an Other from science, an issue that can be rectified by the creation of a more inclusive science; rather, it is the complete removal of the feminine by what Irigaray calls the male-issued universality of the neuter, or a sexual indifference that erases difference while upholding androcentric centrality. As Irigaray writes, "the self-proclaimed universal is the equivalent of an idiolect of men, a masculine imaginary, a sexed word" (*Ethics* 121). Temple's reaction to what Beard thought was an appropriately neutral answer alerts both readers and the bored journalists that something else is going on, something decisively non-neuter:

The morning would have passed into oblivion like any other had not at that moment the professor of science studies suddenly stood...and announced to the room, "Before I go out to be sick, and I mean violently sick because of what I've just heard, I wish to announce my resignation from Professor Beard's committee."...[T]he journalists leapt to their feet. Professionally engaged at last, delighted, desperate, competitive, they hurried after her. (155)

Throughout *Solar* the media is complicit in the exacerbation of the neuter. Beard's sexism is a narrative tool for McEwan to fictionalize the contemporary dereliction of the feminine as something deeply ingrained in current society. Despite the scathing headlines that initially stalk Beard after the Physics U.K. press conference—"Nobel Prof Says No to Lab Chicks" and "'neo-Nazi' professor (157; 158)—that he fears will "mark him for years" (166), overnight "he was airbrushed from the public prints" to make way for a new public outrage (166). Sinecures, previously removed by institutions and organizations who wished to distance themselves from the

scandal, came flooding back in what the novel identifies as self-centered moves to add Beard's impressive title to their faculty listings: "How magnanimous was public life, and how well did the luster of a Nobel laureate reflect upon an academy and oil the wheels of grand acquisition!" (166-67).

Yet the feminine in *Solar* nevertheless mounts a messy, uncontrollable threat to the order of Beard's life and the clean inarticulacy of his sustainability-touting, money-making plans. When Beard learns that his girlfriend, Melissa, is pregnant with a baby girl, which she names Catriona, his registration of the news is described as the noise of "biology and fate" clicking "into alignment like a steel bolt" (200). Despite Melissa's longing for a child, Beard privately decides to continue to be free of the responsibility of children: "Allowing himself to be Melissa's one success would be a proper mark of distinction, but he did not think he was up to the job. He thought he too would cheat her of a child" (185). Melissa, however, takes matters into her own hands, and in a quiet assertion of her own body as a materiality beyond male governance, purposefully neglects her contraceptive pill. As she calmly tells Beard, if she had not been "selfish" in this particular act, the opportunity to have a child would have slipped by: "If I did nothing, I'd be at the menopause [*sic*]. And that would be the quiet choice you would have forced on me" (205). Her directness is one of the few moments in *Solar* in which the virtual feminine comes to the novel's fore as opposed to remaining a presence intuited in Beard's sexual indifference. It is a way in which Melissa exerts her corporeal identity as a place other than a vessel in which Beard can locate himself as a sexual partner and dominant force. According to Irigaray, for woman to fully come into her sexual difference she must exert this identity and envelop herself in the new, uncharted ontological scapes it opens.

For Beard, Melissa's decision, what he calls a "contraceptive deceit" (206), launches his future into a space of wild uncertainty. His response evokes Jean-Jacques Rousseau's proclamation in *Politics and the Arts* (1960) that the smooth running of the state is jeopardized by "the disorder of women" (109), whose sexual desires, biological inclinations, and devotion to the family prompt male subordination of the public to private interest, thereby threatening the efficient and ethical continuance of public life and politics—and, in the case of *Solar*, inarticulate sustainability. According to Rousseau, women as individuals are unable to develop a sense of a morality of order because the virtue of love, the bedrock of family life, is antagonistic to the virtue of public justice in its intense focus on the private family nucleus, which draws focus away from civil society and the public good.

In a similar way, Melissa's pregnancy disrupts Beard's rigid understanding of his structured future and its successes, seen in the way that he creates an uncomfortable antagonism between the child and his artificial photosynthesis plans. As the couple sit down to dinner after the momentous news, Beard shares with Melissa his work on the solar energy scheme, "talking to put distance between himself and the baby, to replace it in her thoughts with his own ideas, his own baby" (208), as if to erase the very concept of the human child in its entirety. Later, recognizing that he will be unable to talk Melissa into an abortion, as he had previously done with his other partners, he becomes determined—though to no avail, as readers discover—to put a stop to the baby's birth: "He knew it in his gut: it could not happen, this child could not be, he would not permit it, this homunculus must retreat to the realm of pure thought" (215). In yet another evocation of Rousseau, Beard attributes Melissa's desire to keep the child to the workings of female biology. He imagines that in her newly pregnant state her brain was "soused in optimistic hormones, one of evolution's tricks for getting this child past the first post" (207). Determined not to let the events

of the future jeopardize his full attention to his investment opportunities, he counters the uncertain future the baby represents by ruminating on the carbon sequestration scheme, a scheme whose future is, for Beard, blessedly certain and straightforward: “The iron-filing scheme reminded him of all that was purposeful and decent, and that he must not let himself be dragged down” (218). Indeed, his unborn daughter embodies—quite literally, through her own becoming-body in the womb—the evolutionary processes at the heart of temporal reconciliation, and by troubling the neoliberal patterns that structure Beard’s reality disturbs deep-rooted repressions of concepts of femininity in sociocultural existence.

As material evidence of Melissa’s decision to free her body back from the reigning patriarchy, the baby signals sexual difference as “a mode of passage or transition to the future” that provokes a fecundity beyond the reproductive capabilities of the body to forms of practice and innovation (Grosz, “Time of Thought” 49). Irigaray writes,

Sexual difference would constitute the horizon of worlds more fecund than any know to date—at least in the West—and without reducing fecundity to a reproduction of bodies and flesh. For loving partners this would be a fecundity of birth and regeneration, but also the production of a new age of thought, art, poetry, and language: the creation of a new *poetics*. (*Ethics* 5)

Catriona excitingly implies the possibility for the creation of a future of multiplicities and uncertainties. While she herself has yet to come into the world, thus serving as a loose metaphor for the virtual, her conception promises to the rupture of the singular regime of the phallogentric and whispers a coming reality that is to be understood in terms of at least two sexes. In the final section below, however, the virtual feminine in *Solar* moves even further, pushing beyond the

current duality of the human sexes to the teeming ecological economy and presenting a concluding image of temporal reconciliation.

All, But Not Two

While there is no overt connection between the virtual feminine and an articulate sustainability in *Solar*, one scene does echo the technological ethic's successive moments of disclosure and joins Catriona as a moment that opens the novel's fictional world to the uncertainty of evolutionary time. Before the disastrous press launch, Temple introduces herself to Beard and the project's all-male committee by recounting her recent observations of geneticists' technological, laboratory-based endeavors to explore the characteristics and function of a lion's gene called TRIM5. Evoking the work of Bruno Latour and Steve Woolgar in *Laboratory Life* (1979), Temple argues for the social construction of scientific fact. Her explanation portrays fact as an intimate process of collective creation that, as will be seen below, characterizes the technical and technological processes that disclose TRIM5 as propagators of a temporal reconciliation. Temple explains her project to the exasperation of her male colleagues:

Her purpose was to demonstrate that this gene, or any gene, was, in the strongest sense, socially constructed. Without the various "entexting" tools the scientists used – the single-photon luminometer, the flow cytometer, immunofluorescence, and so on – the gene could not be said to exist. These tools were expensive to own, expensive to learn to use, and therefore replete with social meaning. The gene was not an objective entity, merely waiting to be revealed by scientists. It was entirely manufactured by their hypotheses, their creativity, and their instrumentation, with which it could not be detected. And when it was finally expressed in terms of its so-called base pairs and its probable role, that description, that text, only had

meaning, and only derived its reality, from within the limited network of geneticists who might read about it. Outside those networks, TRIM5 did not exist. (151)

For Temple, TRIM5's reality does not derive from the *telos* traditionally ascribed to fact, in which fact signifies the establishment and legitimation of scientific data and where the culmination of experimentation is the only thing of intellectual value. Experimentation as the long process of working with and in uncertainty to attain meaningful data, is resultantly omitted. Temple contrastingly locates TRIM5's factual nature in experimentation as a narrative process of hybrid labor culturally inscribed by the institutionalized space of the geneticists' laboratory. In this scene, *Solar* puts aside social constructivist discussions and anxieties surrounding *who* conducts the experiment and instead places emphasis on the *who* studying and narrating the ontology of TRIM5.³⁸ Temple is a woman telling a narrative about disclosure and evolution in a room of men, who, during her presentation, "listened in some embarrassment" and [p]olitely...avoided exchanging glances. They tended to take the conventional view, that the world existed independently, in all its mystery, awaiting description and explanation" (151-52). In contrast to her colleagues' belief in a neat, independent world—one that notably negates mystery and uncertainty if it only awaits description, as the above quote cheekily suggests—Temple's narrative is one of messy creation, of conceptual and technological steps that weave energy—biological and technological—and matter—TRIM5, the scientific community—together through the process of the gene's disclosure.

Temple's narrative is notable because it is the only moment in *Solar* that approaches Irigaray's idea of a common world as evolution, which subtends the concept of the technological ethic and a related sustainability. It evokes what Latour has famously called collectivity, a

³⁸ For feminist science studies scholars, this includes anxieties regarding gender and representation in the laboratory.

gathering of the human and nonhuman into a grouping that is otherwise than homogenous unification. As Latour explains, “The term ‘collective’ does not mean ‘one’; rather, as I have said above, it means ‘all, but not two’” (*Politics* 94). A collective, in other words, is not an entity composed of two separate categories of being, human and nonhuman, but is rather the ongoing process of life itself and the “many heterogeneous ingredients...the many trades, the subtle coordination” that make up these processes (3). The formulation of “all, but not two” is particularly evocative in the context of the virtual feminine and the technological ethic. Not only does it evokes sustainability’s integration of human and ecological systems, but it echoes the more-than-two of Irigaray’s first biodiversity as well as the ontological opening of sexual difference onto the materialities of the world, which, in their evolving differences, orchestrate the uncertainty of the future.

With the help of Latour’s collective, we reach a clear and final image of temporal reconciliation, where time is kept dangerous through the non-deterministic, ever-increasing aggregate of multiplicities. More precisely, time is kept dangerous as the collective’s evolution, as the arteries of energy that move through and are shared by materialities. Time advances “by way of the gap between [the] two successive iterations” of *yesterday* and *tomorrow* wherein the collective accumulates (191),³⁹ opening the future to uncertain becomings:

Yesterday...we took into account only a few propositions; tomorrow, we shall take others into account, and, if all goes well, even more...in the past, we could compose a common world with only a few elements; in the future we shall be able to absorb the shock of a larger number of beings that were incommensurable before now....We no longer expect from the future that it will emancipate us from all our

³⁹ The quote in this sentence is originally in italics.

attachments; on the contrary, we expect that it will attach us with tighter bonds to the more numerous crowds of *aliens* who have become full-fledged members of the collective that is in the process of being formed...tomorrow the collective will be more intricate than it was yesterday. We shall indeed have to involve ourselves still more intimately; with the existence of a still larger multitude of human and nonhuman beings[.] (191-192, original italics)

The image of a propagating collective very clearly portrays temporal reconciliation as a state that takes joy in the additive, in undetermined movement forward, in the creation of new ways of being in the world and responding to those who inhabit it. It is the constant expectation of the future as that which is not an extension of the present, but its mutation.

The purpose of this chapter was twofold: to exemplify and unpack the concept of temporal reconciliation offered by climate models in Chapter One so as to understand how such an abstract concept might have an ontological impact; and to explore why and how the literary world has hitherto misunderstood *Solar* as a work of climate change fiction, which is simultaneously a way to reflect on the parameters of contemporary sustainability discourse, that is, on how current conceptualizations of sustainability limit the very notion of the future. Both the sustainability of the environmental movement and an inarticulate sustainability are concerned with an unprecedented management and organization of resources, which depend upon human systems adapting to new forms of economy and infrastructure. The future these new forms envision, however, is arguably little more than an extension of the present, of what is feasible within the *now* of reality. Such a future is not a divergence radical enough to seize upon the virtual, to change the fundamentals of human culture—what can be said, thought, and acted upon according to how

bodies, materialities, energies are acknowledged—so that it may open fully to the multiplicity of the collective.

Solar's intrigue as a climate change novel derives from its dislocation from the present and its welcoming of uncertain futures. Temporal reconciliation names this dislocation, and a technological ethic names a virtual modality of sustainability that articulates the sheer multiplicity of the world as a collective. Rather than issue yet another critique of humanity's anthropocentrism, *Solar* redesigns the fundamentals of human culture by making thinkable Irigaray's first biodiversity. Rather than a strategy born of necessity, a dualistic human-nonhuman ethics, policy, legislation, and industry, sustainability becomes uncertainty, experimentation, evolution, the precarity of Serres's natural contract, and the unfolding of a narrative of matter and energies. In short, it names the very living of life within and amongst materialities and their specificities.

CHAPTER 3. EMBODIED KNOWLEDGES: CLIMATE MODELS, FEMINIST CLIMATE COMMUNICATION, AND BARBARA KINGSOLVER'S *FLIGHT BEHAVIOR*

Knowledge so conceived is not a series of self-consistent theories that converges towards an ideal view; it is not a gradual approach to the truth. It is rather an ever increasing *ocean of mutually incompatible alternatives*.... Nothing is ever settled, no view can ever be omitted from a comprehensive account.

— Paul Feyerabend, *Against Method*

Introduction: Embodied Knowledge

In Chapter One, temporal reconciliation bloomed when the limits of climate knowledge were accepted as a knowledge in and of itself. In Chapter Two, the technological ethic translated the theoretical abstractness of temporal reconciliation into a sociocultural practice that would open reality to uncertain futures. When read together, these initial chapters imply that epistemic uncertainty can powerfully derail reality from the track of the present and set it on a corybantic course for unmarked horizon(s). Indeed, if we can, first, accept that a climate-changed future can only be known according to degrees of uncertainty; second, accept such knowledge as scientifically rigorous; and, third, act upon this knowledge by arranging human systems to cultivate temporal reconciliation, then conceptualizing climate change through epistemic uncertainty ushers being into the evolution, multiplicity, Latourian articulacy, and fecundity that characterizes ontological uncertainty. So far, then, my arguments have functioned under the assumption that climate models' epistemic uncertainty is inherently ethical as a conceptual space in which objective knowledge and the subjective engagement of that knowledge co-exist. Such an assumption, however, draws connections between the space of scientific research and the space of the social that are problematic when considered from the standpoint of traditional understandings

of what constitutes rigorous, legitimate science. My first two chapters, in other words, blur boundaries that have hitherto strictly distinguished between what scientists describe as epistemic and non-epistemic values, between objective fact and the social and ethical value judgements that individuals attach to render fact socially meaningful.

In this chapter, I consider the possibilities that arise for thinking and communicating climate change when climate models are conceptualized as spaces in which epistemic and non-epistemic values productively coexist. In science studies and the philosophy of science, the term “epistemic values” refers to core principles or standards in science that allow for the production of empirical accounts of the world based on available data. While there is no agreed-upon list of these standards, they include notions such as consistency, accuracy, evidence, and objectivity that structure experiments and inform hypotheses, theories, and conclusions. They are, in other words, valued concepts in the production of scientific knowledge. In turn, “non-epistemic values” include social, ethical, and moral values that inform sociocultural and political life, and which have been kept apart from the scientific realm so as not to skew the integrity of a scientific method. Hence *non-epistemic*, since they have traditionally been excluded from the creation and appraisal of theories and models of knowledge. My claim in this chapter is that ways of knowing and communicating climate change have been impoverished by the binarism of an epistemic/non-epistemic discourse, which asks for science to be narrowly conceived as content rather than process, as negative rather than additive, as a mode of knowing whose merit is evaluated on the exclusion of, or on its opposition to, other ways of perceiving and interpreting the world. Within the binary formulation, non-scientific values are rendered virtual. Just as Irigaray points out that the feminine is always defined in relation to the masculine, never as something in herself, the very existence of social values are a deferral to the regime of the objective. While epistemic values are held aloft as

legitimate vehicles for the formation of knowledge, social values are often considered conceptual structures buttressed by cultural narratives and beliefs that are associated with emotion rather than critical sophistication and rigor. Social values are a modality of knowing that have yet to become actual.⁴⁰

I argue that a monological upholding of epistemic values is, speaking with Val Plumwood, a crisis of a “‘mind’ that cannot acknowledge and adapt itself properly to its material ‘body,’ the embodied and ecological”—and here, I add, social—“support base it draws on” (*Environmental Culture* 15). A monological upholding of epistemic values is a misunderstanding of one of the foundational missions of modern science: its responsibility to social wellbeing. Climate modeling specifically troubles the notion of science’s splendid isolationism because its very condition of being *is* the public realm. The purpose of climate modeling is to theorize the probabilities of future climate scenarios so that policy-makers may, first, understand the challenges society faces in the coming years, and, second, reach informed decisions of the social, political, and industrial changes necessary for the healthy continuance of human and ecological systems. Complete data accuracy and objectivity are not as important as communicating the probability of a future scenario, and discussions that support the segregation of the social from the scientific risk forgetting its public audience and, importantly, this audience’s *varied relations with ecological economies*, whether these relations be positive, negative, based on scientific literacy, or on belief, experience, imagination, and narrative. I am not arguing against the importance of objectivism in science but against the autonomy of objectivity implied in the dualism of the existing values terminology, which heavily obscures the social and, by extension, the embodied context of all knowledge. As

⁴⁰ For discussions on epistemic and non-epistemic values, see Rooney, Svetlova, Longino, Winsberg (*Science in the Age*, Chapter 6), Winsberg (11-37).

will be seen, I identify the embodied context of knowledge as an enabling condition of climate modeling.

My above claim is feminist and Irigarian. It is an attempt to divert and evolve historically given forms and practices of knowledge in preparation for a climate-changing future. It also opens a space from which to think about the ongoing challenge of communicating climate to the non-expert. I hold that there is a connection between a forgetting of the embodied context of knowledge and the expectations that experts have regarding how readily a public might become climate change literate. During the late 1990s and early 2000s, public skepticism and uncertainty about climate change was attributed to a general information deficit regarding the science and risks associated with the planet's changing temperatures. A thesis—climate science illiteracy—thus had to be countered with an appropriate antithesis—the instigation of climate change literacy initiatives that focused on teaching and explaining the empirical evidence of climate science. Within the past eight years, however, the deficit model has been decisively sidelined as polls reveal that, despite public understanding of the scientific basics of climate change, commitments to environmental protection are disturbingly “equivocal when and where it matters most” (Guber 38), with only one third of Americans finding climate change worrisome to their wellbeing.⁴¹ Just as unsettling is the relatively unanimous suggestion posed by studies published throughout the 2010s that today's climate skepticism is heavily influenced by ideologically-based evaluations of scientific information and its sources—ideologies that notably result from the mutually constitutive nature of the psychic, social, cultural, and political realms that inform citizens' lives—which suggests

⁴¹ For a thorough study of American public opinion, see Leiserowitz et al. For studies on climate skepticism, see: Hulme; Sjöberg; Slovic and Peters; Whitmarsh; Kahan; Kahan, Jenkins-Smith, and Braman. For survey studies on the discrepancy between the American public's documented pro-environmental attitudes and its lack of behavioral changes, see: Bostrom; Brechin; Seacrest, Kuzelka, and Leonard; Capstick, Whitmarsh, Poortinga, Pidgeon, Upham.

that climate communicators' latest challenge is one of cultural boundary work and that belief in the deficit model of climate communication resulted from a misplaced assumption among communicators that the simple objectivity of fact was enough to render scientific knowledge legitimate and accepted in non-scientific spheres.⁴² Indeed, as climate communication scholars have observed, "there is something in *how* we communicate climate change that is failing to mobilize a wider audience" (Moser and Dilling 4). The current challenge that climate communicators face is therefore in the sociocultural work that effective communication requires.⁴³

Ultimately, however, this chapter argues that building a climate change social movement necessitates that climate communication undergo a deeper interpretive turn, one that abandons generalized strategies to discursively weave the realities of atmospheric and ecological changes into the very narratives that structure communities' values, beliefs, and identities. This implies an epistemological turn, a new way of knowing through an opening of the parameters of knowledge to social and ecological dynamics, which echoes the core ethical starting point of feminist thought in both epistemology studies and ecocriticism. In what follows, I propose a feminist mode of climate communication, which hinges on a new figure of an epistemological agent whose knowledge of the world is founded on an understanding of precarity and social interrelatedness. I first review scholarly discussions on the presence of non-epistemic values in climate modeling, consider the extent to which these open onto uncertain futures, and through this discussion

⁴² The growing body of research on climate communication illustrates the mutually constitutive nature of the psychic, social and cultural realms. See Moser, Gorman-Murray, Harrison, Nuttall, Sakellari, and, finally, Moser and Dilling's edited collection.

⁴³ Notably, the need for reformulation strategies has been readily acknowledged by scientists, science communicators, The National Academy of Science itself, and in governmental publications, including the third and most recent US National Climate Assessment in 2014 and the 2012 decadal *National Global Change Research Plan (2012–2021)*. The 2014 US National Climate Assessment was "explicitly designed to address some shortcomings of previous assessments" (Jacobs, Buizer, Moser 3), the "most salient" of which focused on climate science's "failure to truly connect with the American public" (3).

crystallize the budding emergence of a new epistemological agent, which I develop with the aid of Judith Butler's concept of apprehension as outlined in her book *Frames of War* (2009). I then turn to Barbara Kingsolver's climate change novel *Flight Behavior* (2012), where I find a strong example of an epistemological agent and the effects that she could have in the realm of climate change communication in the character of Dellarobia Turnbow. A fictive meditation on the politics and practice of climate communication in rural North America, *Flight Behavior* emphasizes the abiding need for climate information to be communicated through a language that acknowledges human cultural frames and realities alongside scientific fact. As the novel unfurls and hints of ecological crises begin to manifest themselves in its fictive world, Dellarobia develops an understanding of climate change through place-based, personal, and gendered experiences. I argue that these prompt her gradual transformation into what this chapter calls a situated knowledge broker, a formulation of the new epistemological agent that I develop in tandem with Donna Haraway's notion of situated knowledges. Equipped with the "skills needed to understand the work of academics and others" (Litfin 36-37), knowledge brokers are often used in policy-science relationships to translate complex science for decision-makers by framing data in accessible, non-technical language. Once Dellarobia formulates her situated understanding of climate change, she begins to translate climate science to her Christian, conservative family through discursive strategies that use moments from daily life as analogies for the invisible, abstract nature of the planet's thermal imbalance

My goal throughout these analyses is to work toward an embodied and locally anchored strategy for climate communication by applying a feminist logic and discursivity to communication endeavors. I thus keep with contemporary feminist scholarships' ongoing program

to go beyond a simple critique of dominant epistemologies and instead reframe the very nature of knowledge by diversifying what it means to know.

Science, Values, Uncertainty

Broadening a discourse of epistemic and non-epistemic values includes an appraisal of the longstanding discussions regarding their roles in, or dangers to, science and climate modeling. One of the most influential objections to the claim that value-based judgements should remain separate from science was put forth by North American logician and decision theorist Richard Jeffrey in 1956.⁴⁴ Jeffrey argued that the “proper role” of the scientist is to assign probabilities to hypotheses based on available evidence for the use of “rational agents” (245), or decision-makers, who subsequently use the data to decide whether social or political change is needed. Value-based decisions are the responsibility of the social realm of practice, whereas the scientist works solely in the realm of value-neutral theory and inquiry, though notably in the name of the greater social good. Jeffrey’s arguments were a product of the post-World War II and Cold War era, in which the removal of science from the public realm was considered a precautionary measure to ensure that scientific progress could follow an “objectivist vision of the good at which inquiry aims” free from social, political, and industrial goals (Kitcher 138). Scientific progress was touted as a constant striving for the betterment of the populace. In the latter half of the twentieth century, Vannevar Bush’s seminal *Science – The Endless Frontier* (1945) claimed that in the aftermath of World War II, science would serve as the “one essential key to our security as a nation, to our better health, to more jobs, to a higher standard of living, and to our cultural progress” (2).⁴⁵ A

⁴⁴ For how Jeffery’s argument continues to influence cotemporary philosophers of science, see Giere and Mitchell’s respective essays.

⁴⁵ Bush writes: “Industry is generally inhibited by preconceived goals, by its own clearly defined standards, and by the constant pressure of commercial necessity. Satisfactory progress in basic science seldom occurs under conditions prevailing in the normal industrial laboratory. There are some notable exceptions, it is true,

report to President Franklin D. Roosevelt on the United States' scientific innovation and technological progress at the end of World War II, *The Endless Frontier* argued that North American national security and technological health would best be maintained through an elitist approach to research, with scientists able to pursue inquiry independent of public, political or industrial agendas. As philosopher of science Martin Carrier explains in a recent essay, if science is left open to outside agendas, then not only do scientists fear that science's "commitment to truth... [will] be traded for its capacity of intervention" (12), but also that intervention could very well modify the nature of science's research agenda, leading to conflict over which problems to select and address.⁴⁶ The past thirty years, however, have seen science's isolationist discourse complicated by the environmental and climate crises, the practical difficulties of creating strong probability statements for future climate scenarios, and the communication of these probabilities to non-expert audiences. Such challenges are either indivisible from the social realm or, as will be seen below, require scientists to call upon non-epistemic values to navigate the epistemic uncertainties that characterize human knowledge of atmospheric systems. Climate science consequently contributes to an increasing recognition amongst contemporary scholars and scientists that "science is neither exclusively nor principally epistemic" (Laudan 15).

In the context of climate modeling, the question at hand is not whether non-epistemic values should or should not play a role in the modeling process, but the extent to which they are implicit within the modeler's very programming decisions. On one hand, following Jeffery's description of the scientist's role, climate modelers attach probabilities to climate scenarios to

but even in such cases it is rarely possible to match the universities in respect to the freedom which is so important to scientific discovery" (19). See also Bush 18-19, 21-22, 81-83; Kitcher 137-42.

⁴⁶ In an example of the conflicts outside agendas can precipitate, and one which speaks to the conflicts currently surrounding climate change, Carrier writes, "Modes of problem selection are criticized on moral grounds by claiming that questions of short-term benefit are emphasized in politicized and commercialized research, while issues that are essential for large parts of humankind are neglected" (12).

present policy-makers and legislators with information that will guide decisions on whether—or not—and how to adapt social and economic practices to a climate-uncertain future. The mathematical and computerized formulation of probability projections clearly separates the realm of scientific theory from that of social practice, thereby automatically divorcing scientific expertise from non-expert values and viewpoints. On the other hand, climate’s nonlinearity and the uncertainty inherent in climate modeling challenges a value-free modeling process, since it requires that the modeler make a series of programming decisions in which non-epistemic values inevitably and unavoidably arise. In a direct response to Jeffrey’s argument, Winsberg writes that it is impossible for climate modeling to maintain the separation between theory and practice. He points out that climate modelers are constantly confronted with methodological choices, each which “strikes a different balance of inductive risks with respect to [the climate scenario] that concerns her at the time. Choosing which way to go...will inevitably reflect a value judgement” (*Science in the Age* 124). Troubleshooting how a modeling problem might be solved, selecting the best parameters for programming a climate scenario, selecting a metric of success against which to evaluate the model’s results, tuning data to or borrowing data from other climate models, and even seeking advice from colleagues⁴⁷ will reflect a *human* judgement, and so, according to Winsberg, are unavoidably, though perhaps unconsciously, underscored by non-epistemic value judgements. In the following statement, Winsberg provides the strongest example for his reader

⁴⁷ Climate labs across the world are collaborative, and modelers might be saddled with the significant pressure “to tune one’s model to the crowd” (Winsberg, *Science in the Age* 122), especially when faced with the possibility that their data set might be considered an outlier. Due to labs sharing computational code, data proxy, ensemble averages, and sampling methods, the past methodological choices of climate modelers are continuously embedded in new climate simulations.

regarding how modeler decisions involving which climate scenarios to project might reflect personal anxieties that arise from sociopolitical contexts.⁴⁸

But the particular set of prediction tasks that have played a role in shaping our experts' judgements have been the product of a set of choices—for example, the choice to focus on predicting mean surface temperature rather than mean global precipitation. And these choices in turn, reflect a set of values—namely the set of social, economic, or other considerations that have historically led us to believe that predicting temperature is more important than predicting precipitation. (118-19)

The ways in which these values enter the modelling process can be more clearly conceived in a case study that cultural anthropologist Myanna Lahsen conducted to explore the conceptual relation that climate modelers have with their models. Lahsen's study concludes that the "persuasive power of [model] simulations can affect the very process of creating them" (908), and that modelers might begin to consider their models as truth machines rather than heuristics "to the point of losing awareness about potential inaccuracies" (909). The extent to which modelers' can forget to maintain sufficient critical distance from their creations is evident in a specific response Lahsen received from a modeler interviewee to the question of whether modelers think of their models as reality:

Yes! Yes. You have to constantly be careful about that [*laughs*]. You spend a lot of time working on something, and you are really trying to do the best job you can of simulating what happens in the real world. It is easy to get *caught up in it*; you start to believe that what happens in your model *must be what happens* in the real world.

⁴⁸ Winsberg's discussion of climate modeling and values (Chapter 6) in *Science in the Age* is theoretical. It is not an ethnographic analysis of how non-epistemic values influence climate modelers' decisions. There has yet to be such an analysis.

And often that is not true ... The danger is that you begin to *lose some objectivity* on the response of the model [and] begin to *believe that the model really works like the real world* ... then you begin to *take too seriously how it responds* to a change in forcing. Going back to trace gases, CO₂ models – or an ozone change in the stratosphere: if you really believe your model is so wonderful, then the danger is that it's *very tempting to believe* that the way it responds to change in forcing must be right. (908)⁴⁹

Lahsen's emphases, added for her own analysis, highlight the modeler's rhetoric as reflective of levels of urgency and anxiety in relation to the impact of the climate scenario being modeled. Such emotions could be interpreted as influenced by non-epistemic values and sociocultural narratives that have become enfolded in the concept of climate change. Yet while critical distance is necessary for the maintenance of a reasonable and not overblown attribution of a probability to a given climate model scenario, philosopher of science Kristen Intemann also reminds scientists and scholars that it would not necessarily be desirable to eliminate value judgements from the climate modeling process, "particularly if this resulted in producing information that was less useful to protecting those interests valued by stakeholders" (226). It is easier to prompt pro-environmental behavior and structural change when probabilities are assigned a non-epistemic numerical value rather than communicate uncertainty through the perhaps more objective yet less helpful phrase "X is more likely than not to occur" (Intemann 226). Probabilities arguably get their rhetorical, persuasive force for policy makers and stakeholders from the value judgements couched within them, from the weighed and curated levels of climate modelers' urgency and anxiety, though only so long as these modelers maintain familiarity with the limitations of their models and thus

⁴⁹ The punctuation, brackets, ellipses, and emphases included here are all in Lahsen's original transcript.

formulate probabilities in the recognition that model outputs are not truthful representations of the real world.

In light of the complex mingling of epistemic and non-epistemic values in climate modeling, Winsberg writes that the ultimate controversial and philosophical question about science and values is not whether the non-epistemic should play a part in science, but, rather, “the degree to which the epistemic and the normative”—a term Winsberg substitutes for non-epistemic—“can be kept apart” (*Science in the Age* 114). Yet if the goal is to broadly rethink the ways in which epistemic and non-epistemic values are placed in relation to each other, Winsberg gets the epistemic/non-epistemic conversation no closer to reconceptualizing the values beyond their entrenched dialectics. The nature of his question—at the very least the way in which it is rhetorically structured—maintains a tension between them; it does not recast their relation in the spirit of evolution to ask how their blurring would broaden the practice of climate modeling by transforming it from a method into a web of relations that would newly entangle modelers, knowledges, ecologies, and the public. In fact, Winsberg’s question does not extend to the condition of knowledges and relations at all but limits itself to wondering about “the effects that these values have upon the overall performance of our models” (119). It consequently remains within a closed conceptual structure that cannot open to ontological uncertainty and the virtual.

A way to transform climate modeling into a scientific practice that gives credence to the differences between the objective and experiential knowledges that make the modeling process possible is to rework the uncertainty that is climate models’ methodological limitation into a methodological strength. Open dialogue between climate modelers and policy-makers about social anxieties regarding specific climate scenarios—whether sea level rise, precipitation, fluctuating temperatures, storms—could help neutralize the sense that modelers are letting their own concerns

about the future slip into their programming. Neutralize, that is, in terms of deconstructing the social as a threat to scientific practice and creating a forum in which concerns can be recognized and debated and through which climate modelers might develop new standards of objectivity and a heightened awareness of how non-epistemic values function within their work. Neutralize, that is, in terms of weaving social concerns and scientific practice into a narration of shared precarity. What would theoretically result would be a new category of epistemological agents whose knowledge of climate change would emerge from a cross-hatching of epistemic standards and interdependent social contexts.

My use of interdependency has a double entendre that can initiate a transition into Judith Butler's concept of apprehension as a modality of knowledge. While interdependency here evokes a dialogic, conceptual relation, in Butler's *Frames of War* it refers to an embodied, material relation, a relation between individuals in a social group based on the acknowledgement of each members' precarious physical existence in the world. Apprehension is a way of knowing through interdependency, and I would like to posit this modality of knowledge as that which underlies the new epistemological agent. While a dialogic form of interdependency might appear to be at the surface level of a new methodology of climate modeling and climate communication, ideally driving it would be a shared notion and experience of precarity in a time of climate change. In a movement of evolution, knowledge of climate change would be reconfigured, less polarized, more comprehensive. To evoke this chapter's epigraph, it would be an ocean of alternatives rather than a series of self-consistent theories in splendid isolation from the living world.

A New Epistemological Agent

Apprehension is a fundamental component in Butler's famous ethics of precarity. It is the very modality of knowledge through which precarity is realized as an ethical social ontology and is

presented as an intuitive and relational way of understanding and formulating social structures apart from content-based knowledges that can encourage social hegemony. Butler's apprehension is not explicitly interested in offering an alternative epistemology to Enlightenment thought, as this essay strives to do in relation to climate knowledge. *Frames of War* is instead preoccupied with disclosing how media portrayals of modern warfare against the non-white, non-Western other frame the other's life in ways that prevent viewers from cognizing the horrors of violence bodies; the other's life is consequently robbed of its right to be grieved as a life of value. Yet Butler employs apprehension to break down cognitive structures, particularly those that frame a life as non-grieveable, meaning that apprehension is both deeply concerned with toppling a hegemonic way of categorizing lives and bodies and deeply interested in generating new ways of seeing and thinking lives and bodies. As a result, apprehension is suggested here as a modality of knowledge aligned with feminist critiques of the masculinist, "historical privileging of the purely conceptual or mental over the corporeal" (Grosz, "Bodies and Knowledges" 187). Apprehension's avowal of the body in the production of knowledge will thus, unsurprisingly, be fundamental to unraveling *Flight Behavior's* suggested possibility of a non-binary climate belief system and transitioning into discussions of what this essay calls the cultural-gendered—that is, non-ideological—turn in climate communication.

Butler's ethics of precarity describes a life's dependency on others, on a "social network of hands" that offer "reproducible and sustaining social relations" (14; 19). Here, dependency is a radical *interdependency*, in which all social members understand that precisely "because a living being may die, it is necessary to care for that being so that it may live" (14). Precarious life, and the interdependent society surrounding it, consequently exists apart from social living, that which is governed by norms that have historically dismissed certain lives as lesser than others and so

ultimately dispensable. Crucially, interdependency does not exist if life is ascribed a social value and thus deemed to merit protection. Within the networks that construct social living, social norms are used to cognize who or what is a valued life according to whether this life is a recognizable subject of a sovereign system. The living, in other words, are transcribed into known objects by content-based social knowledges that distinguish who is worth protecting, grieving, condemning, aiding, pardoning, or acquitting. Existing outside of this framework, the very concept and formation of sociality formed by an ethic of precarity exists to value and ensure the exigency of life itself. Life in this “beyond” status can never be properly known by the standards of social living and can only be apprehended by an interdependent society as something vulnerable and in need of support. Butler defines apprehension as a form of knowing that is “bound up with sensing and perceiving, but in ways that are not always—or not yet—conceptual forms of knowledge” (5). To know through apprehending is to mark, register, presuppose, or acknowledge something without comprehending it through the function or effect of an official methodology, discourse, or dialectics. “[W]e ought not to think,” writes Butler, that apprehension “masters or captures or even fully recognizes what it cognizes” (13). Precarious life’s status as that which is beyond state-sanctioned ideologies and the rationalities that construct them is the only way in which the exigency of life—that which life’s very precarity celebrates—can ensure an abiding ethical social ontology.

Within the context of this essay, Butler’s apprehension initiates a discussion of a new category of epistemological agents whose ways of knowing climate change are situated in embodied and interdependent contexts rather than in universal conceptual content. Below I move into my discussion of Barbara Kingsolver’s climate change novel *Flight Behavior*, arguing that its protagonist, Dellarobia, illustrates the new epistemological agent that I extract from Butler. As I

stated in the introduction to this chapter, Dellarobia will eventually be characterized as a situated knowledge broker, however, her ability to mediate between ways of knowing to effectively communicate climate change is prefaced and enabled by her own unique and experientially visceral apprehending of climate change and ecological degradation.

Parsing Climate Knowledge

This first section on Barbara Kingsolver's *Flight Behavior* has two aims. The first is to unveil Dellarobia as an epistemological agent who arises from a very specific experience of Butler's apprehension, one that opens her to a unique understanding of the ecological crises and prefaced her transformation into what I call a situated knowledge broker. The second, which sits intertwined with the first, is to parallel the above discussion of the limitations of epistemological dualism in the sciences with a discussion of the pugilistic binarism of climate beliefs and the challenge it poses to climate communication. As ecological and atmospheric tipping points firmly establish themselves on the horizon, hope for mediating their effects lies in reframing the problematic of knowledge as it stands in relation to climate change. Concerned by the bellicose dualism of contemporary climate discourse, this section will eventually illustrate apprehension as a modality of climate knowledge that breaks binary ideological markers. I specifically interpret Kingsolver's novel as a careful parsing of the knowledges that supposedly yield to climate skepticism and as a nuanced commentary on the type of climate communication that would successfully cultivate climate knowledge from within a community itself. At the heart of this argument lies a specific scene in which the novel's protagonist, Dellarobia Turnbow, a farmwife and young mother of two, is told by Ovid Byron, a Harvard-educated lepidopterist, that it is critically vital that she "look at the evidence" of climate change (282). Notably "wary" of the term and its apocalyptic tenor (283), Dellarobia adopts a position that, at first glance, rings of climate denial, saying, "There's just not

room at our house for the end of the world” (283). When Byron misunderstands her, thinking that she wants “the full predicament revealed and proven in sixty seconds or less” (283), she corrects him: “I’m not saying I *don’t* believe you, I’m saying I *can’t*” (283). Rather than interpret Dellarobia’s statement as one of willful non-knowing, as a “shutting one’s eyes, isolating oneself, not wanting to know, only seeing what one wants to see” (Beck 123), this section pursues her *can’t* as something that drops out, so to speak, from dualistic climate beliefs and that resultantly generates a unique knowledge of and ability to communicate the climate crisis.

Flight Behavior narrates the biotic consequences of climate change through Dellarobia Turnbow’s personal journey from the normative boundaries of rural life in Appalachia, Tennessee into the labyrinth of science communication. When millions of monarch butterflies alight in the woods behind her family’s farm and Dr. Byron arrives to study the colony’s aberrant migration, Dellarobia is suddenly plunged into the unfamiliar discourse of ecological crisis. The butterflies’ anomalous presence is explained as an unquestionable quantitative indicator of climate change, the result of unseasonal weather in their normal winter roosts. Nevertheless, Dellarobia’s rural community—farming residents of the fictive town of Feathertown—ascribes the monarchs’ appearance to the spiritual workings and “special grace” of a Christian god (72). Byron becomes quickly distrusted as an “outsider” and the climate-denying verdicts of Johnny Midgeon, who broadcasts the weather report on the local radio, continues to take precedence over climate scientists’ published data (257). Initially, these caricature-like depictions of climate skepticism seem to keep the novel from reaching its potential as an insightful reflection on the origins and possible conciliation of polarized climate perspectives. However, and more compellingly, Feathertown’s skepticism serves as a platform for a series of climate-related conversations between Dellarobia and Byron in which Dellarobia repeatedly wrestles with defining and

separating the ideological nature of knowledge, in which a tribal mentality shapes how individuals approach social issues, from the cultural situatedness of knowledge, in which knowledge springs from communal customs and lifeways rather than from antagonistic assertions of group identity.

Transforming climate change as an object of knowledge necessitates disbanding the presumption that community cultures are equivalent to ideologies, the latter which stereotype and distort cultural traditions and lifeways into politicized identities. Early in the novel, Dellarobia ruminates that nobody “truly decided for themselves” on issues such as climate change (166), “There was too much information” (166). Instead, “What they actually did was scope around, decide who was looking out for their clan, and sign on for the memos on a wide array of topics” (166). Later, in a tense discussion with Byron about the nature of climate beliefs, she directly evokes the hegemonic dynamic of contemporary climate discourse when she describes the climate belief gap as an unbridgeable “territory divide” (321). Suggesting that an individual is pre-programmed to accept or deny climate change according to the “clan” he or she identifies with, Dellarobia tells Byron,

I say the teams get picked, and then the beliefs get handed around... Team camp, we get the right to bear arms and John Deere and the canning jars and tough love and taking care of our own. The other side wears I don't know what, something expensive. They get recycling and population control and lattes and as many second chances as anybody wants.... You think any of this is based on *information*? Come on, who really chooses? (321-22)

Her assessment of these bound ontologies of identity elicits the image of two communities, each which considers itself to be ideal in its cultural hegemony. For Iris Marion Young, the concept of an “ideal” community equates to a totalizing metaphysics that denies difference. In an evocation

of Hegelian consciousness, Young writes that any “ideal of community presumes subjects who are present to themselves and presumes subjects [who] can understand one another as they understand themselves” (1-2). For Young, these subjects’ desire for, and formation of, community relies on a desire for social wholeness and identification comparative to that which “underlies racism and ethnic chauvinism, on the one hand, and political sectarianism on the other” (2). Legal historian Mark Weiner situates this desire in the context of United States politics and climate denial when he points out that climate change directly challenges certain communities’ holistic sense of identity since it “hints at a conception of ‘the political’ that transcends particularistic identity markers and encompasses humanity as a whole” (“Climate Change Denial”). In response to this perceived threat, a community might quickly coalesce around a common identity that becomes fortified as it issues members with an enforced choice between polarities—conservative/liberal, skeptic/warmist, John Deere/lattes—each which promotes an unnecessarily combative perspective and knowledge of socio-political and socio-ecological issues.

Weiner’s observation indirectly communicates the importance of what might be called a community’s conceptual locality, that is, how a community rationally distinguishes itself in national or even global political and cultural landscapes. The rationality of an ideologically created knowledge is one of enclosure, one that in its idealism is a wholly conceptual entity closed to difference and so closed to the materiality of bodies from whence difference arises. A binary set-up of climate beliefs consequently only serves to deepen the crisis of reason as an ecological crisis, that is, as a crisis of a “‘mind’ that cannot acknowledge and adapt itself properly to its material ‘body,’ the embodied and ecological support base it draws on” (Plumwood 15). The critical work of feminist scholars such as Elizabeth Grosz, Donna Haraway, and Sandra Harding attest to the extent to which this hegemonic rationality erases the agency of beings and knowledges associated

with the body and material world. Yet it is only Val Plumwood who points out that the disjunction between rationality and ecology is not simply an erasure of agency but a gross misunderstanding of the very foundational features of reason itself as that which results from situated and embodied perspectives. As Plumwood writes in *Environmental Culture* (2002), such monological forms of reason discount and discard “their own enabling conditions – the body, ecology and non-human nature for example, often because they have written these down as inferior or constructed them as background in arriving at an illusory and hyperbolized sense of human autonomy” (17). Similarly, climate warmism and skepticism as polarized, ideal communities are themselves gross misunderstandings of the social body as an enabling condition for the very concept of community, just as a conceptual locality founded upon hegemonic rationality is a gross misunderstanding of the concept of identity, which is not achieved in isolationism from but in connective relation to difference. In their self-enclosure, ideologically fueled epistemologies thus promote a deeply divisive, and anti-ecological, narrative of community relations that “can be conceived in much more equal, continuous and overlapping ways” (17).

Though her above description of climate warmists is biting, Dellarobia’s democratic leveling of warmist and skeptic communities is particularly noteworthy since her very ability to intuit and describe the territory divide signals that she herself remains beyond its categories. While she identifies Feathertown as her hometown and often defends its rural simplicity against the novel’s more—so-called—worldly characters,⁵⁰ she never succumbs to the ideality of community described above. In fact, as the novel’s opening pages narrate, her “appetite larger than sense” for

⁵⁰ For example, in one scene, Dellarobia tells a reporter who asks why her father-in-law is “not keen” on organic farming that it’s because “people are slow to take up new things” (Kingsolver 204): “You know, [farmers] have to be. When you could lose everything in a season, it’s not smart to gamble. I think my in-laws resent the healthy-and-organic business because it makes it sound like what we’re doing must be unhealthy and unorganic” (204).

the new and the unfamiliar depicts her desperate desire to expand the threshold of her small-town reality (2). She is additionally exasperated by the unrelenting “small enclosure” of Feathertown’s conservative and Christian identity, one that prompts her husband, Cub, to, first, describe climate change as something that “Al Gore can...toast his buns on” and, second, declare that “[w]eather is the Lord’s business” (261; 260; 261). Similarly, she shies away from Byron’s purely quantitative comprehension of climate change and his quick labelling of any non-empirical understanding of the butterflies and the climate crisis as “very superficial” (365). Dellarobia even questions her own binary formulation of ideological communities, wondering whether some of the stranger characters that the butterflies attract to Feathertown also fit into the territory divide of climate beliefs. She particularly thinks about an international group of women activists who traveled to Feathertown to express solidarity with the butterflies by living in the forest alongside them, knitting monarch replicas out of recycled orange yarn as a way to draw attention to the monarchs’ climate-related plight (300): “Where did wild-haired girls knitting butterflies in the woods fit into this scheme?” (321). Within this essay’s feminist framework, her question is notable, first, for positing the possibility of a climate change knowledge unbounded by a binary belief system, and, second, for implying an ontology woven amongst materialities. The activists demonstrate an embodied knowledge of climate change. Not only have they consciously situated themselves within and in relation to the local environment, but their knitting is a material acknowledgement of climate change as a larger, metaphorical weaving of global relations in attempts to bring into perspective the intertwined climate and ecological crises.

As a metanarrative clue to a non-binary reformulation of climate knowledge, Dellarobia’s question additionally serves as an echoing chamber for her emphatic and mysterious distinction between *don’t* and *can’t*: “I’m not saying I *don’t* believe you, I’m saying I *can’t*” (283). If her

can't rings as vague and obscure, it is precisely because it asks to be read as an epistemological and ontological departure from a binary climate discourse. Throughout *Flight Behavior*, *can't* is gradually clarified as a unique cognitive approach to climate change that moves beyond the pale of mainstream climate denial and the limited and limiting framework of territory divides. As Dellarobia attempts to explain to Byron, the difficulties of acknowledging the advent of climate change are much more complex than simply refusing to deny, or “face up” (230), to its reality. During one of their conversations, she hints that quantitative data holds little weight in a science illiterate community like Feathertown that might understand climate information more successfully through inference systems that call upon pre-existing knowledge or narratives. “It’s not that we’re all just lazy-minded” (282), she tells him. “People can only see things they already recognize.... They’ll see it if they know it” (282). On one hand, Dellarobia’s comment is easily dismissed as an evocation of a cordoned-off consciousness that cannot think newness if newness does not sprout from within the cultural logic it subscribes to. On the other hand, in her covert description of Feathertown as an epistemological community, she conveys to Byron that there exists a far broader understanding of evidence and logic than that bequeathed by science in what might be a covert suggestion for the re-evaluation of his communication methods.

My above use of the phrase epistemological communities is borrowed from feminist philosopher Linda Nelson. The phrase epistemological community describes “a group or community that constructs and shares knowledge and standards of evidence” (124). For Nelson, epistemological communities are prior to knowing individuals (138). In other words, individual knowledge or experience of the world is derivative and entirely dependent on how knowledge has been shaped and mediated by historically and culturally specific theories and practices, which profoundly influence the nature of evidence and experience (138). While Nelson exclusively uses

epistemological communities to describe groups of expert knowledge-makers, such as academics and scientists, the term can be extended to non-expert communities, such as Feathertown, as a general and much-needed reminder that local communities are also active knowledge-makers.

Indeed, Dellarobia's response to Byron indicates that Feathertownians are not passive recipients of knowledge, subjects whose social relations and contexts are irrelevant to their knowing. She instead suggests that the townspeople are a specific group of knowledge-makers who would be more likely to qualitatively create knowledge of climate change by conceptualizing it through local experiences, discourses, and practices. For example, as she tells Byron's graduate students, her church community's conclusion that the butterflies are spiritually meaningful provides an ethical learning opportunity for those who previously saw their environment as nothing more than an everyday backdrop: "It's inspiring for people to see. It helps them respect the earth" (152). Feathertown's Christian beliefs are presented here as providing fertile ground for the cultivation of community members' awareness of climate change and environmental wellbeing. Bobby Ogle, the local pastor, even uses a Sunday sermon to condemn the habits of today's "throwaway society" and frame environmental mismanagement issues in relation to the Bible: "the Old and New Testaments together had over a thousand passages about respecting God's earth" (166-67). In these examples, the knowledge that "we are *of* the world" leaps from the community's cultural roots rather than ideological assertions and suggests the possible development of what Plumwood calls an ecological rationality, a material, "dialogical, non-reductionist and self-reflective" modality of reasoning critical to rethinking the dualistic zeitgeist—mind/body, man/woman, human/nonhuman, skeptic/warmist—of the Anthropocene (Zylinska 54; Plumwood 53).

Plumwood's ecological rationality departs from the premise that the crisis of reason has transformed rationality into a tool for justifying elite powers, since the mind/body dualism naturalizes radical inequalities between a privileged class—identified with a rationalist system of ideas—and material forms of life and knowledge. In Plumwood's work, ecological rationality thus serves a strategy for the instigation of environmental justice and an ethical, dialogic global society in which peripheral, disadvantaged, and minority voices can speak and be heard on matters of environmental and human welfare. Within the context of this essay, however, the ecological rationality synonymous with Dellarobia's *can't* is an embodied knowing of climate change facilitated by qualitative, experiential frames. The material relations these frames engender become known via a knowledge that is otherwise than ideological. Knowledge, in other words, is no longer something socially legitimated through a series of agreed-upon norms, rather, it can perhaps best be explained as Butler's concept of apprehension, which provides a working basis from which to discuss the nature of Dellarobia's non-binary knowledge of climate change and its implications for her transformation into a situated knowledge broker.

Apprehending Climate Change

Dellarobia's apprehension of climate change hinges on her personal understanding of the exigency of life, which remains highly visible throughout *Flight Behavior* in her intense awareness of the vulnerability of human and nonhuman bodies. The first suggestion of this apprehension emerges when she is invited by Byron and his graduate students to see what their scientific investigations consist of. Standing among the butterfly roosts, Dellarobia listens closely as the students explain how monarchs are biologically programmed to migrate to geographical locations they had never been before, such as her own backyard, in order to adapt to changing environmental circumstances, such as unstable temperatures. She remains lost in their jargon-laden terminology until a familiar

word gives her pause: “Bio-geography, roosts, host plants, overwintering zones, loss of something—communities, devastation. That one she got, devastation” (147). The significance of this familiarity remains mysterious until roughly fifty pages later, when Dellarobia reveals in conversation with her best friend, Dovey, that a heartbreaking miscarriage had preceded her two children (192). Narrated in the disarming context of Dellarobia helping Dovey prepare for a date on New Year’s Day—the eleventh anniversary of the miscarriage—the tragedy seems, at first glance, unrelated to the novel’s climate change concerns. Yet Dellarobia’s personal devastation and mourning of the lost infant powerfully influences her apprehension of climate change.

In fact, throughout *Flight Behavior*, scenes that obscurely and separately meditate on the butterflies and the miscarriage come to inform each other, with Dellarobia’s experiential knowledge of the latter giving way to an understanding of the larger ecological changes implied and forecasted by the former’s aberrant presence. In a concrete yet fleeting connection made between the devastation of the infant’s death and the devastation that would be the colony’s extinction if it does not survive the oncoming Appalachian winter, Dellarobia imagines that the butterflies “would pass through this world like that baby”—swiftly, quietly, heartbreakingly—“while most people paid no attention” (229). Here, infant and butterfly become linked as two proximate points on a spectrum of mortality, both which highlight humans’ profound difficulty in understanding how to conceptualize and live in the growing shadow of impending climatological and environmental disaster. The butterflies’ endangered status underscores, in Joseph Masco’s words, humans’ “limited ability to apprehend, let alone comprehend, the edges of extinction, its almost-here-ness, or, as Thom Van Dooren might put it, the “flight ways” of ongoing species loss” (87).⁵¹ The unnoticed passing of the infant as one who precedes the butterflies, as if s/he were a

⁵¹ Here, Masco references Van Dooren’s *Flight Ways*. The connections between flight ways and the title *Flight Behavior* will not be lost on the reader.

tragic sounding-board to measure humans' reaction to the coming extinction, suggests that not only do humans have a limited ability to apprehend the edges of extinction but they also have a very limited understanding of loss that impinges upon thinking connections between life, life endangered, and life extinguished and how these define the contemporaneity of the climate-changing present.

In a scene where Dellarobia precipitates a discussion about her miscarriage with Cub—it's a topic that has been astoundingly swept under the rug of their marriage—Cub vocalizes these limitations upon asking why they need to talk about the infant if its "gone" (381). Dellarobia, stricken, responds, "It is not *gone*. Not like something that never existed. It *was*, Cub" (381). Her emphasis on the infant's life as a life that was lived, and that should be remembered for it, imbues the infant—crucially, not the memory of the infant but the infant itself—with a type of agency that takes on a generative meaning and expands the interdependent network that precarious life relies upon beyond the parameters of mortality. The infant's death, and thus its existence, profoundly impacts the realities of those that outlive and proceed it and toward the end of the novel is concretely revealed as a shaping factor in the Turnbows' lives. As Dellarobia tells her young son, Preston, in one of the final chapters, his sibling prepared the way for his own existence: "if that [other baby] hadn't come and gone, there'd be no Preston.... The other baby gave us a present, which was you" (424). The infant's life and death are invoked here as something generative, as part of the interdependent social network that makes Preston's life possible. A reconsideration of *Flight Behavior* through the lens of this scene suggests that the infant exemplifies how Dellarobia apprehends climate change: as a devastating event, as a change that will drastically reconfigure the lives of those it impacts, but also as a change that opens new opportunities for life and new discoveries of life's capacities.

Indeed, throughout the novel, Dellarobia recasts the butterflies' migration from that which is foreboding in its aberrancy to that which recalls life's adaptive capabilities. When Byron describes the butterflies as a "complicated system" whose migration is indicative of its own breakdown (145), a corollary image formulates in Dellarobia's mind of a beautiful body in cross-continental, migratory flight: "This was a living flow, like a pulse through veins, with the cells bursting and renewing themselves as they went. The vision filled her with strong emotions" (146). Contrasting to Byron's mechanistic and methodological explanation of butterfly life, as if it were a marble "rolling from one end of a box to the other and back" (146), Dellarobia envisions the monarchs' *en masse* biological functioning as an entity asserting its capacity to exist, change, adapt. Life becomes something that is meaningful and beautiful in its very exigence. It is this specific way of knowing and seeing the butterflies that illuminates the logic behind her relief that they are not "refugees of a horrible misfortune," forced into Tennessee by some sort of destruction of their summer roosting site; if that were the case, Dellarobia thinks, "there could be no beauty in them" (143). While Byron makes the case that the monarchs are refugees of the anthropogenically-induced misfortune of climate change, for Dellarobia, the butterflies are beautiful precisely because of their capacity for adaptation, which is powerfully conveyed in moments of flight. On the novel's closing page, for instance, as a watery spring begins to dawn, Dellarobia watches the colony's winter survivors billow into the sky to begin their next migration in a scene that once again evokes the image of a vibrant, living body:

Not just a few, but throngs, an airborne zootic force flying out in formation, as if to war.... Their numbers astonished her. Maybe a million. The shards of a wrecked generation had rested alive like a heartbeat in trees, snow-covered, charged with resistance. Now the sun blinked open on a long impossible time, and here was the

exodus. They would gather on other fields and risk other odds...flanked by white mountains, they flew out to a new earth. (433)

Dellarobia's apprehension of climate change through the interconnected frames of the infant's generative body and the butterflies' adaptive bodies models a knowledge of environmental crises that wells from experience and challenges human exceptionalism as the historical, primary framework for understanding the world. In its avowal of the corporeal, Dellarobia's knowledge challenges traditional presumptions about the objective, value-neutral nature of epistemology that has historically dictated what is accepted as a legitimate, rational, and true knowledge of the world.⁵²

Apprehension broadens the concept of epistemology to the multiple, to experiences, perspectives, anxieties that together reconfigure what it means to know. It is an Irigarayan revolution, in which the given is cracked open by the sudden acknowledgement of an array of attributes and qualities and becomes a field for the interaction of different expressions of knowledge and knowers as subjects with affective bodies. As an example of the epistemological agent that was earlier disclosed by my interpretation of Butler's concept of apprehension, Dellarobia is an actualizing of the virtual in the fictive world of *Flight Behavior*. This alliance of Butler and Irigaray's feminisms in the name of reconceptualizing the ways in which we can think climate change jumpstarts the below investigation into a feminist climate communication.

Feminist Discursivity

It is one thing to call for a feminist mode of climate communication to acknowledge the legitimacy of the multiple ways in which non-expert communities cognize environmental change and risk. It is wholly another to communicate climate change in a manner that will register as relevant and

⁵² On these presumptions, see Grosz, "Bodies and Knowledge."

meaningful to the discourses and practices of non-expert communities, especially when the former has already been perceived by the latter as connotative of political agendas that pose an existential threat. What results is the community's quick coalescence around a sense of common identity from which it is easy to adopt a pugilistic view of politics and the issue of climate change. Weiner's observations indirectly communicate the importance of what might be called a community's conceptual locality, that is, how a community conceptually distinguishes itself in the national or even global political and cultural landscapes. Ecocritic George Hadley and theologian Willis Jenkins have each separately argued that communities' immediate defensive positions of climate denial are not only unproductive but unnecessary and that the preservation of conceptual locality begins first and foremost with expressing the "autonomy of the human imagination" (173). In an essay on climate skepticism and Christian responses to climate change in the United States, Handley emphasizes that there "are ample resources...within every society to remake and revitalize human community in light of new phenomena without having to betray or distort tradition beyond recognition" (173). Similarly, Jenkins suggests in *The Future of Ethics* that communities can "use their [cultural] inheritances to create new responsibilities for unexpected problems" (5). Both scholars conclude by suggesting that the future of conceptual locality, and similar expressions of human freedom, "starts with a fundamental, sobering acknowledgement of the contingencies of the biological context in which human choices are made" (Hadley 173).

If these arguments are read with the challenge of climate communication in mind, the connections they draw between environmentally ethical thought and practice and the maintenance of conceptual locality suggests that it would be strategically advantageous for climate communicators to present climate information through a feminist discursivity akin to what Evelyn Fox Keller, in another context, describes as a language "of [environmental] kinship, embeddedness,

and connectivity” (35). Feminist discursivity, however, is not simply a matter of adopting a language of kinship as a delivery method for an ethos of multiplicity; rather, it is language-making as an interpretive undertaking. In other words, it is the process of creating a common language that demonstrates itself as an interpretation of community values, priorities, and anxieties. For example, in her monograph *Ozone Discourses*, an investigation into the discursive science-policy work of the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, Karen Litfin speaks to the crucial importance of presenting science through the lens of culture when she observes that *how* atmospheric data was communicated during the lead-up to the protocol was more important than exactly *what* the data entailed. Litfin writes that during the ozone talks, scientific knowledge of ozone depletion only became legitimized in the eyes of policy-makers when it was translated by knowledge brokers into interpretive frameworks directly related to national interests and political agendas (6). To incentivize the United States’ ratification, for instance, the “messy” issue of climate change “was essentially excluded from [United States] policy discourse despite being a central concern of scientific research” (189). Knowledge brokers instead linked the ozone issue to policy-makers’ pre-existing concerns over the rise of skin cancer, discursively repackaging climate science information to tell a worrisome narrative of the health effects that continued ozone depletion would have on American citizens throughout the twenty-first century. Litfin consequently concludes that the impact of scientific knowledge is determined far more by its incorporation into larger political, social, and cultural discursive spheres than by its objective validity.

Indeed, soundbite portrayals of climate change in the media—including scientific models, measurements, and climate projections—often lend the illusion that knowledge of climate change is solely produced and interpreted in the splendid isolation of scientific laboratories. Yet the

widespread acceptance and validity of climate data largely originates in the hybrid spaces of research-and-policy projects, such as the Montreal Protocol, where it is translated into the potential for national or global change through sociopolitical processes of legitimation. For example, each of the assessment reports issued by the IPCC have been reviewed by a wide range of governments and organizations before publication. Due to the crucial importance of international political consensus on climate change knowledge and policy, government representatives have even significantly contributed to the wording of the reports' chapter summary conclusions. Such input occurs under multidimensional science-policy advisory relationships that reveal the co-production of climate science's epistemic authority. In an ideal advisory relationship, scientists and policy-makers would work together to mediate the epistemological and ideological constraints of their separate professional worlds. These relationships are often conceptualized as moments of "boundary work," which describes the purposeful translation of information across the epistemological and methodological "boundaries" of different disciplines through meaning-making practices that allow for the social negotiation of that information.⁵³ Often, however, science-policy relations are stymied by a host of contextual, institutional, and ideological factors. Policymakers might co-opt scientific data to further a political agenda or even label data as inaccurate for ideological reasons. Scientists might shy away or deliberately refrain from addressing the policy implications of their research, feeling that the policy arena is not objective

⁵³ Such practices are evidenced in colloquial expressions that describe atmospheric phenomena. During the Montreal Protocol, the now well-known phrase "ozone hole" was coined to translate the science of ozone depletion into a cognitive image of a vulnerable planet in urgent need of repair. In the early debates on anthropogenic climate change, climatologist Jerry D. Mahlman popularized the term "hockey-stick graph" to describe scientists' reconstruction of hemispheric temperatures evidencing unprecedented global warming in the 20th century. The graph shows a long, relatively even maintenance of temperatures until 1990, whereupon a sharp spike-like increase is visually reminiscent of the blade portion at the end of a flat hockey stick shaft. Both "ozone hole" and "hockey-stick graph" continue to serve as fundamental metaphors for communicating atmospheric changes to non-scientific audience. For more on boundary work see Gieryn and Hoppe's respective works.

in the scientific sense. At this point, the advisory relationship is maintained through the work of knowledge brokers, chameleon-like intermediaries who can discursively massage information to set the terms for science-policy discourse. Not only are knowledge-brokers familiar with the academic research involved in research-and-policy projects, but they are also able to identify its policy-relevant angles and thus strategically frame science-policy information in language accessible to both parties.

Throughout *Ozone Discourses*, Litfin discusses the role of the knowledge broker in facilitating science-policy. Equipped with the “skills needed to understand the work of academics and others” (36-37), knowledge brokers “have a flair for translating that work, identifying the policy-relevant angles in it, and framing it in language accessible to decision makers” (37). Their ability to make a broad range of highly specialized science or research discursively available underscores that, in the process of science communication, “interpretation is more important than fact” (37). Indeed, knowledge brokers are significant to the process of science communication due to *how* they communicate, as opposed to *what* they communicate. Their role in rendering information interpretable to the non-expert makes them crucial players in scientists’ and environmental advocates’ ongoing operation to bridge the climate information gap between scientists and the public, which requires fostering a knowledge of scientific uncertainty via appropriate interpretations.

While knowledge brokers have mostly served as intermediaries around the policy table, their translation abilities have been noted as particularly effective in the rare occasions that they have communicated climate change to the public. In one case study, the work of knowledge brokers became particularly effective at the local level when knowledge brokers “pair personal stories with climate science to make climate change personal” (Galford et al. 390). When climate

researchers in the state of Vermont partnered with knowledge brokers from the Vermont Climate Assessment (VCA), they were able to connect stakeholders with researchers to provide information on regional climate impacts and engage decision makers in state climate assessments. In Rutland County, Vermont, VCA knowledge brokers paralleled local stories and traditions with climate data to transform climate change from an abstract to a personal event with implications for the residents' and surrounding environment's wellbeing. As Galford et al. explain, many long-term Rutland County residents "perceive climate change indicators out their back door, such as shifts in phenology, lengthening of ice-free time on a lake or increased number of peak flow events on rivers" (390). As an exercise, VCA knowledge brokers used Joe's Pond Ice Out, an event at a local pond, as a discursive strategy to connect residents with data showing a history of warming in the Rutland County area:

[Every year,] the [Rutland County] lake association holds a contest to guess the date the ice melts, as measured by a cinder block that crashes through the ice and unplugs a clock anchored on shore. This is a local news highlight. The data begin in 1983 and show that, on average, ice off is now occurring 5–6 days earlier than in the 1980's. Vermonters have long been familiar with Joe's Pond Ice Out; the VCA refocused the event through the lens of climate change. Historical changes in climate may not reveal the variability or acceleration of climate trends but observed changes often resonate with decision maker's experiences or identification with proximity to the site of the measurements. Acceptance of these historical patterns is the basis for interpreting future scenarios of change, so to identify changes already underway increases comprehension of scenarios for the future. Thus

historical trends were presented to introduce future climate change, with further authority and understanding provided by local vignettes from citizens. (390-391)

The Joe's Pond Ice Out example emphasizes that knowledge brokers do not simply translate information to render it interpretable to the non-expert, but that they may be highly active in distributing information through networks and contributing to the production of the knowledge that they translate. In the past, knowledge brokers have "identified local gaps in climate information and, in many instances provided primary data" (388). According to Galford et al., on several occasions, "brokers worked with researchers to co-produce climate information that emphasized science and society...When knowledge is coproduced in collaboration between scientists and decision makers it is more likely to be utilized by these authorities...and the information process is viewed as more legitimate" (389). However, as Galford et al.'s above use of tentative vocabulary suggests, rendering data interpretable does not necessarily equate to persuading audiences to take mitigative action against climate change. Knowledge production, as Johan Pottier emphasizes, "is embedded in social and cultural processes imbued with aspects of power, authority and legitimation; the act of producing knowledge involves social struggle, conflict and negotiation" (2). Knowledge brokers are therefore additionally tasked with anticipating and navigating these contexts if they hope their translations will incite change. Yet while Galford et al. and Litfin's respective studies present general examples of climate communication as an interpretive undertaking, Weiner, Hadley, and Jenkins' commentaries on the ideological challenges facing climate communicators suggest that the interpretive turn in climate communication cannot simply be interpretive but also *situated* amidst communities and ecologies. I speak here with Donna Haraway and her notion of the situated gaze that is immanent in the multiplicities of the world, which I will elaborate on below. My idea for a feminist discursivity is

therefore deeper than an ability to productively rework climate science into a meaningful narrative. Its method of communication is Latourian articulation, that is, the recognition of radical difference and the participation in the chorus of the collective through a swapping of energies. It weaves the world into the narratives of communities.⁵⁴

In her essay “Situated Knowledges,” Haraway seeks to decentralize the discourse of objectivity from relativist doctrines in order to revitalize science as a practice that privileges multiplicity and jumpstarts the “transformation of systems of knowledge and ways of seeing” (585). For Haraway and scholars who espouse a feminist epistemology, a relativist understanding of objectivity derives from the “unmarked positions of Man and White” that, through the lens of “the conquering gaze from nowhere,” visualize and claim to know an object of knowledge (581). The emphatic use of “unmarked” and “nowhere” describe relativism as a metaphysical positioning, a transcendental state of “being nowhere while claiming to be everywhere equally” (584). Haraway stresses the profound unethical implications of such an un-situated gaze, stating that relativism’s so-called “‘equality’ of positioning is a denial of responsibility and critical inquiry” in its refusal to conceive that there are limits to its perspective (584). The result is a complete abnegation of alternative ways of viewing and knowing. Against the absolutist “gaze from nowhere,” Haraway posits a situated gaze, or a positioned understanding of the object at hand, which she characterizes as a platform from which to begin weaving the parameters of a situated, feminist objectivity. Rather than describe a designated fixing-in-place, situatedness connotes a positioning of the subject amidst a multiplicity of viewpoints. It asks the subject to “split” herself as a knower (587), that is, to become contradictory to a restricted economy of self. For Haraway, the subject’s process of splitting “should be about heterogenous multiplicities that are simultaneously salient and

⁵⁴ For a discussion of Latourian articulation, see Chapter Two.

incapable of being squashed into isomorphic slots or cumulative lists” (586). Splitting thus describes a multidimensional subjectivity, in which the “knowing self is partial in all its guises, never finished, whole, simply there and original; it is always constructed and stitched together imperfectly, and *therefore* able to join with another, to see together without claiming to be another. Here is the promise of objectivity: a scientific knower seeks the subject position, not of identity, but of objectivity, that is, partial connection” (586). From this patchwork perspective, the object of knowledges becomes “an actor and agent,” something in its own right with its own perspective rather than “a screen or a ground or a resource... [or] a slave to the master that closes off the dialectic in his unique agency and his authorship of ‘objective’ knowledge” (592).

If the methods of climate communication were reconfigured so that knowledge brokers were engaged in situated interactions with communities themselves, the methods of climate communication would transform from simply a strategic deliverance of climate data into a project of connectivity interested in fostering webbed connections and in mixing practices of objectivity. If focused on becoming attuned to the situatedness of an epistemological community’s knowledge, a communicator’s task would take on an anthropological aspect that would require a submersion in the community’s discourse with the intention of learning the socio-cultural roots and articulations of communal needs, fears, strengths, and goals. These could then be used as guidance to establish the discursive strategies necessary to effectively communicate about climate and would function to ensure that all communal realities would be honored. Rather than exclusively locate the potential for belief in climate change and pro-environmental behavior in communities’ acceptance of empirical data, the *situated* knowledge broker would consider herself responsible for molding climate information to community cultures, values, and epistemologies via a dialogue that would be immanent in the world. Shifting, teasing, crossing, and pushing at the boundaries

that delineate perspectives, she would play with the demarcations of reality to shoot towards the virtual and open new possibilities for relating to the ecological economy, both for herself and for those she encounters. I find the possibility of a situated knowledge broker in Kingsolver's *Flight Behavior*.

The Situated Knowledge Broker

Dellarobia's quiet and unconscious role as situated knowledge broker is manifested early in the novel in her keen ability to notice divergent realities. In a scene when her mother-in-law, Hester, arrives at the house, Dellarobia moves to put her toddler daughter, Cordelia, down for a nap. Far from tired, Cordelia is busy playing with a plastic toy telephone, "tapping the yellow head of her telephone receiver against the edge of the table" (134). When Hester comments, saying that the child will do everything with the phone but talk on it, Dellarobia begins to see the toy in a different light: "Dellarobia studied the toy – bulky body, cord, receiver, dial – and realized it did not resemble any telephone that existed in Cordelia's lifetime. Phones lived in people's pockets, they slid open, they certainly had no dials" (134). She realizes that Cordelia wouldn't know to talk into it since she wouldn't even recognize that the shape of her toy was that of a corded telephone. Dellarobia is momentarily stunned: "She'd seen something so plainly in this toy that was fully invisible to her child, two realities existing side by side. It floored her to be one of the people seeing the world as it used to be. While the kids shoved on" (134). Though Dellarobia's thoughts read as lightly veiled analogies of a pre-climate change reality and a climate changing one, her ability to simultaneously conceive of two ways of knowing and marvel at their heterogeneity illustrates her situatedness, her conceptual immanence amidst multiple perspectives on reality.

Whereas Byron's use of scientific methodology to search for an objective answer to the monarchs' aberrant migration fictionalizes science's dogged drive to "tell us what *is*" (320)—an

epistemological position that feminist science scholars roundly criticize as corralling the world's multiplicity into a transcendental vision of absolute fact—Dellarobia's involvement in Byron's scientific activities generate from a desire to participate in the ecological configurations that engender and sustain life. Indeed, as she decisively tells herself halfway through the novel, "She had to be part of [the monarch's] story" (256). The language in which this realization is conveyed, its emphasis of her need to enter a global ecological collective, illustrates the critical, heterogenous mental positioning Haraway emphasizes as key to achieving situatedness. Indeed, the image of Dellarobia entering the "story" is a succinct illustration of the situated knower as one whose knowledge of the world is achieved not through a methodological transcendence of limits to knowledge but by becoming immanent in a world-community. Here, ways of seeing, interpreting, and knowing that previously functioned in accordance to the absolutes of dominant ideologies are fractured, split, made partial to reside alongside others "for the sake of the connections and unexpected openings" (Haraway 590)—or for the continuance of life—that such unassuming partiality makes possible. When Dellarobia's husband, Cub, asks her what she does as a secretary and amateur assistant to Byron and his team of scientists, she responds, "I see new things" (258). While perhaps literally referring to the newness of science as a discipline that has recently been opened to her, Dellarobia's comment more compellingly suggests that her experience of lepidoptery, however elementary, serves as the threshold of a community of existents that, when crossed, severs her from the absolutes of the normative and initiates her into the kinetic frenzy of collected partialities.

What does practicing and thinking a situated science imply for climate communication? The feminist objectivity Haraway posits above characterizes the situated knower as one who is an assemblage of partialities, each which represents a different way of understanding and living

within the world. A partiality is laden with a specific way of knowing unique to its ontological position. As an assemblage of partialities, the situated knower is encapsulated within an ontological framework engendered by myriad orders of difference. The situated knowledge *broker* is uniquely aware of this framework and thus able to, first, identify where it needs applying to the social sphere, and, second, entwine the partialities of scientific and non-scientific communities through discursive strategies that disclose and reflexively reconsider what Evelyn Fox Keller calls the “thickness” of scientific language (*Secrets* 28). Practicing and thinking science from a situated position therefore implies laying the groundwork for a common language that communicates the urgency of mitigative action and proposes pro-environmental behaviors while simultaneously modifying science to acknowledge and address community-specific anxieties.

Establishing a common language means breaking down disciplinary strictures that have traditionally distanced science from the public sphere. In *Secrets of Life, Secrets of Death*, Evelyn Fox Keller explores the constitutive role of language in scientific thought and action when she outlines how discipline-specific linguistic representations of the material world lend experimental control to scientists’ investigations. As descriptions of methods and results are discursively engineered to communicate an experiment’s logical structure and objectivity, language becomes a modality of scientific rationality that establishes conventions by which claims to truth can be supported and variables controlled.⁵⁵ Intended to facilitate transparent and objective communication between scientists, scientific language as a technical discourse was not intended to be shared beyond the science community. As a result, challenges arise when it is reworked into everyday language, especially when specific definitions of, or relations between, theory, reality, method, and proof fail to survive the translation process. Removed from the structure and context

⁵⁵ See Keller 15-38 in *Secrets of Life, Secrets of Death*.

of scientific language, these might misleadingly suggest more ambiguity than fact, causing audiences to distrust or call for a closer scrutiny of scientific practice.

Flight Behavior fictionalizes the divisive consequences that translation has upon science-public relations. Over the course of the novel, Dellarobia urges Byron to speak to journalists reporting on the monarch phenomenon, arguing that he alone can lucidly explain the anomaly as a troubling symptom of rapid climate change. Byron, however, shies away from the media, telling Dellarobia that the objective aims of science limit the extent to which scientists should directly interact with the public: “All we [scientists] can do is measure and count. That is the task of science” (244). Tangling in public debate jeopardizes both the perceived linguistic purity of scientific discourse and the reputations of scientists themselves: “our peers will criticize our language as imprecise, or too certain. Too theatrical. Even simple words like ‘theory’ and ‘proof’ have different meanings outside of science” (323-24). Yet Dellarobia interprets Byron’s anxieties surrounding the monarch colony’s aberrant migration as a sign “that the task of science was a good deal larger than” ensuring the continued perceived legitimacy of its language and methodologies (244). The “task” of science, she quietly realizes, additionally includes effective science communication: “Someone had to explain things” (244). As one both troubled by the monarchs’ plight and aware that a widespread change in human behavior requires an equally widespread, basic scientific understanding of biology and environmental science, Dellarobia keenly feels Byron’s lack of an organized, dedicated attempt to explain his work to the public.

Here, *Flight Behavior* extends a metanarrative challenge to the scientific tradition: in a historical moment in which clear science communication is crucial to advancing pro-environmental behavior, science is strongly urged to reflexively consider the extent of its splendid isolation from the public realm. Amending the task of science to include science communication

would automatically open critical modes of scientific objectivity to the partialities—in Haraway’s sense of the term—composing the public sphere, even if only through scientists’ awareness that their methods and conclusions would eventually be responsibly translated to different communities of non-expert audiences. Dellarobia’s comment therefore powerfully calls for the public to become an ongoing presence interwoven, if invisible, amidst scientific practice. Notably, this requires science to abandon the discipline-specific anxieties Byron evokes above and invest in translating scientific information with the goal of reframing social imaginaries around the co-formative link between human and natural ecologies. Yet, as Dellarobia comes to realize, this is a reframing that Byron is unable to facilitate by himself. Despite his training in “the study of biological communities” (324), she notes that he remains woeful unaware of the socioeconomic and identity dynamics that influence human populations. Observing, for example, his perplexed expression when she attributes Feathertown’s disinterest in environmental concerns to its financial and, consequently, psychological inability to support a sustainable agenda, she notes that “[m]aybe he knew more about butterflies than people” (323). Determined to open the lines of communication, Dellarobia undergoes a more conscious expansion into a situated knowledge broker as she begins to orchestrate communicatory possibilities between Byron and the local community.

As one familiar with what she calls the “small enclosure” of Feathertown’s logic and the basic science surrounding the butterflies’ appearance (261), Dellarobia can discursively bridge Byron’s scientific reality and the disadvantaged socioeconomic reality of the town’s farmers. At the heart of her attempts to establish a common language is the realization that the groups’ disparate beliefs and priorities converge in their shared interest: the butterflies. The mountain roost quickly becomes a pilgrimage site both for the scientists, eager to witness a climate change phenomenon, and the Feathertown residents, eager to interpret the butterflies as a quasi-religion

sign or, at the very least, a good omen. As Dellarobia notes, “There were two worlds here, behaving as if their own was all that mattered. With such reluctance to converse, one with the other. Practically without a common language” (152). Yet she intuitively realizes that the mass converging on the Turnbow’s property highlights a shared awareness of life gone awry. Though the scientists and residents evidence varying levels of, and reasons for, concern regarding the inexplicable changes to the butterflies’ biotic processes, their interest nonetheless highlights the monarchs’ presence as a clear common denominator underlying, with the possibility of interlinking, radically different world outlooks.

Dellarobia uses the shared experience of the extra-ordinary as a baseline from which to weave a common language. Her extended conversations with, for example, her mother-in-law, Hester, and her husband, Cub, in which she gently introduces climate change as the probable cause of the butterflies’ appearance, urge readers to focus on the process of this weaving, specifically the ways in which she relates scientific and community-based discourses. During a rare moment in which Dellarobia and Hester bond over the agriculturally disastrous months of rain—“Water torture, they were calling it on the radio” (336)—Dellarobia is able to delicately explain climate change to Hester during the course of their conversation. Referring to the rain, Dellarobia says, “They say this might be permanent... Scientists say that. The weather will just get all wild instead of settling down...look at all the crops here that molded on the vine. And us, having to buy hay for our sheep. You have to wonder, you know. Who’s going to feed who?” (337). When Hester asks the cause of the weather, Dellarobia stops to think before explaining climate change to her down-to-earth, Christian mother-in-law in a succinct word: “‘Pollution,’ she said. ‘You pollute the sky long enough, and it turns bad on you’” (337). Hester accepts that this “[s]tands to reason” (337). In pausing to consider her choice of words, Dellarobia opens a pathway for Hester to

consider the possibility of an alternative reality, one that becomes disclosed through rhetorical and reasoning techniques that emphasize the familiar.

The forging of such strategic pathways is even more apparent in an earlier scene in a conversation between Dellarobia and Cub. One January morning, as she and Cub inspect the condition of the fence enclosing their farm's pasture, Dellarobia suggests to Cub that Feathertown officials should approach Byron to better understand the butterflies' presence. When Cub agrees yet admits that no one in town wants Byron's council since he's an "outsider" (257), Dellarobia attempts to transform Byron into a more familiar figure by comparing his work and motivations to those of a farmer's responsibilities to his livestock. "It's just knowing all there is to know about an animal," she tells Cub, adding that Byron's interest in the butterflies is like the Turnbows' own vigilance over their sheep, "He wants to know what's making the butterflies sick" (259). Only when she stops translating, explaining Byron's hypothesis that the butterflies' migration is due to changing temperatures, is Cub quick to disagree. Aware that her husband is not "disposed to this way of thinking" (259), Dellarobia reverts to analogies that frame lepidoptery within the local discourse he is familiar with. When he asks her to elaborate on the butterflies "sickness," for example, she explains,

"It's like if every Friday you drove to Food King, but then one Friday you did the same as always, followed the same road signs, but instead of Food King you wound up at the auto parts store. You'd know something was messed up. Not with you necessarily, but something out of whack in the whole town."

Cub appeared to take this in.

“So they’re here by mistake,” she said. “And they can’t adjust to it. Dr. Byron said it’s like if we got persuaded to come out here for some reason and live among the sheep. We still couldn’t eat grass.”

.... “What persuaded the butterflies off their track?” Cub asked. (260)

Cub’s curiosity and intelligent questions continue until Dellarobia mentions climate change, whereupon he snorts, kicking the frost on the ground and saying, “Al Gore can come toast his buns on this” (260). Recognizing the comment as a line frequently used by the local radio weatherman, Johnny Midgeon, Dellarobia asks why Cub would take the word of a radio persona “about something scientific” over that of scientists themselves. Cub replies, because “Johnny Midgeon gives the weather report” (261). While Dellarobia reels at the “small enclosure of this logic” (261), their conversation is notably a productive exchange of information until climate change is associated with the political arena, whereupon the discussion veers away from the wellbeing of the natural world and becomes anthropocentrically grounded in local and political alliances.

As if to combat future generations following in the wake of Cub’s reasoning, Dellarobia later convinces Byron to invite her son’s kindergarten class to his make-shift laboratory and the butterfly roost site. Byron only accedes to the field trip after engaging Dellarobia in “several well-tempered disagreements about ordinary people mistrusting scientists” (353), seemingly slow to grasp her intention to build science-public relations through an education-based encounter. The field trip additionally serves as a much-needed learning experience for Byron himself, extracting him from his enclosed world of objective methodologies and conclusions and exposing him to a facet of the Feathertown community. For example, when one little boy asks if Byron was the president of the United States, explaining himself with the forthright comment, “Because you’re wearing a tie” (356), Byron is taken aback at the logic and asks the kindergartener whether his

father wore a tie for work: “‘No,’ said the boy, and Dellarobia could see Ovid taking this in: no on the tie, or no on the going to work, maybe no dad, period. She felt this was a productive meeting of minds” (356). Though quick, this is perhaps the lepidopterist’s most powerful encounter with the concept of difference. The process of attempting to make sense of the boy’s “no” forces Byron into a temporary leave-taking of the objective, universal scale of science for the consideration, however quick, of the existence of another outlook upon the world. The child’s comment seems to remind Byron that processes of meaning-making—in this case, making sense of who Byron is based on his tie, a symbol of power and authority in the kindergartener’s mind that he evidently does not associate with his father—do not always emerge from scientific measurements but from socially-inflected processes of knowing specific localities. Indeed, the boy’s logic, like Cub’s, presumably stems from experiences exclusive to Feathertown as a farming community hard-pressed to make ends meet.

Curiously, while environmental thought and activism have placed utmost emphasis on the need for pro-environmental behavior if the brunt of climate change impacts are to be avoided, little thought has been given to the communication methods that would make this very behavior possible. There has yet to be a significant effort to rethink climate communication as a form of Butler’s interdependency, which here can be slightly modified to include the acknowledgement of not only of the Other’s physical precarity in the world but also of her values, beliefs, anxieties, and experiences. To discount these is to return to the binarism of the sciences’ epistemic/non-epistemic discourse and its display of a rationality configured on the belief of an existing corrective, on a good, pure, legitimate way of thinking that can counter or ward off bad, tainted, or illegitimate forms of expression or representation. Though the corrective mentality that perpetuates or upholds a binary discussion of values in the sciences cannot be directly connected to the corrective methods

of early climate communication strategies—the very notion of communicators’ belief in a “deficit” model, for example, implies that a correction of some kind is needed—if climate communication is considered a realm of practice correlative to climate modeling as a realm of theory, the two highlight a need for a new epistemological agent that accepts mixtures, hybrids, uncertainties.

The structural uncertainties of climate change here issue the human with yet another demand to evolve by remembering herself as a materiality that knows through her affectable body and acknowledges the materialities of Others. To see difference as an additive rather than a corrective, as an invitation rather than a contaminant is to foster a diverse, conscientious, and articulate public sphere that displaces a regime of dualisms. The idea of a situated knowledge broker and her ability to enfold climate science into the realities, rhythms, and environments of a locality suggests that climate communication can be based on communal and narrative criteria that gives special emphasis to dialogue and experience in the knowledge-production process.

While the situated knowledge broker cannot illuminate a surefooted path to agreement, she can prioritize revealing multiple possibilities to those she addresses, offering and providing a multi-focal yet unifying contextualism from which decisions can be approached, experiences can be considered, and knowledge reframed. In the process, she would ideally prompt the creation of other situated knowers able to understand and imagine themselves inhabiting the places from which multiple viewpoints originate and would thus peddle the egalitarian promise of climate communication justice. Ideally, the situated knowledge broker would be able to prompt a knower to ask the following question, which repeatedly surfaces in conversation throughout *Flight Behavior* between Dellarobia and the other characters: “What’s *real*?” (Kingsolver 173). A question that repeatedly surfaces in conversation throughout *Flight Behavior* between Dellarobia

and the other characters.⁵⁶ The context in which the question arises provides a hidden answer. Always referenced in discussion, it suggests that what is real is the discussion itself, or, rather, the discussions themselves. What is real are epistemological communities and the possibilities for their interaction. The situated knowledge broker seeks to connect these communities.

⁵⁶ The question arises between Dellarobia and Cub (173), Dovey (181), Byron (282-83), and Preston (428), respectively.

CHAPTER 4. GENDERING SUSTAINABILITY: WOMEN AND WATER JUSTICE IN INDIAN LITERATURE

Introduction: Women, Development, Sustainability

In 1967, the United Nations General Assembly issued the Declaration on Elimination of Discrimination against Women and requested that all member nations prepare reports on the status of women in their countries. In response, the Government of India constituted the Committee on the Status of Women in India (CSWI), which was tasked to conduct a nation-wide review of the positive changes in women's status that were expected to have resulted from constitutional equality and national development. The resulting report, however, tellingly entitled *Towards Equality* (1975), exploded assumptions that Article 15 in the Constitution of India (1950) had eliminated gender inequality in its proclamation of fundamental, legal rights for all citizens. *Towards Equality* provided rigorous statistical data that unveiled women's economic exploitation, their brutalization in the domestic and public realms, and their severe social marginalization. Written primarily by female CSWI committee and task force members who traveled the country to learn of the lifestyles and gather the testimonies of their sisters across caste, class, and urban and rural sectors, *Towards Equality* not only revealed the status of women in post-Independent India but, in doing so, gave witness to the sociocultural entrenchment of patriarchal structures.⁵⁷ At the level of government,

⁵⁷ CSWI committee and taskforce members were made up of social workers, academics, members of Parliament, experts in education, political scientists, social anthropologists, and academics in law and literature. Vina Mazumdar writes that the Report was revolutionary in its gathering of information about women of "nonprivileged classes and was thus able to draw the concerns and priorities of the latter into the perspectives of the movement" (43). In contrast, "The earlier women's movement was led by a very small number of educated women, who gathered and analyzed social data to influence its own leadership. This limitation confined the concerns of the earlier women's movement to a few social problems that affected women mainly in the urban middle class and, at a later date, in organized industry. The extension of the post-1975 research to peasant women and women in the informal sector generated new sources of information for the fast-growing women's movement" (43).

the report led to comprehensive legislative and administrative measures to combat gender inequality. At the level of the populace, it issued a powerful ethical injunction that defined the agenda for women's studies and the contemporary women's movement.

Towards Equality was a call to broaden the notion of the social by replacing class with gender as a central organizing principle of social discourse and analysis. As an interdisciplinary, critical dimension of the social sciences, women's studies used this call to raise questions about the way social theory framed the operations of modernization—as the progressive urbanization of the regressive rural—and assessed models of growth.⁵⁸ “Any analysis of development cannot be only quantitative, a question of more or less development,” writes Vina Mazumdar, who stewarded the CSWI report's publication and pioneered women's studies and activism in India. Rather, development discourse and assessment additionally require qualitative analysis given that the effects of development differ across class, caste, tribe, and gender. “The question, therefore,” as Mazumdar continues, “is not about development as such but, rather, what kind of development—one that only increases inequality and gender exploitation, for example, or development that is sensitive to egalitarian and gender concerns” (46).

Yet the question of development and its effects on social groups is also a political question that encompasses issues of who is granted or denied political subjecthood and who is given a participatory voice in the nation's future. Notably, while *Towards Equality* was intended by the government to “enable women to play their full and proper role in building up the nation” (*Towards*

⁵⁸ According to Mazumdar, these questions include: “Why did women's historic roles in the discovery of agriculture, pottery, and textile production in India (and the world) remain hidden from the educated community for so long? Why has the massive infrastructure for agricultural research and development failed even to *see* women's contemporary roles and problems? Why has women's labor in the family remained outside the framework of any analysis of the production and reproduction of commodities and services and their valuation? And why have investigations into the caste-class-community nexus failed to examine its connections with controls over women's labor freedom and behavior?” (47).

Equality xii), the report—and consequently the initial wave of women’s studies it influenced—was silent on the political front, giving no consideration to the relation between gender, development, and governance. In 1994, Mazumdar attributed this to the Indian government’s loss of “political perspective on the issue of gender equality” (Mazumdar qtd. in Gopalan 348). For her, the committee’s retrospectively myopic examination of gender and society had been engineered by government-issued terms of reference intended to guide the report’s general production: “There is talk about social status, housewife, mother and discrimination and then suddenly the absence of the term ‘political’ hits you” (Mazumdar qtd. in Gopalan 349). A year later, a curiously similar disjunction between gender, politics, and development was witnessed on the international stage when the United Nations Development Programme (UNDP) stated that improvements in “the public sector management aspects of governance...might promote the realization of objectives of sustainable human development” (“Reconceptualizing Governance” 1). In her essay, “Locating Gender in Governance Discourse,” Niraja Gopal Jayal points out that both the instrumentalization of governance as a means to sustainability and the implicit endorsement of the public-private divide in the UNDP’s emphasis on public sector management only further exacerbated women’s marginalization in development discourse. As she writes, the UNDP made “little or no attempt to recognize the private sphere as an area of governance—e.g., the family—or as an area influencing the exercise of social power and modes of governance” (109). The national and supranational conceptions of governance Mazumdar and Jayal respectively criticize emphasize that the franchises of constitutional equality and development not only have very limited potential to transform women’s realities but also open to severe questioning the apparent gender-neutrality of the concept of the citizen.

Jayal's observation provides the starting point for this chapter in its implicit suggestion that sustainable developmentalism, an appropriation of the climate crisis by economic liberalization, is divided along sexual lines. The below sections reveal and disturb this crisis, seeking to situate women as political actors within India's national sustainability discourse and politics at large. More specifically, they examine the joint effects and inequalities that national governance and supranational sustainable governance exert on rural Indian woman in the context of participatory sustainable water management programs intended to combat climate-change-induced water scarcity. While Jayal uses sustainability as a prompt to broadly consider the idea of contemporary governance and the lack of female political agency, this chapter identifies the possibility for female political agency from the conceptual standpoint of a gendered sustainability.

What I call a gendered sustainability identifies gender difference as the specificity of effective resource management; that is, it rethinks resource management as the utilization and maximization of what Jacques Rancière calls the "distribution of capacities" (49). For Rancière, political subjecthood occurs when an individual's capacities—what she can see, hear, speak, and do—are uncoupled from the policing discourse of an established order that organizes and limits modes of participation in a common social world. The realm of politics thus becomes "the employment of the [unlimited] capacity of anyone whatsoever" with political action founded "in the action of uncoupled capacities that crack open the unity of the given and the obviousness of the visible, in order to sketch a new topography of the possible" (49). To connect to the language of "uncertainty" that I have been employing throughout this book, we might say that Rancière's action is necessarily uncertain in its transcendence of a linear ordering of things, hence its ability to sketch new possibilities. It is thus better thought of as ongoing moments of collective intervention, where outcome is undetermined and intervention an undisciplined performance.

Individuals constitute themselves in relation to the common social world through their speech and actions rather than through identities prescribed by the disciplinary ideological dictates of caste, class, or gender.

A gendered sustainability is both located within and helps to perpetuate this common world of action. It is a cultural effort to slough off the hegemony of globalism, the masculinist-solutionist mentality of modern economic means, and the patriarchal structures that accompany them. We can powerfully conceptualize gendered sustainability as a subversive social struggle for a politics akin to what Vandana Shiva has called Earth Democracy—a term that Shiva uses to describe the reclamation of the planet as a commons in a political movement for peace, justice, and sustainability. Prioritizing the distribution of Rancièrian capacities, Earth Democracy replaces developmentalism, technocracy, and efficient accumulation programmatic with a radical democracy centered upon the interrelationships between people, their communities, and local ecologies. Gendered sustainability, as an ecological praxis, is thus an articulation of the intertwined and agential uncertainty of human and ecological capacities, wherein the former describes an undisciplined performance of identity and the latter encompasses the biological capacity of organic material to adapt to new climates and impact inorganic natural systems.

India's water scarcity crisis is the crucible of rural women's issues. In this chapter I show how a gendered sustainability manifests itself in forms of female political agency centered on water practices. I begin with a review of the general, historic relation between women and water, to give a preliminary understanding of the vulnerability that a climate-related increase in water scarcity will have on rural, particularly Dalit, women. The joint occurrence of gender inequality and resource injustice is perpetuated by India's caste and economic systems, which rigidly prescribe how and where water can be accessed and collected. While women are daily water

handlers, their interactions with water are mandated by a sociocultural politics of caste and gender within which their labor is invisible and their political subjecthood null.

As I have shown in previous chapters, political issues of class and gender are closely connected to the science of climate modelling. While climate modeling does not have a discursive apparatus capable of fully conceptualizing and thematizing the ontological character of women's political position in relation to water, climate model probabilities can provide a sense of the uncertainty that humans and, more particularly, disadvantaged and minority populations face in relation to a climate-changing future. For instance, climate and hydrological models suggest a rise in the probability of disastrous floods and severe water scarcity at the heart of India's watershed regions. Model probabilities sketch extreme gender and resource injustices in rural communities that have yet to enter into mainstream climate justice discourse. Model uncertainties can be used to anticipate and mitigate these injustices by influencing policy and reinforcing the concept of uncertainty that underlies gendered sustainability.

A sharp decrease in water availability will have profound implications for the food and water security of populations and will strongly affect the gross domestic product of India's agrarian-based economies. The Indus, Ganges and Brahmaputra river basins, for example, support approximately 700 million people to the south of the Hindu Kush Himalayan ranges and are used for drinking, industry, agriculture, and hydropower.⁵⁹ With an 2018 online article placing India's current annual water withdrawal for agricultural use the highest in the world at 688 billion cubic meters (DownToEarth, "688 billion cubic meters"), it is clear that surface water and, more particularly, groundwater scarcity in South Asia will severely impact the water available for municipal purposes. Due to aggressive groundwater consumption by agricultural and industrial

⁵⁹ Approximately 144,900 ha of land are currently being irrigated in the Indus Basin, 156,300 ha in the Ganges Basin, and 6000 ha in the Brahmaputra Basin. See Immerzeel, van Beek, and Bierkens.

sectors, groundwater tables are already falling steeply, with depletion equivalent to a net loss of 109 km³ of water between 2002 and 2008 (Rodell, Velicogna, Famiglietti 1001).⁶⁰

The latter half of this chapter considers how participation in sustainable water management schemes have compounded gender inequality through a hybrid form of neoliberal and traditional governance. Throughout the twenty-first century, women have been increasingly involved in participatory water management programs as tokenistic figurines intended to either amplify a water program's efficiency or provide the illusion of gender equality. Here, I consider the importance of literary works of Indian feminist drama in troubling the gender-blindness of existing water management policies. Employing a feminist and political ecology lens, I read Mahasweta Devi's play *Jal/Water* (1976, trans. 1986) and Dalit playwright M. M. Vinodini's street play *Daaham/Thirst* (2002, trans. 2005) as contesting deeply-rooted inequalities in the social distribution of water. Both plays seek to redefine water rights from gendered and socioecological perspectives in their parallel staging of Dalit women's struggles to ensure their community's equal access to local wells in the face of drought, discrimination, and government corruption. When read through the uncertainty of climate models and gendered sustainability, *Jal* and *Daaham* imbue the Dalit feminist consciousness with a crucial socio-political agency in relation to sustainability endeavors and jumpstart the renegotiation of social constructions of gender and caste in the cultural imaginary. Ultimately, I argue that future water-related climate change injustices can be prevented if rural women and their communities are placed at the forefront as political actors of localized and sustainable water management initiatives.

⁶⁰ Astonishingly, this equates to double the capacity of India's largest surface-water reservoir, the Upper Wainganga, and nearly triple the capacity of the United States' Lake Mead, the largest man-made reservoir in North America (Rodell, Velicogna, Famiglietti 1001).

Establishing the Political Frontier

The radical democracy that a gendered sustainability proposes rings reminiscent of First World ecofeminism's political horizon, which is encapsulated in the notion of globalization-from-below. A gendered sustainability performs a figurative linking of the many local, grassroots movements resisting the degradations of corporate globalization in order to mount a universal democratic project in defense of cultural and biological diversity. While not to be considered an umbrella movement in and of itself, globalization-from-below describes the figurative assemblage of local groups across the world, each working apart from the others but all thematically joined together in pursuit of what Vandana Shiva calls "a new global order of ecological care" ("The Greening of Global Reach" 155). Notably, there is no singular, go-to expression of globalization-from-below but rather a multiplicity of articulations stemming from ecofeminist analyses, organizational structures, and activist efforts formed in the spontaneous eruption of local communities' individual decisions to stand in protection of, and out of responsibility for, the rights and integrity of diverse lives and lifeways. Globalization-from-below is consequently intensely pragmatic in that it describes concerns, hopes, and a practice of resistance unique to each community and the community's relation to the local ecology.

Amongst ecofeminist scholars, Shiva offers one of the most powerful and complete visions of globalization-from-below in her *Earth Democracy* (2005), a manifesto for "an emergent political movement for peace, justice, and sustainability" that unfolds "in an atmosphere of dialogue and diversity, of pluralism and partnerships, and of sharing and solidarity" (1; 4). Shiva's title describes a people's project to return the planet to a commons state, thereby fostering a community of beings supported by the earth's ecological systems. Formulations of economy, politics, and culture would evolve from a constant, kaleidoscopic "unfolding of the potential of diverse and multiple locals" (96), and communities would act "in self-organized ways but guided

by the common principle of...reverence for life” (96). The heterogenous universality that characterizes globalization-from-below is most clearly articulated in Shiva’s assertion that Earth Democracy is “the emergent quality of all people living by the universal principles of non-violence” (96), which evolve “from the consciousness that while we are rooted locally we are also connected to the world as a whole, and, in fact, to the entire universe” (5).

Shiva’s repetition of the adjective “emergent” is noteworthy: it describes communities and ecologies as mutative, or, better yet, möbian, emerging from diversity while simultaneously being the place from which diversity itself emerges. Indeed, Earth Democracy is not a destination but an ongoing destabilization of transcendental conceptual structures that limit the proliferation of fundamental freedoms, basic rights, common responsibilities, and ecologies’ abilities to flourish. In *The Good-Natured Feminist* (1999), one of the first comprehensive books to holistically consider the ecofeminist corpus in relation to democracy, Catriona Sandilands describes the emergence of a democratic sense of the universal in the concept of globalization-from-below. Her notion of universality is a virtuality and names a global-wide collective of local practices of resistance that together form a “political anthology of grassroots struggles” (133). Sandilands writes, “the universal is both politically necessary and politically unattainable. It carries the weight of the common good but is always derived from particular identities and interests” and resultantly cannot derive from nor congeal into an ideological structure (134). Conceptualizing, striving towards, and enacting this state of becoming is undeniably the foremost element in creating a global order of ecological care. However, ecofeminists have yet to consider how to help empower those whose localities and daily realities are organized and dictated by socio-politically entrenched patriarchies. How, for example, are rural Dalit women to develop social agency or a political voice when they are doubly oppressed by the Hindu caste system and strict gender relations and divisions

of labor? Do these women see their lived, material relation with the local environment as an extension of these patriarchies? Or, perhaps, can these material relations—which include women’s daily and seasonal knowledge of local resources—be strategically developed or expressed in a way to become invested with political clout?

Towards Equality’s revelation of India’s profound gender inequalities and Mazumdar’s critique of the Indian government’s political gender-blindness here become partners for ecofeminism in their ability to incite a reflexive consideration of ecofeminist discourse. Is there an inadvertent degree of injustice to conceptualizing the universal as the political frontier when women and other marginalized groups have yet to freely participate as citizens with individual rights in their country’s political system? Bina Agarwal hints at this question herself in her 1992 essay “The Gender and Environment Debate: Lessons from India,” where she coins “feminist environmentalism” to provide a “Third World perspective on gender and the environment” (120), one attained through the realization that “women’s and men’s relationship with nature needs to be understood as rooted in their material reality, in their specific forms of interaction with the environment” (126). Evoking women’s studies’ emphasis that a responsible championing of women’s rights in India necessitates a consideration of women’s issues at the material levels of caste, class, religion, and ethnicity, Agarwal points out that gender-material relations in India are specifically contextualized within the caste and class system, which facilitates or limits individuals’ and groups’ access to resources, including arable land and potable water. A feminist environmentalism therefore engages in an immediate grappling with dominant groups for joint gender-economic justice in an attempt to shatter patriarchal conceptualizations of labor and access. Differentiating it from ecofeminism, Agarwal writes, “On the feminist front there would be a need

to challenge and transform both *notions* about gender and the *actual* division of work and resources between the genders” (127).

Admittedly, Agarwal was responding to early ecofeminist scholars—such as Ynestra King, Carolyn Merchant, Judith Plant, Ariel Salleh, Susan Griffin, and Karen J. Warren—whose work focused on “the *symbolic* construction of women and nature and the ways of *acting* upon them” as well as how these ways suggested “new values and social structures...based on the full expression of both male and female talent and on the maintenance of environmental integrity” (Agarwal, “The Gender and Environmental Debate” 122; Merchant xix). Agarwal’s emphasis on women’s interaction with resources, and the extent to which these interactions are affected by discriminatory caste- or class-based rules, continues to be relevant today.⁶¹ Despite remaining unconsidered by Western ecofeminisms, a feminist environmentalism offers a productive entry point to think an intertwining of women’s rights in India and a feminist material politics.

My concept of gendered sustainability extends Agarwal’s feminist environmentalism. As a strategy for change, it is an intimate analysis of: the structural maintenance of traditional gendered divisions of labor and the constraints these erect against women’s ability to participate in local resource governance; the extent to which these have been impacted by a global mainstreaming of a sustainability discourse heavily inflected by the privatization of resources; the projected impact that climate change will have on India’s groundwater and the gender vulnerabilities that might consequently result from increased water scarcity in the coming years; and, finally, the possibility that women’s work-based relation with water can become a platform upon which women can develop agency in local, regional, and national governance to influence resource policy and social reform. Gendered sustainability is consequently not another description

⁶¹ For more on the relation between women, patriarchy, and agriculture in India, see Agarwal’s *A Field of One’s Own*.

of globalization-from-below. It instead provides a way for women to break oppressive local patriarchies and achieve the autonomy necessary for the implantation and influencing of a global order of ecological care. More succinctly, it is the establishment of what this chapter will call a material gender politics, which names *how* to reformulate the woman-resource relation that will usher in a gendered sustainability. Material gender politics is envisioned here as a political frontier that precedes and prepares the way for an Earth Democracy.

Material Matrices: Gender, Water, and the Female Body

In the context of India, a material gender politics would mean recognizing rural women's lived experience of hydrological infrastructure as grounds for their open participation in politics and the political economy, both generally and in terms of sustainable practice. While rural women are daily water handlers, supplying their households with drinking, bathing, and cooking water from wells or pumps, their interaction with water is heavily mandated by a patriarchal politics of caste, class, and gender that leaves unacknowledged not only the life-giving work of women's water labor but also their acute knowledge of their community's water needs and the facilities required to manage and improve community-based access to clean, potable water. As will be seen, rural hydrological infrastructure—which here refers to public water structures such as wells, irrigation canals, communal taps, and water pipes—is deeply entrenched in a context of structural violence that leaves unacknowledged the vital importance of women's work and knowledge to communities' wellbeing and to local and regional preemptive preparations against water scarcity.

Understanding women's roles in the rural water economy is the first step toward subverting patriarchal water priorities and achieving women's access to and participatory management of local water sources. While there is no direct road from the awareness of gender-resource injustice to political action, troubling a patriarchal water infrastructure brings women's water work out of

the shadows and onto the national and international stage so that it can, first, be acknowledged with the intention of reorienting the nature of power and the meaning of citizenship, and, second, be used to better anticipate how women's current vulnerabilities will be heightened by climate change. The task of this section is to throw these two points into relief by establishing what Rey Chow calls "the automatized and animated condition of [women's] own voices" as "the conscious point of departure" for an Indian feminist intervention intended to institute a material gender politics (112). Within the context of her article, "Postmodern Automatons," Chow's description of women's voices calls attention to the female body as "an automaton on which social injustices" take on a life of their own (107). Here, the body becomes subject "to social exploitation whose origins are beyond one's individual grasp" (106), and in this way becomes deconstructed as a living, agential assemblage of materialities. Though Chow's own references to the automatized body take place in a discussion of modernism, postmodernism, and Third World feminism, in the context of India and gender-resource injustice, the automatization of the female body results from the patriarchal, discursive production of women and water in the Indian cultural imaginary.

"The Thakur's Well" (1931), a short story by the early twentieth-century Hindi writer Munshi Premchand, provides entry into a discussion of the prescriptive, gendered, and caste-based relation between water and women. The narrative opens with Gangi, a Dalit woman, realizing that the water she had drawn from a distant well had turned foul overnight—"Surely some animal must have fallen into the well and died" (83)—whereupon she risks drawing a *lota* from the local thakur's well to safely hydrate her sick husband, Jokhu.⁶² As she prepares to leave, Jokhu reminds her of the harsh penalty acted upon Dalits that draw from upper-caste water sources, "You'll come back with your arms and legs broken.... You'd better just sit down and keep quiet" (83).

⁶² *Thakur* is a feudal title for master or lord; *lota* is a vessel within which water is stored or carried.

Historically, Hindu social hierarchy viewed Dalits' bodies as eternally unclean, tainted by their traditional occupations dealing with death, excrement, blood, and dirt.⁶³ The nature of their work instigated their enforced ethnic segregation from upper-caste facilities and resources since it was feared that they would pollute food and water sources. Though Gangi knows that a violation of cast codes could result in bodily punishment, she is driven to the well out of necessity: "she didn't know where else she could get water" (83). "The Thakur's Well" culminates in and concludes with the following scene:

[Gangi] looped the rope around the bucket. Like some soldier stealing into the enemy's fortress at night she peered cautiously on every side. If she were caught now there was not the slightest hope of mercy or leniency. Finally, with a prayer to the gods, she mustered her source and cast the bucket into the well.... [S]uddenly the Thakur's door opened. The jaws of a tiger could not have terrified her more.

The rope escaped from her hand. With a crash the bucket fell into the water, the rope after it, and for a few seconds there were sounds of splashing.

Yelling 'Who's there? Who's there?' The Thakur came toward the well and Gangi jumped from the platform and ran away as fast as she could.

When she reached home, Jokhu, with the *lota* at his mouth, was drinking that filthy, stinking water.

Premchand's story problematizes the situatedness of rural water sources, both in terms of where potable wells are located and how these locations organize and are organized by the dominant cultural imaginary. Available water sources are barometers of caste and gender inequalities.

⁶³ Traditional Dalit occupations include sewage cleaning, tanning, leatherworking, removing the carcasses of dead animals from public areas, catching rats, street and latrine cleaning, and cremating and burying bodies.

Individuals or groups are either capable or incapable of accessing these based on patriarchal policing. Who is given access to what well thus serves as testament to whose presence and participation in the common social world is welcomed, acknowledged, or denied.

While “The Thakur’s Well” immediately lends itself to a meditation on caste inequalities, when read against the water crisis and the sexual division of water labor, it draws attention to how the situatedness of water bears on rural women’s material realities. Gangi’s plight is a literary dramatization of the practical challenges that perpetuate caste-gender inequality and resource injustice, including physical punishment for incursions to general or caste-established rules of water-access and the daily task of journeying to water and carrying it back to the homestead. Furthermore, the entrenchment of the caste system in rural communities makes Dalit women far more constrained and at risk when fulfilling water responsibilities in comparison to upper-caste women. Women who do not have privileged access to a nearby communal water source spend approximately four to six hours a day walking to and from distant wells (Rao 68), during which they balance as much as forty to fifty kilograms of water-filled containers on their heads, hips, or shoulders (Gopalan 236). The extreme weight carried for long distances over unpaved terrain has resulted in severe health problems, including joint pain, slipped discs, postural defects, prolapsed uteri, and even paralysis if an accident occurs. Additionally, in the action of collecting and carrying water, women are exposed to water-borne diseases and skin rashes due to pollution from fertilizers, chemical runoff, and fecal coliforms.⁶⁴

Water sources are feminine spaces insofar as they are extensions of the domestic sphere, with water work strictly defined as women’s work. The gendered nature of water work is so severe that pregnant women are not exempt and under the arduous physical labor of carrying water

⁶⁴ See Freeman, Trinies et al. for discussions of water contaminants.

containers risk poor fetal development if no other female family member in the household is available to help.⁶⁵ In some communities, respite from water duties only arrives during menstruation, which becomes a way to attribute water scarcity itself to women's bodies. For example, upper-caste residents of the mountain village Chuni in Uttarakhand draw water from sacred underground mountain springs. When the water level drops or the source dries up—an increasing occurrence due to the severe depletion of India's water table—the water is said to have been polluted by menstruating caste Hindu women, who are forbidden to draw water until they are “purified” from their bodily flows on the fifth or seventh day (Joshi 58).

Socially constructed meanings in relation to the situatedness of water additionally bear on rural women's political realities. Very bluntly, the so-called femininity of women's water work occludes political subjecthood since the form and nature of gendered water labor, as an extension of the domestic sphere, remains unacknowledged by national, state, and local governments as labor proper. Neither external, central, nor state government policies mention the work or vulnerability of rural women in water supply policies and during periods of drought state-level supply schemes prioritize crop irrigation for big agriculture over household water scarcity. By a “backward chain of logic, when politics *are* formulated to tackle drought, it is assumed that drinking water scarcity has also been addressed” (Rao 74, added emphasis). Furthermore, state water priorities are focused on—and sometimes are even managed by—the water needs of Western agencies that have largely taken charge of irrigation development throughout the country rather than on those of small landholders, subsistence farms, and communities. In the 1990s, India's central government

⁶⁵ Deepa Joshi writes that only “unique personal situations coerce young men to perform domestic water-related work. In Chuni village, Anand Agari aged about 16, is one of the few young men who regularly fetches water, cooks food, washes clothes, sweeps and mops the floors, etc. His mother is unable to see in both eyes and his two elder sisters are married. Anand's mother is deeply pained at her son's situation and the poverty of the household which she believes makes Anand a ‘lesser’ man” (57).

delegated water responsibilities to individual states while simultaneously reducing the amount of funds available to instigate or continue programs to combat water scarcity. The reduction in states' fiscal independence led to a welcoming of foreign direct investment through water programs instigated by the World Bank and International Monetary Fund.⁶⁶ In taking charge of the majority of India's irrigation development, these supranational agencies newly defined water rights by determining percentages of water use among land users in a given area (van Koppen 364), a decision that heavily reflects the extent to which water management revolves around specific priorities and definitions of water use and categories of water users. Indeed, the general prioritization of agricultural irrigation over household water scarcity in rural India means that very little thought is given to the class, ethnic, or gendered characteristics of non-agricultural water users and how these users are affected in moments of drought or groundwater scarcity. For example, in the Indian state of Gujarat, residents of the village of Vadabar laid underground pipes to divert water from a nearby agricultural canal into an empty village pond for women's household use. Canal authorities, however, later filled the pipes with concrete and cement to keep the water from being siphoned to non-agricultural sources, forcing Vadabar women to use a livestock water trough to bathe, wash clothes, and collect water for domestic use (Shah, "Women and Water" 174).

In the very performance of backbreaking labor, women are repeatedly taught their own sociocultural inability and invisibility. Configured by socio-religious discourse, gender relations and divisions of labor essentialize the Indian woman, characterizing her through a constellation of gender-appropriate ideas, such as fertility, purity, sin, disgrace, wifehood, and motherhood, that come to discursively manufacture her very being. Rarely does this constellation acknowledge the material or environmental realities—water, farming, flood, drought—that impact rural women on

⁶⁶ For a thorough history on India's economic liberalization and privatization in the water sector, see Asthana (Chapters Three and Four).

a daily or seasonal basis. As Partha Chatterjee notes in his book *The Nation and its Fragments* (1993), throughout the religious and cultural texts that morally reason modern India's gender relations, "The figure of the woman often acts as a sign...standing for concepts or entities that have little to do with women in actuality" (68). Characterized by religious and social law, the Indian woman thus appears to be a construction of language, a fictive representation fashioned by systems of power that divorce her from the material realities that inform her existence.

Yet even when women are culturally linked to materialities there is an overwhelming disjunction between the material attributes that lead to a symbolic gendering of natural phenomena and the socially inscribed attributes that represent the living woman. Water has a symbolic central position within India's religious and cultural imaginary, and in the rich written and oral cultures of riverine communities it is socially constructed as feminine, equated with the life-giving and destructive powers of Indian goddesses. In a recent essay, anthropologist Kuntala Lahiri-Dutt problematizes this representation, inadvertently evoking Chatterjee's above observation in her argument that the feminine construction of rivers and groundwater in the cultural imagination celebrates the sign of femininity while continuing to subordinate women to patriarchal structures of power: "Femininity is an integral part of this imagination, yet the woman of riverine communities with their daily burdens...are carefully left out of this symbolism" (389). Indeed, the conflation of rivers and goddesses identifies symbolic femininity as something that transcends gendered relations and labor, uncoupling the very concept of the feminine from women's social positions. Lahiri-Dutt points out that this uncoupling is rooted in the ways in which waterways have been predominantly imaged and imagined as representations the feminine *shakti*, a nourishing spiritual energy that unites the manifold planes of cosmic and individual life (392). The holy river Ganga, for example, with its supposed purificatory qualities, is often considered as *shakti*,

personifying the goddess Ganga, who is depicted in Hindu mythology as a beautiful young woman, loving mother, and graceful consort of Lord Shiva. Similarly, the rivers of Bengal have been equated to the powerful goddess Kali, who in the Hindu pantheon represents a female version of time, a symbol that easily evokes a braided image of riverine and spiritual flows, each which moves “towards the cessation of itself” in its eventual merger with a larger body (393).

Yet the prevalence of shakti as the primary manifestation of female divine power, both within and beyond its relation to water, has caused feminist scholars such as anthropologist Veena Das to suggest that its expression ultimately stems from a masculine fear of woman’s materiality. Das points out that the principle of *shakti* only finds expression in goddesses “who come to the aid of man and the gods in periods of cosmic darkness” (48), while feminist critic Betty Joseph writes that this subservience of female mythical and religious figurations to both mortal men and their divine male counterparts anthropomorphizes appropriate subject positions for the Indian woman (144-45), subject positions that are notably stripped of all relations to the material world. Chatterjee elucidates this conceptual stripping in a discussion of mystic, Bengali texts that symbolize woman as representative of all worldly things that keep man from achieving spiritual communion with God. Unpacking and explaining the treatment of women in the *Sri Sri Ramakrishna Kathamrita*,⁶⁷ Chatterjee writes that the woman “who stands as a sign of man’s bondage in the world is the woman of flesh and blood, woman in the immediacy of everyday life, with a fearsome sexuality that lures, ensnares, and imprisons the true self of man” (*The Nation* 62), keeping him from reaching spiritual purity. The materiality of the female body appears as “a representation of the prison of worldly interests” that the family man must remove himself from by relating to his wife not as a sexual partner but as a mother (63). In this erasure of the woman’s

⁶⁷ The Bengali *Sri Sri Ramakrishna Kathamrita* recounts the dialogues of the 19th century mystic Ramakrishna and is revered as Hindu scripture.

threatening sexuality, a husband reaches a realization of the true essence of womanhood as an aspect of the Divine Mother, the goddess Kali, and a conduit of *shakti*. As the *Kathamrita* claims, “he who realizes that all women are manifestations of the Divine Mother may lead a spiritual life in the world. Without realizing God one cannot truly know what woman is” (qtd. in Chatterjee, *The Nation* 67). This true knowledge of womanhood, Chatterjee explains, transcends the material body that is woman in the material world, enabling “man to relate to women without either lust and attachment or fear and disgust.... With this knowledge, the family man can live up to a new ideal of masculinity” (67).⁶⁸

When comprehended from a contemporary feminist perspective as an energy that cleaves the woman from the materiality of the world and her own body, *shakti* can be conceptualized as a primary discursive tool in the patriarchal system that hamstring the possibility of Indian women’s political subjectivity. Author Bankim Chandra Chatterji’s novel *Anandamath* (1882), which can be read as a feminist critique of nationalist sentiments in eighteenth-century colonial Bengal, powerfully narrates how *shakti*’s iconographic emphasis on the divine Mother sacrifices female political agency to further a male politic. The novel takes place during the Sannyasi rebellion (1770-1820), in which Bengal Hindu ascetics revolted against the rule of the East India Company. The figure of the divine mother and the problematic of a sexist political ideology emerges early in the novel when the character Kalyani, who embodies the mythologized purity of the devout Hindu wife, dreams of a veiled Mother India who appears alongside a “Supreme form of light” and claims that she is an impediment to the male nationalist struggle (47). Pointing to Kalyani, Mother India says, “It is for her sake that Mahendra [Kalyani’s husband] hesitates to take refuge unto me” and fully embrace his destiny in the budding Hindu nationalist movement (47). The Supreme light

⁶⁸ See Chakravarti, for a discussion of how a patriarchal discourse of motherhood related to caste divisions.

advises Kalyani on an appropriate course of action: “You had better leave your husband and come unto me. This woman veiled in darkness is the mother of you both. Your husband must serve her whole-heartedly. He cannot serve her properly as long as you stay with him. So come;—come unto me” (47). Recognizing that her gender and wifely position yield her no active role in political struggle, Kalyani realizes that her only available form of agency is to obey. Swallowing poison, she releases Mahendra from her materiality—from his ties to her as a provider and sexual partner—to render him capable of an all-encompassing physical and mental devotion to the nationalist cause. At the point of death, she tells him, “I was afraid that for my sake you might refuse to follow the path of your own duty... I have been a burden to your progress.... By choosing death this way and in your presence, I have done well.... Faithfully with all your body, mind and soul, you must now serve Mother India” (49).

In her own interpretation of this scene, Joseph reads Kalyani’s suicide as a “one way of showing how ‘woman’ must be redefined and reimagined to meet the requirements of the [historic and political] moment. Otherwise she can derail the nationalist”—or, in a water management context of the twenty-first century, the patriarchal development and androcentric resource management—“imperative” (123). The remaining sections of this chapter derail this imperative in order to render the female body and its material connections thinkable—that is, available to think with—by uncoupling these from dogmatic representations, thereby offering the Indian woman the opportunity to embody her own materiality. By taking up this offer, the woman automatically becomes a political subject in that she troubles an androcentric politic, wherein trouble, in Judith Butler’s sense of the term, is “the sudden intrusion, the unanticipated agency, of a female ‘object’ who inexplicably returns the glance, reverses the gaze, and contests the place and authority of the masculine position” (Butler, *Gender Trouble*). To derail the imperative is to move beyond

Kalyani's restricted, self-destructive conceptualization of agency and break the body-water-*shakti* nexus that reifies the un-bodied woman. To trouble the politic is to reinvent the political realm through the materiality of women's bodies, which, as entities that interact with and are compositionally influenced by the heterogeneities of matter, contest monologic elaborations of development, power, and religion. A critical question for the establishment of a material gender politics now begins to emerge: how can we think the Indian female body in conjunction with the material world in a way that best empowers rural women at the local level and in the context of water management?

Thinking the female body in conjunction with contemporary materialities includes thinking the female body in conjunction with the uncertainty that characterizes climate change. Uncertainty frameworks the future of India's groundwater and, by extension, its water management initiatives. Climate and hydrological models programed to explore the effects that anthropogenic climate change will have on India's river basins and water table level point to a rise in the probability of severe water scarcity as the Himalayan glaciers that feed India's rivers and aquifers are gradually lost to rising temperatures and the water-holding capabilities of soil and rock continue to be destroyed by mass agriculture. With groundwater currently accounting for approximately eighty percent of domestic water needs (Shah, "Water" 43), caste and gender vulnerabilities will inevitably worsen as water work becomes increasingly strenuous, with women forced to travel further and further distances to potable groundwater sources. Climate model projections and their accompanying uncertainties covertly advocate for a material gender politics by prompting decisionmakers to rethink the organization of the social in relation to resource infrastructures and their centralized management. The below section summarizes climate models' projections of precipitation, glacier melt, and temperature fluctuation in India's main river basins, explaining

their impact on the country's water future before transitioning into the possibilities that climate models and their uncertainties offer to this chapter's conceptualization of a material gender politics.

Climate Models and Water Scarcity

Studies concerned with the effect that climate change will have on South Asia's water scarcity sketch a dark and paradoxical outline of water availability in the twenty-first century. Generally, these studies agree that the total annual water availability in the subcontinent will initially increase due, first, to the intensification of precipitation levels during the monsoon season and, second, to rising temperatures that will trigger glacier melt throughout the Himalayas. Yet the extreme natural events that these changes will incite, including a combination of ferocious flooding and drought in watershed regions, and the manner in which they will be compounded by the legacy of colonial infrastructures of land and water control mean that South Asian populations are facing severe water shortages that will exacerbate existing groundwater and surface water scarcity.

Global water withdrawal, which describes the removal of water from its source, whether through groundwater extraction or in the damming of surface water, has increased more than six-fold within the last century, resulting in approximately 35% of the world population living in regions with severe water scarcity (Kahil, Dinar, and Albiac 95). In a 2016 global scale assessment of the impact of climate change on water scarcity, geographers Gosling and Arnell calculated that within the next sixty years the greatest proportion of populations living in water scarce regions would be in South Asia, with an incredible approximation of 1559 million people living in water scarcity by 2080 (375).⁶⁹ Notably, these numbers were calculated according to estimations of future population levels and water extraction in *absence* of climate change. When Gosling and

⁶⁹ In comparison, East Asia would see 1038 people living in water scarcity, the United States 258, and North Africa 234 (Gosling and Arnell 375).

Arnell added climate change to their study as a factor of water deprivation, they concluded that South Asia will experience a minimum of a 60% increase in water scarcity, which they explain as meaning that 60% of those living in the subcontinent's river basins will experience an increase in water scarcity that is solely attributed to climate change (376).

Global climate model (GCM) assessments of the impact of climate change on water scarcity reveals an indirect and yet urgent need for remedial water management strategies. Data provided by different families of GCMs suggests that climate change is expected to manifest itself in India primarily through an increase in precipitation in the Indus, Ganges, and Brahmaputra basins, particularly during monsoon seasons. The Indus basin, for example, is projected to see a large increase of precipitation levels by 2046-2065. Immerzeel et al. (2010) analyzed data trends from five GCMs and concluded that precipitation in the upper bas is projected to increase by 25% from current baseline levels, while Akhtar, Ahmad, and Booij (2008) similarly projected an increase of up to 21% with data from the PRECIS—Providing Regional Climate for Impact Studies—regional climate model. Using a rainfall model, Forsythe et al. (2014) projected a 27% increase in precipitation intensity during the wettest months of February, March, and April in addition to calculating an annual mean change in precipitation of 18%.⁷⁰ GCM calculations in the Ganges basin also generally show an increase in precipitation but with fluctuating amounts around the monsoon period. In relation to climate change, Pervez and Henebry projected an increase in monsoon precipitation of 10-2.5% over the Ganges basin, while Kumar et al. projected an increase

⁷⁰ The study dates are placed after authors' names as an indicator of when the studies were conducted. Additionally, the last two GCM outcomes were relatively standardized—that is, as far as climate models go—since both used recent data taken from Britain's HadCM3 (the third version of the Hadley Centre Coupled Model, a coupled atmosphere-ocean general circulation model and one of the primary models used in the IPCC's Third Assessment Report) that represented the physical drivers of climate change, such as sunlight intensity, precipitation patterns, and ocean circulation.

in summer monsoon precipitation by 9-15% toward the end of the twenty-first century.⁷¹ While studies in the Brahmaputra basin reveal no statistically significant trends in annual precipitation, they do suggest increases in monsoon precipitation as well as a shift in the monsoon peak period from July to August, which could severely impact agricultural production in the area and increase extreme flooding in densely populated floodplains.⁷²

Despite the increase in precipitation, water scarcity still looms large on India's horizon. Throughout South Asia, water scarcity does not necessarily mean a decrease in precipitation but a decrease in perennial, life-giving rivers and the environment's ability to store and replenish groundwater and surface water. An increase in temperature means the melting of the Himalayas glacier, which is already retreating an average of 27 meters per year (Shiva, *Water Wars* xvii). Glacier meltwater feeds India's river systems and aquifers, meaning that as they disappear the reduction in the amount of meltwater replenishing water sources will have a significant impact on agriculture in the Indus basin, which will sharply escalate the need for water productivity (Nepal and Shrestha 2009). In the Ganges-Brahmaputra watershed, a rise in precipitation and glacier runoff will result in devastating floods and changes to seasonal and peak river flows. Perennial, snow-fed rivers will become rain-fed and seasonal, affecting the communities that live along their banks.

India's food productivity and potable, well-based drinking water rests on the monsoon, which replenishes the groundwater and surface water systems used for irrigation and municipal purposes. A rise in precipitation would consequently seem beneficial. However, the large-scale extraction of the groundwater that supplies the Indus and Ganges river basins currently exceeds

⁷¹ All these studies' predictions are compared to baselines for different weather scenarios. These studies mention what these baselines are in the study.

⁷² See Pervez and Henebry as well as Immerzeel. For discussions and data on climate-induced changes in river flood patterns, see Mirza, Warrick, and Ericksen as well as Gain, Immerzeel, Sperna, Weiland, and Bierkens.

both natural and return-flow recharge, even at increased precipitation levels. Furthermore, water-intensive chemical farming of monoculture crops has not only dramatically over-exploited groundwater but has also destroyed the water-holding capacity of soil, which requires more external inputs of irrigation that, in turn, require the extraction of more groundwater. In short, water-withdrawal technologies have destroyed water commons and collective water rights, depleting water sources to the extent that they have created groundwater famine.

Mining and deforestation projects have additionally influenced porous rocks' abilities to retain water. Hard-rock aquifers, which represent 65% of India's total aquifer surface area are underlain by hard rock formations that have poor permeability, which limits their recharge during rainfall. In *Water Wars* (2002), Vandana Shiva writes that water levels in North India "have fallen by 1.6 inches (4 centimeters) per year between August 2002 and August 2008" with more than 26 cubic miles (109 cubic km) of groundwater having disappeared from aquifers during that time period (xxi). The agricultural destruction of the ability of natural water catchments to retain water means that increased precipitation during monsoon seasons will result in extreme water run-off with high probabilities of disastrous floods and reoccurring drought.

What results is thus a tragically paradoxical parallel between the increase of precipitation and the increase of water famine. The double impact of climate change along with India's history of water management strategies is creating hydrological extremes that will exacerbate the socio-economic and physical vulnerability of regions within the river basins and, by extension, the women and communities within these regions that depend on water access. The groundwater scarcity and flooding that climate models project means that not will women have to work harder for food and water sources but that they might have to do so without the support of male family members, who have begun to outmigrate to urban areas due to the water crisis and in search of

employment, leaving women to care for families and subsistence agricultural plots (Kannabiran 146). Women are thus coming into leadership positions in familial and communal structures that emphasize their need to become involved in water management processes. However, water users are persistently seen at the resource policy and management level as a homogenous group, with Barbara van Koppen stating that the class, gender, and ethnic characteristics of water users “rarely mentioned in mainstream policy, intervention, and even research” (326). She goes on to say that water rights are instead generally vested in households and, more specifically, in the male head of the household (326). The growing outmigration of men to urban centers consequently has negative reverberations for women, who, despite functioning as the practical head of households, not only continue to experience the direct effects of resource scarcity on a daily basis but also continue to have no voice in regional politics and no male voice to advocate on their behalf. Often, regional politics are women’s only opportunity for resource injustices to be addressed and changed.⁷³

Based on the projections of climate models, India is under pressure to develop an efficient water management system and provide incentive for the creation of resource policies that will aid vulnerable members of the country’s population manage the coming water crisis. Of course, all climate model projections are infused with uncertainty, with climate modelers acknowledging that baseline uncertainty factors for South Asian climate models are compounded by the diversity in hydro-climatic patterns due to the region’s unique and variable geographical characteristics.⁷⁴ Yet

⁷³ On women and water, see Das (“Women’s Participation”), Kannabiran, Kumar (*The History of Doing*), and Prokopy.

⁷⁴ As Hassan et al. write in their own study, “Despite substantial improvements in [models’] numerics and in the representation of the physical, chemical, and biological processes taking place in the climate system, a realistic representation of the hydrological cycle in these models has not been achieved, so far” (44). All of the studies quoted here are transparent about uncertainties and dedicate at least a paragraph to describing the uncertainties that their study faces. But see particularly S. Hasson et al for a discussion of what these uncertainties might specifically look like for hydrology predictions. Also, a short discussion of the development of GCMs capabilities of representing hydrological cycles can be found in Hejazi et al 2861.

climate models' uncertainties are just as important as any certain fact in helping India realize that a business-as-usual approach to water management is no longer possible. As Nepal et al. point out in specific reference to GCM uncertainties, "In communicating results on the impact of climate change on water resources to policy and decision makers, the uncertainties associated with the results should also be made clear. This will add value while designing adaptation strategies for different ecological zones and associated with various climate scenarios" (215). Knowledge of the conditions of uncertainty can help decision-makers understand that the data being presented might be an underestimation or overestimation of certain factors. For example, in one model family, the CMIP5, misrepresents the topography of the Tibetan Plateau and Hindu Kush–Karakoram–Himalayan ranges because it does not include the substantial, year-long irrigation activity that impacts regional atmospheric circulation and "plays an important role in determining the strength and spatial extent of concurrent and subsequent monsoonal precipitations" (Hassan et al. 44). The exclusion of irrigation activity negatively impacts the "possibility of achieving a realistic simulation of the precipitation regimes over the region, particularly of that associated with the summer monsoon" (44). An understanding of model dynamics and parameters of uncertainty would help decision-makers evaluate how to approach agricultural and resource challenges. It would, for example, allow the National Institution for Transforming India, the central government's main planning body, in developing or adjusting its ambitious fifteen-year plan for economic growth in relation to appropriate water management.⁷⁵ Ideally, however, processes of adjustment would go beyond simply economic growth, with policy-makers realizing that climate models and their probabilities could open new spaces for democratic discussion regarding the current and future wellbeing of Indian citizens.

⁷⁵ See Shah, "Water," for a summary of the plan's consideration of water.

Uncertainty, Negotiation, Sustainability

Climate model's uncertainty offers itself to policy as a site for negotiating how to sustain collective and individual life in a climate-changing future. It asks policy to approach the triumvirate of economy-society-environment as a vulnerable composition, that is, as an assemblage that is and will be affected by climate change, exposed to and influenced by the unforeseeable changes in earth and atmospheric systems.⁷⁶ Tinged by uncertainty, economy-society-environment no longer names different domains to be domesticated and governed; it instead articulates transversal affinities that rework the conventional categories that they evoke.

My above use of the term “negotiation” is meant to crystallize the impact of uncertainty on resource governance in a time of climate change. It is influenced by J. K. Gibson-Graham's concept of “community economy” in *Postcapitalist Politics* (2006). For Gibson-Graham, community describes a space of “sociality and interdependence” in which beings interact with each other free of essentializations of identity and interdependent in their mutual need to negotiate an ethical economy (83). Economy, therefore, is not a force but an open site of struggle “emptied of any essential identity, logic, organizing principle, or determinant” (Cameron and Gibson-Graham 152). It describes the moment of encounter during which beings negotiate how to organize society around the means of life by engaging in the hard work of encountering others and attempting to compose a world together. Additionally, as Gibson-Graham describes, the negotiation at the heart of community economy is uncertain. How negotiation is accomplished or what it entails cannot be known or even abstractly considered because the process of negotiation is specific to the various needs of interdependent collective life rather than to majoritarian generalizations and categorical predeterminations.

⁷⁶ For a detailed and localized study on economy-society-environment (though one that is only tangentially related to climate change), see Miller.

While Gibson-Graham discusses negotiation within the context of economy, as an ethico-ecological process negotiation is also a space of radical democracy within which a gendered sustainability can bloom as politics. Like the negotiation of community economy, gendered sustainability as a politics is something uncertain, something that escapes capture because it is a formulation of human plurality engaged in negotiating collective life. In contrast, and according to the World Bank, water governance in India since the late 1990s equates to “sound development management” and “the manner in which power is exercised in the management of a country’s economic and social resources for development” (3). Missing from this definition is the idea of a democratic politics in which a multitude of actors are the very substance of governance, so that “governance is no longer simply equated with civil service reform, or with the application to public organizations of management strategies devised in the private sector” (Jayal 98). Here we can begin to make connections between, first, Mazumdar’s observation of the lack of the political in relation to the woman in *Towards Equality*, and, second, the lack of the political in water management, the latter which has been explained as an unacknowledged extension of women’s rights. A gendered sustainability that derives its plural politics from climate model uncertainties emerges as a possibility once we have identified the problematic juncture from which these two lacks spring: the seemingly popular notion that the individual and the collective are incapable as resource managers without the aid of the state.

Elinor Ostrom’s argument in *Governing the Commons* (1990) describes this notion as one that derives from institutions harvesting resources according to the competitive and individualistic nature of the market, which, in its myopic state, lacks an awareness of human and nonhuman communities. This summarizes Garrett Hardin’s famous expression “the tragedy of the commons.” Introduced in his seminal 1968 *Science* article by the same name, the tragedy of the commons

references the degradation of an ecosystem when too many individuals use a resource in common (e.g. a pastureland, farmland, fishing or hunting grounds, groundwater basins, irrigation systems, and communal forests). *Governing the Commons* complicates and elaborates on Hardin's concept by examining "the tragedy" in the late twentieth-century. Considering resource management against the backdrop of multi-national corporations, contemporary public policy, and the neoliberal market, Ostrom states that "the problem facing [common-pool resource] appropriators *is one of organizing*: how to change the situation from one in which appropriators act independently to one in which they adopt coordinated strategies to obtain higher joint benefits or reduce their joint harm" (39, added emphasis). What Ostrom identifies as a problem particular to common-pool resource appropriators might be expanded to describe a challenge pervading the general field of sustainability studies: contemporary conceptions and systems of social order do not consider self-organized collectives as viable forms of social organization through which resources can be appropriately regulated.

Critiquing contemporary policy prescriptions that promote the centralized control and regulation of resources, Ostrom argues that what is missing "from the policy analyst's tool kit – and from the set of accepted, well-developed theories of human organization – is an adequately specified theory of collective action whereby a group of principles can organize themselves voluntarily to retain the residuals of their own efforts" (25). Many analysts presume "that common-pool problems are all dilemmas in in which the participants themselves cannot avoid producing suboptimal results, and in some cases disastrous results" (24). This leads to contemporary conceptions of a social order that imagines an omniscient government, or centralized power, as an agent that is always external to a developing situation, transcendent in its human subjectivity, and able to restructure society to maximize social welfare. "Private individuals, in contrast, are

credited with little or no ability to solve collective problems among themselves” (Sugden qtd. in Ostrom 215). Yet imposing external resource management on a collective means that shared resources and their wellbeing no longer constitute the civil code of society; rather, society becomes coded by the external agency—exerting either centralized, or, as will be seen below, a decentralized control over a population—as incapable and consequently in need of management.

The label of incapability inevitably throws to the fore certain social actors (for example, state and international agencies) and certain types of social transformation (for example, technology transfer) that systematically break forms of local autonomy and social organization that are other to those related to power and developmental thinking. Resource management as a discourse of environmental repair and caretaker services transforms people into universal individuals and groups who are not only susceptible to management but whose very rights and lifeways become managed. For example, Vandana Asthana writes that a number of studies about ancient India have shown that water management has historically been in the hands of local society and has conditioned their ability to organize themselves as local collectives and responsible resource users:

Water management of innumerable water works in villages and the countryside in the form of dams, tanks, wells, reservoirs, lakes, step wells, etc. were managed by local people.... The local control over water and land paved the way for development of the social, economic and political autonomy of villages and communities and regions that often negotiated with, and resisted the authority of, the centralizing control of state or empire. Water was managed through a system of patronage and community control through village councils in most parts of India.

Prior to the arrival of the British in South India water was collectively managed by communities through a system called “kudimaramath[u]” (self-repair). (45)

Kundimaramathu was the practice of building ponds and tanks by local communities that was fed by nearby lakes. Notably, in Tamil, *kundi* means people, while *maramathu* means repair or construct. The *kundimaramathu* system was largely halted during colonialism as bureaucrats with little knowledge of local issues and the seasonal flow of water bodies in their areas took over water management and discontinued state patronage for the maintenance of water works through the introduction of land property rights and resource commercialization.⁷⁷ As a result, local water management fell into disrepair and “completely disappeared from large parts of South Asia” (Asthana 45).

The structural violence to local social organization and resource commons continues unabated with the decentralization of water governance in the Indian states. In an article on women right’s and decentralized water governance in Maharashtra and Gujarat, Seema Kulkarni points out the extent to which this leads to the marginalization of rural women even as both external and internal agencies claim these women to be key figures in the sustainable management of groundwater. Kulkarni summarizes how India’s Ninth Five-Year Plan (1997-2002) sought the

⁷⁷ On the transformation of local water management systems in British India, historian W. C. Neale writes, “When the British came to India it never occurred to them that cultivated land could belong to no one, or, if no one prefers, to a large number of people, each owning [it] in a different way” (51). The British approached the South Asian floodplains like a great environmental laboratory to control flood-prone rivers, manage their flows, separate soils and fluids into separate domains to satisfy the British agrarian imagination, and therefore transform solid land into useful property to tax and sell. These transformations were made with the assumption that rivers in monsoonal tropical regions behaved similarly to rivers in temperate areas of the world. Changing the very structure of rivers has meant that those rivers that drain monsoon rainfall on the Himalayan slopes, such as the Ganges and Brahmaputra, are unable to carry billions of tons of water and sediments to the Bay of Bengal which has been described as the “dumping ground of the Himalayas” (Schiermeier 164). In the past, sediment carried downstream would have refreshed the delta, however, the diversion of the rivers means that sediment is being displaced elsewhere, causing not only the flooding of delta lands by rising seas but also the flooding of inland areas by sediment build-up. For a description of British impact on river courses, see Lahiri-Dutt and Samanta.

decentralization of the private water sector by calling for rural people's participation "at all stages of project implementation right from the selection of technological options to implementation and maintenance" (65). These decentralization programs seemingly signaled a change in India's organization of *the social* in their displacement of centralized resource management with a people's management. A new form of resource democracy seemed on the horizon that gestured to the fulfillment of Ostrom's hope that policy scientists would finally see the collective as a capable self-organizing and self-governing entity in relation to natural resources.

However, as flagship programs were established at the level of the state governments to help rural water users establish water management programs, it quickly became clear that efficiency, not equity, was the chief goal. Low-cost, ongoing supply maintenance was ensured with the decree that water users alone were to be fully responsible for the operation and maintenance of water infrastructure through *pani samitis* (water committees) and village *panchayats* (village councils), since the unit of the community as a storehouse of traditional and local knowledge was lauded as the best way to manage local resource governance. Participatory management approaches included tasks such as planning the location of stand posts, tariff decisions, and contributing to operation and maintenance costs. The right to water and the magnanimity of returning the commons to the people was ultimately a government investment whose profits returned to those who watched from a privileged—and, notably, an urban and water-plentiful—vantage point.

Notably, even though participatory programs highlight a movement away from centralization, it is the centralized State that provides the "collective locus" for development (Miller 85). Participatory water management is an articulation not of the State's belief in the population's capabilities but an articulation of a project that concedes itself to the forces of

privatization and globalization. Even as rural water users are seemingly being given agency, this agency is being removed from them. Any local participation in resource management becomes nothing more than a staging of agency.

Women's participation has been considered integral to India's water management in the domestic sector. As many feminist scholars writing on women and development point out, this is partially because of an international discourse of women's rights that was beginning to reshape global policy agendas in the early 2000s, yet it can perhaps more realistically be attributed to the fact that women's daily collection and utilization of water positioned them as instrumental means for the water sector's ends.⁷⁸ Assessing a specific participatory project, ethnographer Kathleen O'Reilly writes that women were asked to see to the maintenance of public taps and the water system supply since they were the ones who needed a reliable water supply to fulfill their domestic rolls ("Insider/Outsider Politics" 199). O'Reilly states that the social change the project "hinted" at suggested that women's groups might "eventually proceed to solve other problems besides that of drinking water supply" (199). However, what is more manifestly clear is the naturalized connection between women and water, the call for women to give their labor freely (almost always without pay), and the establishment of women's health and hygiene as second to the smooth running of water infrastructure:

Women's groups must first and foremost serve the purpose of making the water supply system sustainable in the long run, i.e., women must be mobilized to take responsibility for the water management of their village. The health and hygiene education objective and the empowerment and self-help objective are important but

⁷⁸ For a discussion of women's tokenism in water governance on the international stage see Foskey.

should be subordinate to this overriding goal. (qtd. in O'Reilly, "Insider/Outsider Politics" 199)

Despite assumptions of women as naturally inclined to water work, women's participation in local water governances is largely tokenistic, especially in regard to women from Dalit or lower-caste groups who are continually characterized by internal patriarchies as incapable figures with no role to play in social organization. As Agarwal writes bitterly, it is easier to "give poor women a slightly better deal" (*A Field of One's Own* 44) or to give women in general seemingly more rights (the female engineer, for example) rather than challenge gender inequalities. While women are required to fill representative seats in *pani samitis* and *panchayats*, their participation remains at low levels since their voices and opinions as members of governance are often controlled expediently and silenced through patriarchal frameworks.

For example, in a 2007 article on women empowerment through watershed development project in Uttarakhand, Meenakshi Joshi writes that despite the official line that women are major stakeholders in the development and management of watershed resources, women have been marginalized due to the male-centric agrarian context in India. "So much so," writes Joshi, "that watershed development has been described as 'anti-women' by many workers. They allege that 'women's participation' implies that they do the physical work – digging of soil, raising bunds, planting trees – partly as paid labour and partly as *Shramdan* (Voluntary labour [*sic*]), while men enjoy the privilege of decision making and controlling the financial benefits" (192). According to Joshi, the guidelines for India's 2001 National Watershed Development Project for Rainfed Areas reflect "mere tokenism" with reference to the participation of women (193). As Joshi writes, "According to the guidelines, there should be at least two women members in [a] watershed committee and at least one in [a] watershed development team" (193), which are drastically low

numbers. Similarly, neither the Ninth Five-Year Plan nor the National Water Policy make specific mention of gender differentiated water needs or women's water management (Kulkarni 66), and in water management programs gender analysis, gender-sensitive proposals, and gender-trained staff or consultants were largely absent. Such a lack of support structure means that certain sociocultural factors that are keeping women from participating, such as education, cannot be identified and rectified. Kulkarni writes that in her own study she found that a large number of women on a *pani samitis* shared with her that they wanted to participate in water governance, "but did not have the technical knowledge to do so. For example, some of the women were keen to ensure quality of material purchased for setting up water infrastructure. Most of them complained that they were never trained to understand that" (Kulkarni 66). In the plains of Uttar Pradesh, women who attend committee meetings in certain communities are not allowed to speak in front of men who are not family members, and sometimes women avoid or are ordered against attending meetings, sending male family representatives in their stead (Prokopy 11). Finally, there are women who share with researchers that they do not have the time to devote to meetings due to the inconvenience of scheduled meetings during their domestic and agricultural work, cultural taboos, lack of confidence, and lack of permission from male guardians (Prokopy 11; Joshi, "Women Empowerment" 193).

In an assessment of India's Twelfth Plan proposal to fundamentally change water management in India, Mirhir Shah writes that the challenge of groundwater management has been ascribed to the extraction of water by millions of farmers with "no effective mechanism to ensure that the rate of extraction is sustainable" (Shah 43). Additionally, Shah writes that research institutions have been at work to map India's aquifers and that in order to manage groundwater levels "partnerships among government departments, research institutes, gram panchayats/urban

local bodies, industrial units, civil society organizations and the local community” will be required (43). However, proposals to budget cropwater at the scale of a village or watershed and plans to institute regulatory water options at the community level raises questions as to the equitable distribution of groundwater in regards to tribal and Dalit communities as well as the extent to which farming communities will have a say in the management of small-scale irrigation and drinking water resources in their area.⁷⁹ If, in 2009 roughly 89% of agricultural irrigation has come from groundwater and 11% for domestic and industrial uses, and if in the last four decades the primary cause of over-exploitation has been agricultural demand for groundwater due to water-intensive monocrops, which is compounded by the additional power subsidies needed for agricultural groundwater extraction,⁸⁰ it remains to be seen as to whether government groundwater regulators will, as Shah says, bear “in mind principles of equitable distribution of groundwater across all stakeholders” (43). A 2015 overview of the state of groundwater in India issued by India’s Institute for Policy Research Studies writes that the National Water Policy states the necessity for issuing water tariffs for different water uses beyond basic needs.⁸¹ The overview notes that “the implementation of the part of the policy that aims at providing basic access to water while establishing economic value and full cost recovery is a conflicting intention. In the absence of a suitable financial model, it remains to be seen how water will be allocated to users with limited capacity to pay for the cost” (Suhag 6).

⁷⁹ Regulatory water plans include deciding on “drilling depth (or whether to drill tubewells or borewells at all), distances between wells (especially with regard to drinking water sources), cropping pattern that ensures sustainability of the resource (aquifer) and not just the source (well/tubewell), [and a] comprehensive plan for participatory groundwater management based on aquifer understanding” (Shah, “Water” 43)

⁸⁰ The “current regime of power subsidies for agriculture has had a major role to play in deteriorating water tables in most parts of India...an imaginative way needs to be found, which breaks the groundwater-energy nexus, without hurting farmer interests” (Shah, “Water” 43).

⁸¹ See Suhag.

The above suggests the extreme vulnerability of lower-caste South Asian women on two fronts: an environmental front and an institutional, bureaucratic front that is both national and international in nature. The structural violence of a rhetoric of environmental development and globalization is headed by the neoliberal formulations of the International Monetary Fund, the World Bank, and the World Trade organizations. The two former entities play a key role in forcing water privatizations by insisting that countries who receive their loans and assistance include water public-private relationships that they can financially benefit from. In 1998, for example, a review of India's water supply sector led by the World Bank culminated in a report that called for the need for the instigation of a demand-led oriented approach to water supply with the supposed aim of allowing individuals to choose what kind of water service delivery is most financially viable for them. This is what the report said:

The DRA [demand responsive approach] takes into account that rich men, rich women, poor men and poor women may want different kinds of service. DRA provides information and allows user choices to guide key investment designs, thereby ensuring that services conform to what people want and are willing to pay for. In exchange for making contributions, in cash or kind for a satisfactory service, the stakeholders have a voice and choice in technology type, service level, service provider and management/financing arrangements. (Dayal, van Wijk, and Mukherjee 2)

Sustainability, which can be radically conceived as meaning to encourage effective participation in local issues in response to questionable effects of economic globalization, is here framed and regulated by institutional arrangements that end up marginalizing crucial social actors, including women and girls. The transformation of water into a commodity is touted to empower payees as

subjects of capitalism, creating an environmental subjectivity that assumes an ideal of competitive individualism and influences the treatment of women and girls in certain villages.

In the Indian state of Rajasthan, for example, a decentralization water supply project installed water supply systems in villages throughout the region that impacted the social standing of young girls in their communities. The project, which began in the early 1990s and was completed in 2005, expected each village to maintain their given water supply system, leaving the villagers themselves responsible for community bill collections. As O'Reilly explains in her own review of this particular project, payment systems are based on *angaa*, "a traditional system of water payment that divides the cost of water consumed by the total number of water consumers (people and livestock) in the village" (O'Reilly, "They Are Not of This House" 50). Each household pays the unit price multiplied by the number of family members and livestock, the latter which count in most villages as one person. Girls, however, are not counted as water consumers by their families because they are not considered part of their parents' household but a future member of their husband's. As one mixed group of men and women explained to O'Reilly, "girls get married and they go to another house. They are not of this house" (49). Girls' lives, in other words, do not have the same value as those of married women, men, or boys, and they were only granted official right to water after being attached to a man in marriage. In these villages, the families pooled their money together to pay for the girls' drinking water, causing O'Reilly to point out that neoliberal water governance had yet to erase expressions of mutual aid and social connections between community members. More worryingly, however, is that neoliberal water management policies have caused water consumption to become connected with social belonging. Water commodification, as O'Reilly points out, intersects with "notions of girls' non-membership in their natal households in such a way that girls' exclusion from payment becomes a topic

discussed by village water committees and villages at large” (52). While the commodification of water is touted as a way to empower villages as water-consuming customers, payments only empower payees as a subject of capitalism. Girl children, who are not traditional customers in the paying system, are consequently marginalized. O’Reilly writes, “if the state in a neo-liberal system is expected to respond to the needs of villagers as customers, not as citizens, then girls’ non-payment...hints at a weakening of girls’ citizenship in the eyes of the state” (52), rendering them invisible citizens.

Such neoliberal schemes negatively impact sustainability endeavors. The marginalization of girls as (non)water citizens means that they are less likely to develop water conservation awareness and feelings of ownership and inclusion that the Rajasthan communal village water systems depend upon for sustainability. Girls might grow up not having been involved in water projects and carry learned behaviors of their inferiority to their married households. While married women have been the target of water management endeavors, Frances Cleaver points out that an understanding of how girls participate in fetching and carrying water and helping their mothers with water in the domestic sphere emphasizes that girls should be included in participation water management plans and projects. However, unless these water management projects can bring women true empowerment it might not be helpful to solely call for engendered resource management. Perhaps, in addition to talking about participation, a theory of collective action is needed that addresses the institution of local democracy and gender equality and can provide a building block for women’s activism at the regional, national, and international level.⁸²

⁸² See the conclusion of Basu’s essay “Gender and Governance: Concepts and Contexts” for a discussion of contexts and example in which women’s activism at the local level can help rethink the nature of power in India.

While Indian states have attempted to absolve the positionality of patriarchal structures of governance by introducing gender participatory water management programs, sustainability-developmentalism and women's tokenistic participation in water governance highlight Indian states' overall disinterest in reversing entrenched sociocultural attitudes towards women. Water privatization and questions of tariffs and distribution reinforce a sharp gendered line of agency and veil women's increasing vulnerability in a climate-changing world. Though women are the subjects of water work, the situatedness of water sources determine degrees of water access, with upper-caste wells and agricultural canals barred to certain categories of women. Voiceless in water governance, women cannot influence decisions that will affect the futures and wellbeing of their communities and families. Within the arena of capital, women's water work is subsumed by their status—or not—as payees of neoliberal water services, and at the watery heart of India's cultural imaginary they have been denied the materiality of their own bodies. Affective life, as a powerful feature of feminist response against injustice, is neutralized if it does not further neoliberal agendas and neoconservative nationalisms.

The tokenism of women's participation in water management suggests that an enfolding of a material gender politics into resource governance cannot solely depend on ensuring the equal representation of gender or subaltern groups in moments of communal, regional, or national decision-making. Rather, a material gender politics, as an ethical arrangement of bodies and enacting of relations, requires a new conceptualization of the social space in which bodily arrangements and relations occur. The below analyses of Mahasweta Devi's play *Jal* (1976) and M. M. Vinodini's street play *Daaham* (2002) locate the possibility for this space in the open admission that a justice-oriented discussion of gender and resource management cannot begin in earnest until politics is uncoupled from ideologies that determine if and how identities and lifeways

are represented in the public sphere. I read both plays as uniquely identifying the substance of the political in individuals'—specifically, female characters'—performative constructions of identity as they take place in the public realm and through affective interactions with environmental materialities.

In their formulations of a material gender politics, *Jal* and *Daaham* indirectly address the organizational dilemma at the heart of Ostrom's discussions of sustainability in *Governing the Commons*. The centralized, individualistic nature of the market and its simultaneous simplification of the human to a consumer and the earth to a commodity resulted in Ostrom's call for a theory of collective action, in which local groups care for common-pool resources and solve common-pool problems without the intervention of an external, centralized agency. The plays' redefinition of politics through an ethical arrangement of bodies in relation to each other assume new modes of social organization that raze hierarchies of resource regulators and, by extension, ideologies and epistemologies that naturalize centralized control. What results is an embedding of a genuine relationality into the social contract so that the very notion of the social articulates a shared humanity. As will be seen, the specificities of this relationality include an affective linking of the human to local resources so that equitable access to and care for the commons becomes the basis of a new social order.

Towards Establishing a Common World

Jal and *Daaham* each stage the affective resistance of women and Dalit communities to patriarchal devaluations of labor and bodies and conclude in the establishment of new forms of social organization that topple neoliberal and neoconservative powers. In *Jal*, affective life is found in what Gayatri Spivak describes as the aporetic structure of responsibility, which the female protagonist, Phulmani, emphasizes as the ultimate key to realizing collective agency and asserting

her community's fundamental right to water as a commons. In *Daaham*, the relation between women and water powerfully materializes through a re-attachment of women's water work to affect through the biology of the female body. Both plays stage collective action to eliminate a caste-based injustice that is rooted in the water-women nexus even as they seek to reconfigure the woman-water imaginary to emphasize gender and communal vulnerabilities and diversify political subjectivity.

As social justice activists, Devi and Vinodini would probably disagree with their plays being labeled as feminist writings insofar as the term might divert attention from their works' fierce advocacy for the protection and rights of Dalit communities. However, in the works of Kalpana Kannabiran, "it is my argument that the articulation of feminism takes place at multiple sites, in multitudinous ways, not in women's groups and feminist collectives"—nor in self-proclaimed feminist writings—"alone" (125). The entwined gender and resource justice that sit at the heart of *Jal* and *Daaham* and the female characters that jumpstart community agency transform these plays into locations of feminist insurgency. Furthermore, the plays' different engagements with the violenced female body contextualizes them within the space of India's feminist activist theatre, in which the violenced body has been recently performed in a manner that challenges victimization and seeks to build a feminist politics of justice through the careful staging of protest, anger, and demand for change. Unfortunately, it is difficult to contextualize *Jal* and *Daaham* within a genealogy of Indian feminist theatre since very little is known of their performances. Samik Bandyopadhyay, *Jal*'s translator, mentions that Devi's 1970s plays "confronted Indian mainstream theatre with a challenge—the challenge of an experience revealed—that the theatre failed to take up" (xx), though in a 1997 postscript to *Five Plays* he mentions that several of these plays have been performed by non-professional theatre groups, "mostly in [Devi's] own state,

West Bengal” (xxi). He makes no specific mention of *Jal*. In an introduction to *Daaham* in her 2005 Indian women’s theatre anthology, *Staging Resistance*, Tutun Mukherjee writes that *Daaham*, as a street play “scripted in 2002 and enacted by Dalits, has been a phenomenal success” (467). No information, however, can be found on the 2002 performance or whether the play has been staged since.

Due to their evasiveness, the *Jal* and *Daaham* are analyzed below as literary drama rather than theatrical performance. Nevertheless, it is worth noting that theatre is a particularly powerful genre through which to narrate what can only be described as the performance *qua* formation of a material gender politics through the performativity of affect, which, as will be seen, is a public and personal response on behalf of the plays’ female characters to gender-resource injustice. I read these performances as structured by Gayatri Spivak’s notion of responsibility. In her essay “Responsibility” (1994), Spivak engages in a deconstructive, Derridean reading of the 1993 Conference on the World Bank’s Flood Action Plan in Bangladesh to not only show “that deconstruction is relevant to what is called the political sphere” but to also question the rational foundations of political action in the context of the global justice movement (23). Spivak describes responsibility as “all action [that] is undertaken in response to a call (or something that seems to us to resemble a call) that cannot be grasped as such” (22). The call is something limited, unable to be grasped because it is unable to be purely formalized. There is a secret essence to it that does not translate in the call-and-respond structure of responsibility and forever remains lost to knowledge and realization. Responsibility as the response to the other’s call thus perpetually exists in “a sort of intermediary stage” (22), never reaching a final, pure formalization because of the secret essence that escapes in the slipstream of the call:

This is perhaps one way of being responsible to the thinking of responsibility, that whatever is formalizable remains in a sort of intermediary stage. The rest cannot be *purely* formalized. These steps must be formally taken *and* experienced as limits before the usual beginnings can be made. Full formalization itself must be seen not as impossible but as an experience of the impossible, which may be to say, the “same thing.” (22)

The experience of the impossible can be explained as Spivak’s notion of aporia and will be central to the concept of radical democracy developed in this section. An aporia is a situation in which the elements that make a thing possible are simultaneously the same ones that make the same thing impossible. It is solved by “an unavoidable decision that can never be pure” (“Translator” 209 note 15), that is, that can be made without fully formalizing that which is being decided upon. One of Spivak’s clearest examples of aporia is found in her analysis of the secret essence featured in the plot of Mahasweta Devi’s celebrated novella, “Pterodactyl, Puran Sahay and Pirtha.” When Puran, a journalist, travels to a tribal village, he comes face-to-face with a prehistoric pterodactyl, a representation of the ungraspable other who wishes to speak in the name of human and environmental justice. The aporia manifests itself in the impossibility of communication, despite the pterodactyl’s deep desire to communicate a message and Puran’s even deeper desire to understand. Ultimately, only an intermediary stage of communication is reached in Puran’s repeated attempts to infer what the pterodactyl wants to share:

Puran’s eyes put a question.

— What will you eat?

What do its eyes want to tell Puran?

... There is no communication between eyes.

Only a dusky waiting, without end.

.... The collective being of the ancient nations is crushed. Like nature, like the sustaining earth, their sustaining ancient cultures received no honor, they remained unknown, they were only destroyed, they are being destroyed, is this what you are telling us?

The dusky lidless eyes remain unresponsive. (Devi, *Imaginary Maps* 157)

Within the impossibility of communication lies the current impossibility of justice to India's oppressed tribal peoples. What *is* communicated, however, is that "the tribal and the nontribal must pull together" (Spivak, "Afterword" 204), and that the tribals' collective struggle should be supplemented with ethical singularity, an acknowledgement of individuals as individuals in relation to the shared world of public life. It is, as Puran learns, not a championing of the other through representation but a moment of change in the self as the other in her singularity is faced and recognized. As Spivak writes, "To confront [the other] is not to represent them but to learn to represent ourselves" ("Subaltern" 84). Thus, "an aporia discloses itself only as a crossing" to a moment of personal change that equates to a step forward in the direction of justice (*Critique* 326).

There is thus responsibility in thinking about responsibility as limited, which allows for the call and the caller to remain singularities to each other, to remain apart from the formalization of subject positions. Responsibility is thus the active and necessary marginalization of the other that keeps her from being drawn and locked into an ideological and thus controllable subject position. Importantly, this is not to be thought of as the continued state of marginality created by globalization and the power of states, but a marginality that defines the status of a new politics. It is marginality as radical democracy.

There are three specificities to the politics unraveling here that need to be highlighted as aspects that will further the journey towards justice—a journey that will inevitably open even more experiences of impossibility through which to realize the ethical singularity of the other. First, in the aporia of responsibility, the other remains an uncertainty, unpredictable in its being because it is not encapsulated in an ideological political subjecthood. Uncertainty is thus the specificity of radical democracy. Second, the specificity of uncertainty is materiality. Ethical singularity is a responding to the reality of the materiality of the other rather than to her ideological standing. Third, the transformation of the self in the acknowledgement of ethical singularity is an action of care. Responsibility is thus concerned with advocating for a politics that is immanent in materiality, emerging in tandem with affected bodies that develop agency through their relation to and interactions with the non-human materialities of their environments. The power in the voices of India's woman's movement, for example, does not result from a system of political representation but from a discourse of human rights and basic human needs heavily bound to resource justice.

The limited structure of responsibility and uncertainty as the resulting experience of the impossible comes to bear on a discourse of sustainability and resource-gender justice through the new realm of the public that these envision. A radical democracy founded on responsibility reconfigures the distribution of capacities, of what can be seen, heard, spoken, and thought, through what Hannah Arendt describes as performance, that is, the action and speech by which an individual discloses her unique identity: "This disclosure of 'who' in contradistinction to 'what' somebody is—his qualities, gifts, talents, and short-comings, which he may display or hide—is implicit in everything somebody says and does" (179). For Arendt, the common world, which she clarifies as the human world— "not identical with the earth or with nature" but "related, rather...to

affairs which go on among those who inhabit the man-made world together” (52)—is built through the performance of individual identities in the public realm, where action and speech can be responded to. It is notably only through the performative public appearance that the individual develops a unique sense of self. Only in the act of joining the uncertainty of the public realm, a space where anything can happen, can the individual present herself as an ethical singularity to be recognized through aporia. It is in the public space, then, where humans reach their personal potential and aid others to reach theirs by learning how to represent themselves both as singularities and as those who respond to the call of other singularities; “it is where we live among each other, producing a common world and producing ourselves diversely within it” (Sandilands 57).

Responsibility in Jal

A blueprint for the establishment of the common world glints at the heart of Devi’s *Jal*, created by a material gender politics that takes responsibility as its cornerstone. Perhaps more precisely, it takes the performance of the ethical call as its cornerstone, inverting Spivak’s structure of responsibility, which primarily concentrates on the self’s transformative response to the Other in her material vulnerability. *Jal* instead forefronts the form and positionality of the Other’s call, that is, the manner in which and the space from which the call is projected. There is purposeful intention in this projection, which takes place through the body’s performance of its own vulnerability in what amounts to a living manifesto of justice and a proclamation of allegiance to the materiality of water as something that cannot be regulated through appropriative ideological intentions. In this way, *Jal* forefronts the irreducible performativity of the Dalit body and the affective quality of its disruption of centralized social organization and water regulation.

Jal initially reads as an offbeat *Bildungsroman* that tells the political coming-of-age of Maghai Dom, a respected elderly Dalit in the drought-stricken village of Charsa. Maghai

eventually leads his community in rebellion against the economic injustices imposed upon them by Santosh, an upper-caste landowner who deprives the Charsa Dalits of drinking and irrigation water by enforcing caste-based restrictions on public wells. Maghai's political awakening, however, is irreducible to a Marxist-inflected awareness of caste-based injustices, and is instead contingent on the realization of a scene of responsibility that he—and, by extension, the audience—is called to participate in. As will be seen, this call is evoked through *Jal*'s staging of affective relations between women and water and the play's specific formulation of a material gender politics through performance.

Maghai's political awakening and the possibility for a new, ethical arrangement of bodies and materialities is dependent upon his leave-taking of a restrictive sense of fate, which unintentionally perpetuates his own people's subjection to Santosh's injustices. Maghai is introduced to the audience as the descendent of the mythical sage Bhagirath, who, in offering gifts of worship to the goddess nether-Ganga, "the mother deity of all the hidden waters" and the groundwater sister of the holy river Ganga (*Jal* 147), was blessed with the ability to divine the location of groundwater for the construction of wells and ponds. Having inherited Bhagirath's powers of divination, Maghai unequivocally believes himself destined to continue the work of his ancestor, whom he honors by neither refusing requests to identify areas where groundwater is accessible nor charging a water-finding fee. His gift is heavily abused by Santosh, who calls upon him to find groundwater springs for wells that, when built, are made inaccessible to the Charsa Dalit community dying of dehydration and starvation. When Maghai's adult son, Dhura, angrily points to Maghai's complicity in Santosh's inequitable water management system, the water-diviner is torn between his religious devotion and the sudden realization of the injustice this devotion perpetuates. Nevertheless, Maghai argues that water-divining is a holy, predestined, and

age-old occupation that must be respected, a comment that signals a misplaced sense of responsibility, a responsibility *to* that does not allow for a responsibility *for*. As Maghai tells Jiten, the village primary school teacher, “Dhura tells me not to divine water. But, Teacher, it’s a job handed down to me by my ancestors. I’ll be doomed to hell if I betray their trust. I do my job, and go without water” (171). The responsibility Maghai feels to the gods and family ancestors is formalized here as an obligation rationalized by religious belief that does not allow for responsibility to be conceptualized as anything other than a devotion imbricated in the abusive power structures of Hindu caste society.

Maghai’s, albeit reluctant, complicity in his exploitation as a religio-cultural unit of work excludes the Dalits from the space of the social as a space in which injustices are countered, coalitions assembled, resource regulations debated, social change instigated, and personal identity freely performed—in brief, of collective and ecological life. In fact, in their hydrological dispossession, the Dalits become endangered, displaced and excluded from water as the literal possibility of life by an appropriative-neoconservative ideology. However, even as Maghai deepens the Charsa Dalits’ exclusion from the social, *Jal* revives the notion of a common space of inter/action by visualizing the affective effects of water extraction on the body. As a responsibility *to* that bars a responsibility *for*, Maghai’s reinforcing of an inflexible, unjust sociocultural order on the earth incurs violence on the Dalit body, particularly the female body engaged in water work. His normalizing of the inhuman conditions of starvation and dehydration is a direct denial of the Dalits’ rights to basic material needs and, by extension, their very materiality. The violence of this double dispossession is literal and painful. Desperate for water, the village Dalit women dig holes in the sandbars of the dry Charsa river every evening in hopes that overnight condensation will yield a small pool of drinking water. The repeated digging rakes their hands raw, as Maghai’s wife,

Phulmani, reveals in a scene where she confronts Santosh in front of a Dalit gathering, demanding that he open the public wells for their use: “(*Raises her palms before Santosh*) These two hands of mine are full of sores, Santosh, all from scratching about the sands of the Charsa for water... This year we demand a well for our use” (137-38). If, as Arendt writes, “our feeling for reality depends utterly upon appearance and therefore upon the existence of a public realm into which things can appear” (51), then the unignorable appearance of the materiality of Phulmani’s sand-torn hands openly challenges the ideologies governing water extraction. Her public display instates and affirms a reality in which materialities exist free from codifying valuations. Both the affect of pain and, more powerfully, the affective possibilities of pain as dispossession-made-manifest combat the translation of humanity and the nonhuman into terms of extraction, thereby clearing a space in which materiality can be reclaimed as an ontological formation as opposed to a heuristic operation.

Within this space, the affected body becomes aporetic, and politics, as the arrangement of human bodies, becomes a process by which the common world is constituted as a space of shared humanity. More specifically, the body, in its material demand for an institution of the ethical, is the very site of politics. Phulmani’s hands are an ethical singularity that place Santosh, Maghai, and the audience at a uniquely characterized crossroads. They can either acknowledge her materiality as an unformalizable essence and cross into responsibility or they can continue to uphold an ideologically structured reality. However, regardless of their decision, in the arrival at this crossroads they have been made conscious of Phulmani’s self-identification as an ethical singularity and thus have been made conscious of the virtual existence of a reality structured by responsibility. Indeed, Phulmani’s upraised hands testify to a self-supplanting beyond the grammar of appropriation and into a new vocabulary of existence, wherein she ruptures the patterns of reason that rationalize a politics that stratifies bodies through the regulation of labor and the

organization of resources. Within the sudden uncertainty she presents, the possibility of a new politics subsequently emerges, one in which bodies become social through mutual respect for the vulnerable nature of their material composition. A common world forms around this conceptual space of shared humanity.

Yet Phulmani's hands are not simply expressions of the Dalits' dehumanization. As the result of a certain form of contact with the earth, they also declare a relation to the environment that suggests an amendment to Ostrom's collective action theory. Phulmani's wounds and affective performance give testament to a transversal graphing of human and nonhuman materialities. In *Jal*, both the formative structure of a material gender politics and the call of responsibility originate in a moment of material interfacing, in which the common world of the human becomes imprinted with the world as commons. For Ostrom, entrance into collective action is founded on individuals' ability to *rationalize* collaborative and egalitarian resource management for the shared benefit of the group. Yet this ability is itself dependent on, first, an affective understanding of shared humanity, and, second, that this shared humanity is itself a principle of environmental respect and protection: the wellbeing of our bodies is dependent on the equitable distribution of resources, which can only be had through the preservation of ecosystemic balance. *Jal* suggests that any arrangement of bodies in ethical relation to each other evolves from affect and the interfacing of materialities as the specific circumstances of affect's emergence.

While Phulmani's call to responsibility goes unheeded, *Jal* concludes with an image that mirrors the trans-materiality of the Dalit women's torn hands. Maghai relinquishes his identity as a water-diviner upon realizing that the Dalits can create their own cost-free water management system when Jiten suggests they build a stone dam in the river's flood zone to make a water reserve that would fill during the monsoon and last throughout the dry months. Leading the Dalits in the

dam's rapid construction, Maghai undergoes a political awakening, buoyed by the sudden awareness of his community's agency to command their own destiny by—in what reads as an inversion of the Bhagirath myth—accepting the offering of Charsa's seasonal waters. In the realization that his people are no longer subjected to begging Santosh for water, he mocks his previous belief in his water-diviner destiny, scoffing, “The Bhagirath of the nether Ganga! The great water-diviner! I deserve three sound slaps! (*Slaps himself*)” (188). The Dalits' joy at the prospect of water is short-lived, however, when Santosh, threatened by the group's newfound agency, labels them as hostile political insurgents and marshals the local police force to destroy the dam. Fighting breaks out, during which Maghai is fatally shot and stumbles offstage. As officials begin to make arrests and count the wounded, Santosh enters, panicking, and speaks the play's closing lines: “O Holy Father! Haven't ever seen a sight like this. As the dam crumbled, the river leapt through and seemed to snatch Maghai away, raise him on the crest of its wave, and carry him away like one who is mad. Look at her, there she goes, there, there, carrying Maghai away” (198). Maghai's union with the river Charsa, the mingling of human and nonhuman materialities already made familiar by Phulmani's gesture, goes unseen but auditorily evoked in the sound of rushing water that begins to swell over the theatre speaker system. In fact, the audience's inability to see Maghai's body is a strategic reinstating of the confluence of the common world and the commons, which is visualized by the play's cyclorama backdrop, upon which can only be seen “*the rising, gushing water, with the sound of the water, roaring, till the stage goes dark*” (198). This confluence prefigures the interaction of bodies and water in *Daaham*, where a material gender politics is more concretely staged as a radical democratic intervention against caste-based patterns of oppression.

Taking Stock: Body, Space, Politics

Social justice and feminist writing and efforts from below have sought to create new sociopolitical arrangements that, first, repudiate accounts of women and water as units of economic extraction, and, second, seek to irreparably trouble the connections between neoliberalism and India's traditional patriarchy. Such troubling has been primarily imagined as a meaningful situating of the female body in the external space of the social sphere. The struggle, in other words, remains one of positionality, both in the literal positioning of the woman in the political forum and the conceptual positioning of the woman in the cultural imaginary as a citizen with rights and civil liberties. In this way, the logic of feminist organizing echoes the logic of B. R. Ambedkar's social reform attempts in the 1940s and '50s to abolish caste discrimination towards Dalits by "counter-sterilizing" India in an egalitarian tainting of public spaces that were traditionally "purified" of Dalit bodies (Guru and Sarukkai 80). In fact, placing the conjunction of women's and environmental studies in correlation to recent work in Dalit studies—which proudly continue Ambedkar's thought in relation to bodies and spaces—opens conceptual pathways that are critical not only to reimagining but to actively repositioning women and their communities as agential actors in India's contemporary sociopolitical arena(s).⁸³

⁸³ Since the early 2000s, gender issues and Dalit issues have been increasingly discussed in relation to each other and under the umbrella of a hegemonic minority consciousness. Dalits are often characterized as implicitly supporting each other in their mutual quest to unravel Brahmanical patriarchy. Clarinda Still warns against prioritizing one at the expense of the other and Manisha Gupte writes that "progressive movements involved in caste or class struggle also urgently need to centre stage gender issues. Except in some instances, a strong women's agenda was missing in many progressive movements in spite of the fact that women participated fully – feminist positions were often regarded as being divisive and irrelevant to the Indian context, or a threat to male hegemony within the movement" (558). Sharachchandra Lele and Geetanjoy Sahu remind readers that a progressive vision for environmental governance, effective sustainability and climate change mitigation requires a complete "change in value systems" (46), which includes a hegemonic and expansive "concern for social justice" and "belief in the democratic process" (46).

In *The Cracked Mirror* (2012), a recent and particularly acclaimed addition to Dalit Studies, co-authors political scientist Gopal Guru and philosopher Sundar Sarukkai state a radical thesis: to draw on Indian intellectual practices in order to reclaim the lived experience—pain, suffering, humiliation—of the Dalit from Eurocentric phenomenology while simultaneously positing this reclamation as grounds for a new social theory. Connecting the body of the Dalit, including her constraints and treatment, to ideas of social location and the maintenance of caste hierarchy, Guru describes the oppressive dynamics of caste-based power as configured and upheld by the spatializing effects of the “untouchable” Dalit body.⁸⁴ Brahmanical fear of the literal and spiritual pollution that Dalits were believed to spread resulted in the placement of heavy restrictions on the latter’s interaction with their surroundings, which served to map both the literal “space [of the social] in favour of the socially dominant castes” and the mental space of the cultural imaginary (81). As Guru explains, the Dalits’ untouchability yielded an experience of humiliation so complete that it demolished any ability to think beyond and challenge the pollution-purity ideology upon which the caste system is structured.

The Cracked Mirror’s focus on the lived experience as a bodily experience covertly suggests that a reclaiming of the Dalit experience includes reconfiguring the Dalit body in relation to and as an organizer of social space so that it becomes a condition of possibility for drastic sociopolitical and cultural change. The below and final section of this chapter explicitly thinks the Dalit, female body as the condition of sociopolitical and environmental possibility, both in terms of the specificities that yield this condition and the material gender politics that this condition might yield. My intention here is not to reify the reconfigured subaltern as the magic key to a

⁸⁴ Guru provides examples of how the space was managed around Dalits. In nineteenth-century Maharashtra, “The untouchables were forced by the Brahmanical state to tie [a] pot around their neck so that they could spit in the pot and thus save the space around them from getting ritually polluted. Others, the upper castes, were free to spit anywhere but not the Dalits” (11); the shadow (80)

formulation of gendered sustainability; rather, it is to begin to place a material gender politics in contrapuntal rhythm to progressive strands of Indian thought that throughout this chapter have strained towards the realization of radical democracy in their championing of the agency and rights of the historically oppressed.

In doing so, I also propose to loosely answer a question that Partha Chatterjee poses in his 2012 essay “After Subaltern Studies,” in which he wonders where to locate the space of politics in contemporary Indian democracy. Chatterjee reflects that within the last two decades the figure of “the mass political subject in India” as the figurative space of politics has gone missing (46). Where Subaltern Studies had once located this subject in the structure of an insurgent peasant consciousness reacting to the democratic difficulties India faced as a new nation state in a postcolonial modernity, Chatterjee writes that the dawn of the twenty-first century is bringing forth unprecedented changes in how and where politics is conducted in India. For example, in contrast to the peasant insurgencies that marked the late twentieth century,⁸⁵ contemporary politics is no longer conducted *en masse* but finds itself divided between “two aspects of mass politics in contemporary Indian democracy” (47): “one that involves a contest over sovereignty with the

⁸⁵ The above mention of peasant insurgencies refers to the controversial Naxalite movement. the Maoist 1967 Naxalite uprising, a landmark event in the history of independent India shaped by a Marxist vocabulary of class war and revolution. In March 1967, in the village of Naxalbari, West Bengal, tribal peasants joined with Community Party leaders and urban radicals from Calcutta to end social exploitation and caste discrimination embedded in political systems as the regional and state levels. As one of the uprising’s leaders, Kanu Sanyal, wrote the struggle was “not only an armed struggle for the seizure of land, but also an armed struggle for the seizure of state power” (qtd. in Chandra 26). The entire feudal agrarian structure in the region was soon under attack. Peasants organized into armed village militias and seized land, grains and arms from landlord gentries, burnt land records, and established peasant administrations in charge of villages. Simultaneously, in Calcutta, urban restlessness, economic deprivation, and dissatisfaction over rising unemployment and party politics exploded into violent student protests and attacks against designated class enemies, including politicians, university teachers, and the police. What ensued was a series of violent battles throughout West Bengal between peasant rebels and the State machinery, which later spread into rural southern and eastern India until it was boodily quelled by state militia under the orders of Prime Minister Indira Gandhi in 1971. For a historical summary of the movement, see Sumata Banerjee *In the Wake of Naxalbari*.

Indian state and the other that makes claims on governmental authorities over services and benefits” that affect the bodily experience of everyday life, “like the supply of water...or the access of...villages to public roads and transport or to the facilities of schooling, public health services, public distribution of subsidized foodgrains or kerosene” (47). Here, Chatterjee touches upon a burgeoning interest in sustainability studies, climate politics, and political theory regarding how “politics is sensed in infrastructure projects” (Knox 368), particularly in regard to the role that material relations play in the formation of political life, political action, and the interrelations between subaltern lives, political institutions, market flows, and environmental politics. Yet rather than consider how the human-nonhuman material entanglements that infrastructures evoke might suggest a contemporary site of a mass political consciousness, Chatterjee goes on to suggest that future Subaltern Studies scholars might find a new, unprecedented kind of mass politics in the domain of popular culture and the “panoply of modern technologies of communication” (49).⁸⁶

Departing from Chatterjee’s aborted thoughts on politics in relation to everyday realities and resource infrastructure, and riffing on Guru and Sarukkai’s constellating of body, space, and experience in *The Cracked Mirror*, the below reading of Vinodini’s play *Daaham* pronounces the body—that is, the oppressed, minority body replete with conditions of possibility—as the location of the subaltern political consciousness. Like *Jal*, *Daaham* narrates a Dalit population’s response to oppressive village water politics. Unlike *Jal*, however, the female body in *Daaham* powerfully maps the space of radical democracy through a biological relation to water. As will be seen, the play’s female characters draw agency from recognizing their bodies as articulations of the

⁸⁶ Chatterjee writes: “It is even possible that the task [that of the continuation of Subaltern Studies] has been made easier by the emergence of subaltern global networks that convey images and stories, ceremonies and cults, and objects and practices, from one part of the world to another without going through the sanctified channels sponsored by global corporations or governmental agencies” (“After Subaltern Studies” 49).

confluence of groundwater flows and biological flows, whereupon they demonstrate the extent to which the body, as the shared space of these materialities, can create grounds for a new politics.

Confluence in Daaham

In *Daaham*, the body as a condition of sociopolitical and environmental possibility is begotten in the fluvial mingling of materialities within and unique to the dispossessed female body. I want to use the concept of confluence to unpack the specificity of this mingling and intuit it as the very substance of a local, collective politics. Confluence describes the junction of two or more rivers, where riverine waters either merge or flow alongside each other within the same riverbed in a fantastic parallel of sediments and colors. Not only does this serve as a beautiful visualization of the notion of heterogenous universality that began this chapter, but it additionally evokes the above theorization of climate models' uncertainty as a site of ethical negotiation, in which a plurality of actors come together to form the substance of governance. In *Daaham*, confluence names both the specificity of the body as a condition of possibility and a restructuring of the spatiality of the public realm through a rupturing of ideological boundaries; in other words, the body as a space of confluence becomes the magnetic compass by which the social sphere is configured.

Daaham opens with the initiation of this calibration, with the aftermath of a scene of transgressed boundaries in which Souramma, a Mala Dalit woman, stumbles across the threshold of her thatched hut, having been beaten by upper-caste women for drawing water from the village well with her own hands. Weeping, Souramma tells her family—her husband, Narsaiah, her father-in-law, and her adult son, Dasu—what happened after hours of standing in the sun, unable to touch the well and pendent on the goodwill or pity of others to fill her pitcher with water:

I couldn't stand there any longer. Waiting in the hot sun made me feel dizzy. Then

I stood up and looked around...there was nobody there. Quickly I went up to the

well and put the rope on the eastern side. That's all. Wherever they rushed from...they came like vultures falling on the carcass.... First that bloody woman came hurling abuses, saying whatever she wanted...then the others surrounded me like barking dogs. You low-caste woman, [*sic*] should not go up to the well, should not touch, actually the well is theirs, and on and on they screamed. I got into a rage...couldn't control myself...everybody knows whose life is what, I said. If you conspire, anything will come free for you, I said. They said, the well is for the human beings in the village but not for the pigs of the outskirts. Even if people are dying of thirst, you won't give a drop of water, so you are the pigs, I said. That's all. They jumped on me, pushed my chest, and threw me down. They beat me, kicked me...pulled me by my hair...broke my pitcher and said go and cry wherever you want. (495)

At first glance, the episode emphasizes the structural violence of social patriarchies as the determining environment of the Dalit woman's labor. More notably, however, it yields the realization that the parameters of water work themselves delineate the conceptual space of the patriarchy; caste mediation of the Dalit's body in relation to water becomes an imperative for the maintenance of the social system. Souramma's movement of the rope to the eastern side of the well is consequently not simply a transgression of boundaries that offends but an erasure of the spatial patterns that cut the ontological architecture of Brahmanical ideology.

It is important that the displacing of the rope not be interpreted as an act of desperation or even rebellion. The confluence of physical and cultural spaces that result in the moment of Souramma's transgression is instead, borrowing the words of African American feminist Tina Campt, the "performance of a future that hasn't yet happened but must. It is an attachment to a

belief in what should be true, which impels us to realize that aspiration. It is power to imagine beyond current fact and to envision that which is not, but must be” (17). The movement of the rope enacts a disruptive grammar of feminist futurity that makes a claim to “living the future *now*” by creating a confluent cultural space for the blooming of gender and economic justice (17). In fact, the justice of a material gender politics is itself a spatiotemporal condition because of how it reconfigures collective and subjective life in relation to earth’s materialities. Whereas patriarchal water infrastructures are striated by an extractive, economic logic that disrupts the spaces and temporal processes of hydrological cycles with its own linear tense, a material gender politics asks for space and time to be conceptualized according to, for example, an attention to the composition of the space of water—to the health of rocks and soils and their ability to hold water—or to the adagio of groundwater replenishment. A material gender politics in a time of climate change thus plays out in uncertainty, in the gatherings and emergences of the material universe unregulated by notions of progress or accumulation, interacted with at the site of the local in a manner that ensures resource justice and a meeting of basic human needs. In this way, hydrology once more becomes ontologically intimate with biology, no longer separated from it by modes of caste categorization.

As a culturally constructed phenomenon, however, space itself becomes an instrument of deformation in the possibility of agential life for women and Dalit communities.⁸⁷ To counter Souramma’s seizure of agency, the town’s *panchayat* issues an order: Narsaiah either pays an exorbitant fine to rectify Souramma’s dishonoring of the “traditions and restrictions followed in this village” (469), or she will be stripped, “her head will be shaved, and she will be paraded naked

⁸⁷ In *The Cracked Mirror*, Guru writes: “Space is a culturally constructed phenomenon. Structure and restructuring of a given space is the result of a specific action carried out by a historically dominant social group, which achieves its hegemonic purposes through a regulated exercise of civilizational violence against those social groups that are victims of this kind of violence. Violence in general would seek to restructure space in a specific way” (82).

around the village” (498). The *panchayat*, populated by upper-caste men, knows the sum that it asks of Narsaiah is impossible, meaning that Souramma’s humiliation is very specifically intended to reinscribe the Dalit body into the dominant social order. Justice, says Pedda Reddy, the *panchayat* head, must be exacted, otherwise “the village’s reputation will dissolve in water” (498). Though a turn of phrase, his comment highlights a conceptual linkage between caste tradition and the purity of water, illustrating the extent to which the former is culturally imbued with the life-giving qualities of the latter. As another *panchayat* member tells Narsaiah, “this is a village, not a graveyard, isn’t it? That means, it also has a custom, isn’t it? That’s why if [Souramma]’s not punished the village won’t accept it” (498). Water itself thus vacillates in the Brahmanical ideology as that which is organized according to the patriarchy and that which operates to maintain patriarchal order.

Yet the rope’s movement has jarred the Mala Dalit collective out of their oppression, making them suddenly alert to the possibility of an alternate spatiotemporality. In a display of solidarity, they refuse to allow Souramma’s sentence to be carried out, and in the play’s final scene appear at a village assembly to demand the cessation of caste discrimination. These concluding moments of action are calibrated according to a shift in the space and social dynamic of power, which becomes reconfigured by the biological-hydrological intimacy of the female body. As the assembly begins, Dasu and other young Dalit men quickly come to the fore as the voices of social justice. Not only do they fiercely refuse to pay the fine, but they also alert the *panchayat* that the Dalits will no longer abide by caste traditions of water distribution while additionally demanding that the upper-caste women apologize to Souramma. The heated discussion that ensues is interrupted three times by an unnamed woman who enters to tell Ganga, Souramma’s daughter-in-law and wet nurse to the infant son of Pedda Reddy’s own daughter-in-law, that she must follow

her and feed the baby. The woman is repeatedly ordered away under the Dalits' claim that Ganga will not leave the assembly until their demands are met: "Were you bothered, ever, when so many [of] us along with our children thirsted for a little drinking water?.... Did you even think about us and our babies even once?... Why should we give milk to your children?" (510). Nevertheless, the incident initiates a shift in focus from the organization of the body politic in relation to the external, ideological space of the social to a politics of body-born justice that subverts patriarchal categories of representation by redefining the human according to a common corporeality, that is, to a shared vulnerability of the body in constant interchange with other bodies and the larger environment.

A sharing of confluent material flows initiates this common corporeality. In *Daaham's* final moments, Souramma is issued an apology and the play concludes as Ganga, taking the infant from his mother, "*sits down with the child in her lap*" (511). The immanent act of breastfeeding connects bodies, space, and materialities in a democratic topological formulation, the intimacy of which establishes a trans-material ethics that notably stems from an understanding of confluence as contamination. Though it remains unacknowledged by the characters themselves, this topological weaving is the result of a material trajectory of contaminants, thread-like and binding, that lace the Dalits' sources of hydration, mingle with biological elements in women's breastmilk, and are transferred to the Brahman infants. When one of the *panchayat* members asks the Dalits how they have survived if they had not been "give[n]" water at the well by the upper-castes (509), Souramma replies, "we walked ten miles and brought dirty water from puddles—bathing water for dogs, pigs, and cattle—and drank that" (509). The extent to which the Dalits have been subjected to alternatives to drinking water is also hinted at in the play's second scene, when Narsaiah, after hearing of Souramma's transgression, tells her, "If there's no water, we'd have lived drinking urine" (495). These comments reconfigure water scarcity from a phenomenon that is external to the body

to a phenomenon that is representable within the body, traceable in the material realities of unpotable hydration sources.

By extension, the breastmilk desired of Ganga can be conceptualized as a cumulation of these sources in what is, on one hand, the embodiment of caste injustice and an emphasis on the permeability and violability of the body, and, on the other, a platform for a material gender politics. Indeed, an ethics dwells within this permeability. The body is open to environmental materialities in a manner that sets aside ideologically organized categories of being in an emphasis of corporeal commonality in constant interchange with environmental surroundings. As Stacy Alaimo points out, “Humans are vulnerable because they are not in fact ‘human’ in some transcendent sense, but are flesh, substance, matter” (24). This vulnerability is at the heart of a material gender politics as the struggle for and establishment of equal recognition. In her refusals to feed the child until Souramma and the Dalit collective receive an apology “for abusing [the] whole caste as pigs” (511), an apology that in its opening of the village well to all as equals will reorganize the village space, Ganga forcefully seizes her own body from the patriarchal lexicon, recognizing herself as a corporeal expression of allegiance between bodily and hydrological flows. Within this intimacy lies a form of resource governance that has the capacity to organize the social and create grounds for a new politics according to water work as confluence rather than as a sexual—and caste-inflected—division of labor. Here, work becomes the delivery of life—whether through the fetching of water or the act of breastfeeding—that vulnerably engages with the environment through its materialities rather than as an ideologically-managed infrastructure.

In *Daaham*, a material gender politics arises as a radical, bodily intervention in patterns of oppression that have historically conjoined India’s ecologies and citizens in enforced fungibility. Ganga’s body cuts through the choking sediment of gender inequalities and irresponsible

infrastructures to offer a vision of a future in which resource management is an interfacing, rather than a disciplining, of populations and materialities. The body does not only enable this interaction but is the very point of interface, its materiality a common boundary between different flows and energies. It does not perform itself in an ethical space but is ethical space itself. It does not as much lead to a time of radical sustainability as it makes this time. The key to a just future, it communicates, lies in the present. The virtual crystallizes in moments of confluence when the divide between materialities becomes muddled—such as when a woman agrees to feed a baby and draws a parallel between the life-giving flows of breastmilk and water. In *Daaham*'s final moments, the time of radical sustainability unfurls on stage and in the imagination in full force as the village community, gathered around Ganga, gives witness to this crystallization. Each viewer becomes an extension of the moment of confluence, attentive to the demanding force of life that travels through the earth and body and connects human and nonhuman in a twofold commons. The space of the stage becomes a space of materialities—the hungry baby body, the dehydrated Dalit body, the flow of water and milk—shared and cared for, and Ganga's body as the point of interface becomes a commonality, a point of connection between bodies that creates the powerful political charge of a gendered sustainability.

The goal of this chapter was to consider the conditions that would make an Indian feminist politics possible and how such a politics could subtend and reformulate water resource management on a local scale. Here, climate models served as climate justice tools, able to project not only future climate scenarios but also the future gender and resource injustices that such scenarios would instigate. High probabilities regarding a severe water crisis across the Indian subcontinent suggest a rethinking of current neoliberal water management practices and the gendered division of water labor as a patriarchal norm. While a material gender politics evolves

through the practice of politics as an affectual, local force, climate models emphasize the need for this politics to be implemented at the national level. At the very least, climate models could function as platforms for negotiations between policy-makers, governmental officials, and historically disadvantaged groups affected by resource scarcities, and therefore raise awareness of the lived experiences of Dalit, rural women and the existing knowledge they have of local water conditions. Climate models could, in other words, emphasize at the national level the need for affective resource infrastructures.

Affective infrastructures bloom within the commons. An exciting and almost tangible possibility that a material gender politics presents is the localization of resource management, where villages could access and organize resource supplies without the mediation of a political economy influenced by economic globalization. Under a material gender politics, rural water infrastructures would, for example, be constructed through the just relation of local materialities, including human bodies in the village social sphere and, by extension, the natural resources required for their survival. *All would become confluent through the human body as an affectable point of interface*, that is, through the body that engages in life-giving water work. In their struggles and labors, Devi's Phulmani and Vinodini's Ganga become articulations of uncertain evolutions, of social (r)evolutions that open to unprecedented relations and the unfolding of lives unprogrammed by oppressive powers. The ontological uncertainty that underlies affective infrastructures is the political frontier that prefaces the emergence of Shiva's Earth Democracy.

CONCLUSION: UNCERTAINTY AS (R)EVOLUTION

The goal of this dissertation was to examine how climate model uncertainties, first, present climate change as an emerging reality, and, second, newly condition knowledge and being so as to urge humanity beyond the anthropocentric situation. I have attempted to present climate modeling to the environmental humanities through the specificities of modeling practices and the virtualities that they render conceivable. I have thereby sought to ease scholars' anxieties that climate models perpetuate a transcendental, holistic perspective of the planet that enables the injustices of economic globalization and erases the multiplicity of materialities. The first set of chapters in my dissertation (Chapters One and Two) mainly present an anarchist theory of knowledge in their analyses of climate models, epistemic uncertainty, and climate change.⁸⁸ The second set (Chapters Three and Four) considers how this knowledge emerges from and translates into a politics of ontological uncertainty.

I would like to conclude by conceptualizing uncertainty as a politics characterized by both an ecology of practices and evolutionary processes that work to broaden the singular to the multiple. The discourse of uncertainty traced throughout my chapters names the entangling of realms—social, political, cultural, industrial, ecological—and disciplinary fields—climate science, literature, women's and gender studies, philosophy, sustainability—around the unknown-unknowns of climate change and the precarities and potentialities these imply for the human. Better

⁸⁸ I use anarchism here in Paul Feyerabend's sense of the term, which designates a divergence of scientific theory, method, and knowledge from hegemonic standardization. As Feyerabend writes, "*the events, procedures and results that constitute the sciences have no common structure*" (xiv, original italics). For Feyerabend, the subject of such a science is a knower of varieties; she is engaged in a form of scientific investigation that has no formal horizon but is an exploration in fecundity, where hypotheses and experiences are full of hidden potential and conclusions serve as the starting point for a new space of imaginable possibilities. Knowledge of the world is engagement with the virtual. See Feyerabend, Chapter 1 and 2.

yet, a discourse of uncertainty names an entangling of realms and disciplines around the potentialities found shimmering in states of precarity brought on by the uncertain futures narrated in climate model probabilities. An ecology of practices thus names an evolutionary politics, the latter which refers to a revolutionary force constantly seeking to broaden, disclose, and transform social and socio-ecological relations.

I would like to align my above description of politics with Gilles Deleuze and Félix Guattari's political philosophy to place uncertainty in a genealogy of political thought. Largely neglected across disciplines that engage with their work, Deleuze and Guattari's political philosophy has only recently been highlighted by a handful of scholars. Such a general oversight might derive from the fact that, as the foundation of Deleuze and Guattari's *oeuvre*, their political philosophy is not neatly encapsulated in a specific chapter or section of work but is rather deeply embedded throughout the entirety of their *Capitalism and Schizophrenia* project. However, its neglect not only robs from the complexity of their concepts, hindering a detailed understanding of their overall philosophy, but it also isolates such concepts in an abstract, theoretical bubble that often makes them seem devoid of practical application.

Unrelated to the contemporary definition of politics as affairs pertaining to the state, a Deleuzo-Guattarian politics connotes the contestation of repressive powers by transformative forces that are non-reducible to the category of a counter-power. Politics, in other words, extends beyond the norms of historicization, that is, beyond the ideologically driven regimes that have hitherto composed the discourse of emancipatory struggles. How is it possible to have a politics beyond history? In *Communists Like Us* (1990), Guattari and Antonio Negri suggest that this occurs through the reframing of collective practices and modes of consciousness so that politics becomes "the need to recharacterize...fundamental struggles in terms of a continuous conquest of

(new) arenas of freedom, democracy, and of creativity” (36). Politics thus “attempts to understand contemporary social transformations...on the basis of the productive activities, the desires, and the real needs which regulate them” (36). The above definition of politics is nothing less than the micropolitics discussed in *Anti-Oedipus* (1983) and *A Thousand Plateaus* (1987). If a politics centers around the recharacterization of fundamental struggles, it references a re-organization of society through a re-distribution of power from states to non-state entities, from the macro contenders of the history books to marginalized collective subjectivities.

Sibertin-Blanc offers a third reason for a general scholarly disregard of Deleuze and Guattari’s political philosophy, writing that its neglect has arguably been intensified by “repression of the contexts in which the political positions of [Deleuze and Guattari’s] times were defined, in theory and practice, where the means specific to conceptual work were supposed to take action” (10). Referring to the “political decompositions and recompositions of the 1960s and 1970s” (11), specifically the turbulence of France’s May 1968 revolution, Sibertin-Blanc argues that *Capitalism and Schizophrenia* is inseparable, firstly, “from a complex movement involving the history of the labor movement and its organizations in Western Europe” (11), and, secondly, from the “tendency towards depoliticization in the decade after May ’68” (11-12). Developed amid political upheaval and expectation for political change, Deleuze and Guattari’s concept of politics is intended to extend beyond the theoretical and fulfill itself in practice. Both *Capitalism and Schizophrenia* and Deleuze and Guattari’s individual work actively anticipate society’s movement towards a politics that is beyond history. As Deleuze announces in conversation with Claire Parnet, “*a new type of revolution is in the course of being possible*” (*Dialogues* 147, original emphasis), namely, one that will engender “new relations with the body, with time, sexuality, the immediate surroundings, with culture, work” (Deleuze and Guattari, “May ’68” 209). These relations would enable a “politics

focused on the destiny of humanity” insofar as such a destiny references a process of relational and ethical connections between heterogeneous systems (Guattari, *The Three Ecologies* 67).

In the spirit of evolution and virtuality, uncertainty politics extends and develops Deleuze and Guattari’s concept of revolution. It illustrates how their political philosophy might be furthered beyond the density of their work in *Capitalism and Schizophrenia*. While focusing on social challenges applicable to the twenty-first century, uncertainty is also developed amidst political upheaval, expectation for change, and as a reaching beyond the structures that currently parametrize history. In fact, uncertainty discourse illustrates that a Deleuzo-Guattarian revolution was never a *Deleuzo-Guattarian* revolution. It was never a concept that began and ended with their thought but was rather disclosed from within it. Deleuze and Guattari’s work can therefore be considered an illuminating of potentialities that invites scholars to continue thinking the possibilities of the future from the standpoints of their present. I seek to do just this from the perspective of these early years of climate change, their unique ontological space—one that has yet to transition from anthropocentric structures or experience the climate impacts expressed in climate model probabilities—and their resulting zeitgeist of uncertainty. The following summaries of my chapters are each prefaced with an italicized sentence that articulates the conceptual connection, the genealogical thread of thought, between an uncertainty politics and a Deleuzo-Guattarian revolution. I conclude by highlighting a new connection that uncertainty discourse offers to yet unrealized forms of revolution and politics that continue to shimmer in the space of the virtual.

From Michel Serres’s discussion of the role of scientific models in Chapter One, I extract the notion of temporal reconciliation, *a time of thought that is incompatible with the time or thought of the actual and is thus the time of reinventing politics*. Serres conceptualizes models as

constructions that ask interpreters to acknowledge the inaccessible nature of what a model's plasticity makes accessible. Knowledge of our world is based on a profound uncertainty of natural truths, which can only be accessed through the mediation of the model. The model thus articulates a relation of distance between the scientist and the natural world. In climate modeling, this distance manifests itself in an epistemic uncertainty that is born from the nonlinearity of climate systems and the historical range of climatological data sets necessary for model programming. As climate models simulate future climate scenarios, they enact an interweaving of atmospheric, geological, and human temporalities. They therefore ask to be read as spaces shot through with temporal forces that invite new avenues of thought and existence. The temporal minglings of climate models ask us to consider not "what we are, but, rather, what we become, what we are in the process of becoming" (Stengers 12).

Chapter Two, "Welcoming Uncertain Futures," *recasts the role of production in society so that the political economy is embedded in social and ecological relations*. Technicist solutions to climate change that seek to maintain a fossil fuel economy pose a threat to the development of temporal reconciliation in their attempts to artificially maintain and regulate the energy flows of natural processes. Temporal reconciliation's refusal to extract and abstract energy reserves from matter acknowledges energy's embodied nature and transforms natural resources into narratives of material mixtures and virtual expressions of uncertain futures. With the intention of keeping the temporal processes of the world dangerous—free to deviate and flux according to the laws of thermodynamics—my literary analysis of Ian McEwan's *Solar* highlights two intertwined virtual revolutions that open to uncertain futures, uninhibited energy flows, and teeming materialities: a technological ethic, which describes a form of technological innovation accompanied by an understanding of the limitations imposed on human action by climate and ecological tipping points;

and an Irigarian sexual difference that contextualizes Being within evolutionary becoming. Together, these virtualities promise to broaden the notion and practice of sustainability and articulate an ontology of uncertainty.

My third chapter, “Embodied Knowledge,” *advocates for a movement outside of historical dialectics in search of a new vision of social relations and practices*. I call for a rethinking of the conceptual parameters that determine the legitimacy of scientific knowledge and arguably influence the spirit in which climate change is communicated to non-expert audiences. Traditionally, epistemic values have been a conditioning factor for scientific practice, allowing hypotheses, experiments, and conclusions to be made objectively, uninfluenced by social value judgements. Yet the inherent uncertainty in climate modeling requires that climate modelers make certain programming decisions that blur the lines between epistemic and non-epistemic values, therefore suggesting that the very practice of modeling is enabled by the social, experiential, and embodied context of knowledge. I argue that the dissolution of a binary epistemic/non-epistemic discourse would result in the emergence of a new epistemological agent able to approach the climate modeling process through a productive interweaving of social concerns and scientific practice. Such an interweaving could jumpstart new climate communication strategies, including the idea of a situated knowledge broker, who would discursively weave the realities of atmospheric and ecological changes into the very narratives that structure non-expert communities’ values, beliefs, and identities. Barbara Kingsolver’s *Flight Behavior* enables speculation on the impact that a situated knowledge broker would have in a local community and emphasizes that a welcoming of uncertain futures begins with open, inclusive dialogic practice.

Chapter Four, “Engendering Sustainability,” *imagines an alternative social organization in which the roles of citizenship and governance are reconstituted through renewed relations*.

Climate model projections of climate scenarios in India's river basins suggest the high probability of severe water shortages by the middle of the twenty-first century. This spells deep climate injustice for rural communities and perhaps an even deeper gender injustice for Dalit women subject to the gendered division of daily water labor. If policy-makers read and act upon climate model probabilities in concern for India's vulnerable populations, climate models transform into platforms of ethical negotiation. Policy-makers and government officials would ideally develop adaptation strategies through the hard work of encountering Others, acknowledging their needs, and thereby composing a common world in which such needs are respected and upheld. Within this process of negotiation, concepts of citizenship and governance would broaden and evolve. Climate models and their uncertainties therefore have the potential to open the Indian state to a virtual politics. I argue that an engendering of rural water resource management through a material politics would help prepare communities for the future by placing women at the forefront of localized water management initiatives as political actors. In the context of India, a material gender politics would mean recognizing rural women's lived experience of local water infrastructure as grounds for their participation in local and regional politics, both generally and in terms of sustainable practice. My reading of Mahasweta Devi's *Jal* and M. M. Vinodini's *Daaham* links this engendered sustainability to a recasting of social constructions of gender, which are powerfully renegotiated in both plays through the intimate relation between the human—female—body and water.

The politics of uncertainty I develop in each of my chapters gathers power as a virtual force through an Irigarayan deployment of sexual difference. Irigaray's notion of a first biodiversity recasts politics as a field for the interaction and expression of evolutionary forces; this is in contrast to a politics that struggles for the constitution, recognition, and maintenance of identities from

within existing structures of power. According to Irigaray, the feminine task to “go on living and creating worlds” through transformation is not accomplished through sign, theory, or praxis but through the lived and differential reality of the subject who does not act upon others but upon the world (*Ethics* 127). As Grosz writes, “Such a politics...generate[s] transformation without directing that transformation to other subjects who acknowledge its force” (“The Time of Thought” 52). A politics of sexual difference is a transformative force that affects the very fabric of reality by enabling our ability to conceive of identities and sexualities as ways of being that energetically fling themselves far beyond the pale of present, always engaged in becoming.

The (r)evolutionary politics of uncertainty that my dissertation offers is a force of difference rather than a mode of representation. As such, it adds a unique twist to—or, at the very least, reminds readers of what is latent in—contemporary discussions of sustainability and the Anthropocene, including sexual difference as a cultural revolution immanent in ecological and climatological systems. Irigaray’s wording of “first biodiversity” is such a powerful formulation because it blurs the distinction between the human and the environment. Its reference to sexual difference is, at heart, a reference to radical difference that opens immediately upon the nonhuman world when realized precisely because it extracts the subject from a transcendental position and immediately reweaves her into the web of planetary materialities. My decision to forefront sexual difference as a primary concept in this dissertation is because its thorough reframing of *all* material relations articulates uncertainty as *life* rather than as an anthropocentric zeitgeist or a source of anxiety about the future.

In his essay “Anthropocene Time,” Chakrabarty illustrates the popular use of the notion of force in recent scholarship to conceptualize the problem of the Anthropocene. He writes that popular definitions of the Anthropocene that refer to “humanity as a geological force” displace a

Newtonian understanding of force in the “natural” world with the notion of force as “the human-existential category of power and its sociological-institutional correlates” (9). Force as a relation of difference between materialities—after all, a materiality cannot act on itself, only an Other can act upon it, or vice versa—is twistedly translated into a “regime of historicity” that forecloses relations between things (Hartog qtd. in Chakrabarty 10). The force of first biodiversity, however, is in excess of translation. In fact, it is in excess of the very notion of the Anthropocene itself because it endlessly diverges from the structured parameters of reality. *Force* might be a more productive way to think through the Anthropocene’s possibilities and challenges. It would invite thought as excess, as that which the Anthropocene has yet to become or give way to. Uncertainty names the force of the virtual future.

WORKS CITED

- Adams, Jason M. *Occupy Time: Technoculture, Immediacy, and Resistance after Occupy Wall Street*. Palgrave Macmillan, 2014.
- Agarwal, Bina. *A Field of One's Own: Gender and Land Rights in South Asia*. Cambridge University Press, 1994.
- . "The Gender and Environment Debate: Lessons from India." *Feminist Studies*, vol. 18, no. 1, 1992, pp. 119-58.
- Ahlers, Rhodante. "Empowering or Disempowering: The Gender Dimensions of Neo-Liberal Water Policy in Mexico and Bolivia." *Opposing Currents: The Policy of Water and Gender in Latin America*, edited by Vivian Bennet, Sonia Dávila-Poblete and Maria Nieves Rico. Pittsburg University Press, 2005, pp. 53-71.
- Akhtar, M., N. Ahmad, and M. J. Booij. "The Impact of Climate Change on the Water Resources of Hindukush-Karakorum-Himalaya Region Under Different Glacier Coverage Scenarios." *Journal of Hydrology*, vol. 355, no. 1-4, 2008, pp. 148-63.
- Alaimo, Stacy. "The Naked World: The Trans-Corporeal Ethic of the Protesting Body." *Women and Performance: A Journal of Feminist Theory*, vol. 20, no. 1, 2010, pp. 15-36.
- Alliez, Eric. *Capital Times: Tales from the Conquest of Time*, translated by Georges Van Den Abbeele. University of Minnesota Press, 1996.
- Arendt, Hannah. *The Human Condition*. University of Chicago Press, 1957.
- Asthana, Vandana. *Water Policy Processes in India: Discourses of Power and Resistance*. Routledge, 2009.
- Bagchi, Jasodhara. "Towards Equality." *Social Scientist*, vol. 41, no. 11/12, 2013, pp. 11-23.

- Ball, Phillip. "Coming Clean About Nuclear Power." *Nature*,
<https://www.nature.com/news/2004/040913/full/news040913-23.html>. Accessed 26
 September 2018.
- Bandyopadhyay, Samik. Introduction. *Five Plays*, by Mahasweta Devi, Seagull Books, 1997, pp.
 vii-xxxi.
- Banerjee, Sumanta. *In the Wake of Naxalbari: A History of the Naxalite Movement in India*.
 Subarnarekha, 1980.
- Barad, Karen. "On Touching – The Human That Therefore I Am." *differences: A Journal of
 Feminist Cultural Studies*, vol. 23, no. 3, 2012, pp. 206-07.
- Basu, Amrita. "Gender and Governance: Concepts and Contexts." *Gender and Governance*,
 edited by Human Development Resource Centre, United Nations Development Program,
 2003, pp. 20-58.
- Beck, Ulrich. *World at Risk*, translated by Ciaran Cronin. Polity Press, 2009.
- Bennett, Jane. *Vibrant Matter: A Political Ecology of Things*. Duke University Press, 2010.
- Bergson, Henri. *Creative Evolution*, translated by Arthur Mitchell. Random House, 1944.
- Berkes, Fikret, and Carl Folke. "Linking Social and Ecological Systems for Resilience and
 Sustainability." *Linking Social and Ecological Systems: Management Practices and
 Social Mechanisms for Building Resilience*, edited by Fikret Berkes and Carl Folke,
 Cambridge University Press, 1998, pp. 1-26.
- Berndt, Katrin. "Science as Comedy and the Myth of Progress in Ian McEwan's *Solar*." *Mosaic*,
 vol. 50, no. 4, 2017, pp. 85-101.

“Blair Pledges £100m for Environment.” *The Independent*,

<https://www.independent.co.uk/environment/blair-pledges-pound100m-for-environment-634084.html>. Accessed 26 September 2018.

Bostrom, M. “American Attitudes to the Environment and Global Warming: An Overview of Public Opinion.” FrameWorks Institute, 2001.

Brechin, Steven R. “Comparative Public Opinion and Knowledge on Global Climatic Change and the Kyoto Protocol: The US Version of the World?” *International Journal of Sociology and Social Policy*, vol. 23, no. 10, 2003, pp. 106-34.

Briggs, William. *Uncertainty: The Soul of Modeling, Probability, and Statistics*. Springer, 2016.

Buell, Lawrence. *The Environmental Imagination: Thoreau, Nature Writing, and the Formation of American Culture*. Harvard University Press, 1995.

Bush, Vannevar. *Science – The Endless Frontier: A Report for the President on a Program for Postwar Science Research*. National Science Foundation, 1990

Butler, Catherine, Sarah Darby, Tom Henfrey, et al. “People and Communities in Energy Security.” *New Challenges in Energy Security: The UK in a Multipolar World*, edited by Catherine Mitchell, Jim Watson and Jessica Whiting, Palgrave Macmillan, 2013, pp. 116-36.

Butler, Judith. *Frames of War: When Is Life Grievable?* Verso, 2009.

---. *Gender Trouble: Feminism and the Subversion of Identity*. Routledge, 1990.

Cameron, Jenny K. and J. K. Gibson-Graham. “Feminising the Economy: Metaphors, Strategies, Politics.” *Gender, Place & Culture*, vol. 10, no. 2, 2003, pp. 145-57.

Campt, Tina M. *Listening to Images*. Duke University Press, 2017.

Capstick, Stuart, Lorraine Whitmarsh, Wouter Poortinga, Nick Pidgeon, and Paul Upham.

“International Trends in Public Perceptions of Climate Change Over the Past Quarter Century.” *WIREs Climate Change*, vo. 6, 2015, pp. 35-61.

Carrier, Martin. “Knowledge, Politics, and Commerce: Science Under the Pressure of Practice.”

Science in the Context of Application, edited by Martin Carrier and Alfred Nordmann, Springer, 2011, pp. 11-30.

Carson, Rachel. *Silent Spring*. Houghton Mifflin, 1962.

Carter, Neil. “Party Politicization of the Environment in Britain.” *Party Politics*, vol. 12, no. 6, 2006, pp. 747-67.

Chakrabarty, Dipesh. “Anthropocene Time.” *History and Theory*, vol. 57, no. 1, 2018, pp. 5-32.

---. “Climate and Capital: On Conjoined Histories.” *Critical Inquiry*, vol. 41, no. 1, 2014, pp. 1-23.

---. “The Climate of History: Four Theses.” *Critical Inquiry*, vol. 35, no. 2, 2009, pp. 197-222.

Chakravarti, Uma. *Gendering Caste: Through a Feminist Lens*. STREE, 2003.

Chandra, Amitabha. “The Naxalbari Movement.” *The Indian Journal of Political Science*, vol. 51, no. 1, 1990, pp. 22-45.

Chatterjee, Partha. “After Subaltern Studies.” *Economic & Political Weekly*, vol. 48, no. 35, 2012, pp. 44-49.

---. *The Nation and Its Fragments: Colonial and Postcolonial Histories*. Princeton University Press, 1993.

Chatterji, Bankim Chandra. *Anandamath*, translated by Basanta Koomar Roy. Orient Paperbacks, 1992.

- Chatterton, Paul. "Towards an Agenda for Post-carbon Cities: Lessons from Lilac, the UK's First Ecological, Affordable Cohousing Community." *International Journal of Urban and Regional Research*, vol. 37, no. 5, 2013, pp. 1654–74.
- Chow, Rey. "Postmodern Automatons." *Feminists Theorize the Political*, edited by Judith Butler and Joan W. Scott, Routledge, 1992, pp. 101-15.
- Cleaver, Frances. "Institutions, Agency and Limitations of Participatory Approaches to Development." *Participation: The New Tyranny?*, edited by B. Cooke and U. Kothari. Zed, 2001, pp. 36-55.
- Coburn, Thomas. *Devī-Māhātmya: The Crystallization of the Goddess Tradition*. Motilal Banarsidass Publishers, 1984.
- Colebrook, Claire. "We Have Always Been Post-Anthropocene: The Anthropocene Counterfactual." *Anthropocene Feminism*, edited by Richard Grusin. University of Minnesota Press, 2017, pp. 1-20.
- . "What Is the Anthro-political?" *Twilight of the Anthropocene Idols*, edited by Tom Cohen, Claire Colebrook, and J. Hills Miller. Open Humanities Press, pp. 81-125.
- Committee on the Status of Women in India. *Towards Equality: Report of the Committee on the Status of Women in India*. Department of Social Welfare, Ministry of Education and Social Welfare, Government of India, 1974.
- Corson, Catherine, Kenneth Iain MacDonald, and Benjamin Neimark. "Grabbing 'Green': Markets, Environmental Governance and the Materialization of Natural Capital." *Human Geography*, vol. 6, no. 1, 2013, pp. 1-15.

- Cowley, Jason. "Solar by Ian McEwan." *The Guardian*,
www.guardian.co.uk/books/2010/mar/14/solar-ian-mcewan. Accessed 29 September
 2016.
- Das, Priyam. "Women's Participation in Community-Level Water Governance in Urban India:
 The Gap Between Motivation and Ability." *World Development*, vol. 64, 2014, 206-18.
- Das, Veena. "The Mythological Film and its Framework of Meaning." *India International
 Centre Quarterly*, vol. 8, no. 1, 1981, pp. 43-56.
- Dayal, Rekha, Christine van Wijk and Neelanjana Mukherjee. *Methodology for Participatory
 Assessments with Communities, Institutions and Policy Makers: Linking Sustainability
 with Demand, Gender and Poverty*. World Bank, 2000.
- Deleuze, Gilles. "May '68 Didn't Happen." *Two Regimes of Madness: Texts and Interviews
 1975-1995*, translated by Mike Taormina. Semiotext(e), 2007, pp. 233-36.
- Deleuze, Gilles and Claire Parnet. *Dialogues II*, translated by Hugh Tomlinson and Barbara
 Habberjam. Columbia University Press, 2002.
- Deleuze, Gilles and Félix Guattari. *Anti-Oedipus: Capitalism and Schizophrenia*, translated by
 Robert Hurley, Mark Seem, and Helen R. Lane. Penguin Books, 2009.
- Devi, Mahasweta. *Imaginary Maps*, translated by Gayatri Spivak. Routledge, 1995.
- . "Thirst." *Five Plays*, translated by Samik Bandyopadhyay. Seagull Books, 1997, pp. 123-98.
- Dimock, Wai Chee. *Residues of Justice: Literature, Law, Philosophy*. University of California
 Press, 1996.

- DownToEarth. "688 Billion Cubic Metres: India's Water Withdrawals for Agriculture is the Highest in the World." *DownToEarth*, 28 Jun. 2018, <https://www.downtoearth.org.in/news/water/688-billion-cubic-metres-india-s-water-withdrawals-for-agriculture-is-the-highest-in-the-world-60967>. Accessed 5 Feb. 2019.
- D'Souza, Rohan. "Rigidity and the Affliction of Capitalist Property: Colonial Land Revenue and the Recasting of Nature." *Studies in History*, vol. 20, no. 2, 2004, pp. 237-72.
- Ehrlich, Paul. *The Population Bomb*. Buccaneer Books, 1968.
- Feyerabend, Paul. *Against Method*. Verso, 2010.
- Forsythe, N., Fowler, H. J., Blenkinsop, S., Burton, A., Kilsby, C. G., et al. "Application of a Stochastic Weather Generator to Assess Climate Change Impacts in a Semi-Arid Climate: The Upper Indus Basin." *Journal of Hydrology*, vol. 517, no. 19, 2014, pp. 1019-34.
- Foskey, Deb. "Applying a Gender Lens to the Global Political Economy of the Right to Water." *Fluid Bonds: Views on Gender and Water*, edited by Kuntala Lahiri-Dutt. STREE, 2006, pp. 65-84.
- Freeman, Matthew, Victoria Trinies, Sophie Boisson, Gregory Mak, and Thomas Clasen. "Promoting Household Water Treatment through Women's Self Help Groups in Rural India: Assessing Impact on Drinking Water Quality and Equity." *PLOS ONE*, vol. 7, no. 9, 2012, pp. 1-9.
- Frigg, Roman, Erica Thompson and Charlotte Werndl. "Philosophy of Climate Science Part 1: Observing Climate Change," *Philosophy Compass*, vol. 10, no. 12, 2015, pp. 953-64.

- Gain, A. K., W. W. Immerzeel, F. C. Sperna Weiland, and M. F. P. Bierkens. "Impact of Climate Change on the Stream Flow of the Lower Brahmaputra: Trends in High and Low Flows Based on Discharge-Weighted Ensemble Modelling." *Hydrology and Earth System Sciences*, vol. 15, 2011, 1537-45.
- Galford, Gillian, Julie Nash, Alan K. Betts et al. "Bridging the Climate Information Gap: a Framework for Engaging Knowledge Brokers and Decision Makers in State Climate Assessments." *Climatic Change*, vol. 138, 2016, pp. 383–95.
- Garrard, Greg. *Ecocriticism*. Routledge, 2012.
- . "Solar: Apocalypse Not." *Ian McEwan: Contemporary Critical Perspectives*, edited by Sebastian Gores, 2nd edition, Bloomsbury, pp. 122-33.
- Garrard, Greg, George Handley, Axel Goodbody and Stephanie Posthumus. *Climate Change Skepticism: A Transnational Ecocritical Analysis*. Bloomsbury Academic, 2019.
- Gent, Peter. "Coupled Climate and Earth System Models." *Climate Change Modeling Methodology: Selected Entries from the Encyclopedia of Sustainability Science and Technology 2012th Edition*, edited by Philip J. Rasch. Springer, 2012, pp. 5-30.
- Ghosh, Amitav. *The Great Derangement: Climate Change and the Unthinkable*. The University of Chicago Press, 2016.
- Gibson-Graham, J. K. *A Postcapitalist Politics*. University of Minnesota Press, 2006.
- Giere, Ronald. "A new Program for Philosophy of Science?" *Philosophy of Science*, vol. 70, no. 1, 2003, pp. 15-21.
- Gieryn, Thomas. *Cultural Boundaries of Science: Credibility on the Line*. The University of Chicago Press, 1999.

- Gonçalves, André R., Fernando J. Von Zuben, and Arindam Banerjee. "A Multitask Learning View on the Earth System Model Ensemble." *Computing in Science & Engineering*, vol. 17, no. 6, 2015, pp. 35-42.
- Gopalan, Sarala, editor. *Towards Equality: An Unfinished Agenda, National Commission for Women*. The National Commission for Women, Government of India, 2002.
- Gore, Al. *Earth in the Balance: Ecology and the Human Spirit*. Rodale, 1992.
- Gorman-Murray, Andrew. "An Australian Feeling for Snow: Towards Understanding Cultural and Emotional Dimensions of Climate Change." *Cultural Studies Review*, vol. 16, no. 1, 2010, pp. 60-81.
- Gosling, Simon and Nigel W. Arnell. "A Global Assessment of the Impact of Climate Change on Water Scarcity." *Climate Change*, vol. 134, 2016, pp. 371-85.
- Grosz, Elizabeth. "Bodies and Knowledges: Feminism and the Crisis of Reason." *Feminist Epistemologies*, edited by Linda Alcoff and Elizabeth Potter. Routledge, 1993, pp. 187-215.
- . *The Nick of Time: Politics, Evolution, and the Untimely*. Duke University Press, 2004.
- . "The Time of Thought." *Feminist Time Against Nation Time: Gender, Politics, and the Nation-State in an Age of Permanent War*, edited by Victoria Hesford and Lisa Diedrich. Lexington Books, 2008, pp. 41-58.
- . *Time Travels: Feminism, Nature, Power*. Duke University Press, 2005.
- Guattari, Félix. *Chaosophy: Texts and Interviews 1972-1977*, edited by Sylvère Lotringer, translated by David L. Sweet, Jarred Becker, and Taylor Adkins. Semiotext(e), 2009.
- . *The Three Ecologies*, translated by Ian Pindar and Paul Sutton. The Anthlone Press, 2000.

Guattari, Félix and Antonio Negri. *Communists Like Us: New Spaces of Liberty, New Lines of Alliance*, translated by Michael Ryan, 1990.

Guber, Deborah Lynn. *The Grassroots of a Green Revolution: Polling America on the Environment*. MIT Press, 2002.

Guijt, Irene and Meera Kaul Shah. "Waking Up to Power, Conflict, and Process." *The Myth of Community: Gender Issues in Participatory Development*, edited by Irene Guijt and Meera Kaul Shah. Intermediate Technology Publications, 1998, pp. 1-23.

Gupte, Manisha. "Envisioning India without Gender and Patriarchy? Why Not?" *Alternative Futures: India Unshackled*, edited by Ashish Kothari and K. J. Joy, AuthorsUpFront, 2017, pp. 555-73.

Guru, Gopal and Sundar Sarukkai. *The Cracked Mirror: An Indian Debate on Experience and Theory*. Oxford University Press, 2012.

Hacking, Ian. *The Emergence of Probability: A Philosophical Study of Early Ideas About Probability, Induction and Statistical Inference*. Cambridge University Press, 1975.

Hansen, Anders and Robert Cox, eds. *The Routledge Handbook on Environment and Communication*. Routledge, 2015.

Harari, Josué V. and David F. Bell, introduction to *Hermes: Literature, Science, Philosophy*, edited by Josué V. Harari and David F. Bell (Baltimore: Johns Hopkins UP, 1982), pp. ix-xl.

Haraway, Donna. "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective." *Feminist Studies*, vol. 14, no. 3, 1988, pp. 575-99.

Harding, Sandra. "A Socially Relevant Philosophy of Science? Resources from Standpoint Theory's Controversiality." *Hypatia*, vol. 19, no. 1, 2004, pp. 25-47.

Harré, Rom, *Modeling: Gateway to the Unknown*. Elsevier, 2004.

Harrison, Simon. "Emotional Climates: Ritual, Seasonality and Affective Disorders." *Journal of the Royal Anthropological Institute*, vol. 10, no. 3, 2004, pp. 583-602.

Harriss-White, Barbara and Elinor Harris. "Unsustainable Capitalism: The Politics of Renewable Energy." *Coming to Terms with Nature*, edited by L. Panitch and C. Leys. London Merlin Press, 2006, pp. 72-101.

Hastrup, Kristen. "Anticipating Nature: The Productive Uncertainty of Climate Models." *The Social Life of Climate Change Models: Anticipating Nature*, edited by Kristen Hastrup and Martin Skrydstrup. Routledge, 2013, pp. 1-29.

Hastrup, Kristen and Martin Skrydstrup, editors. *The Social Life of Climate Change Models: Anticipating Nature*, Routledge, 2013.

Heidegger, Martin. *The Question Concerning Technology and Other Essays*, translated by William Lovitt. Garland, 1977.

Heise, Ursula. *Imagining Extinction: The Cultural Meanings of Endangered Species*. University of Chicago, 2016.

---. "Introduction: The Invention of Eco-Futures." *Ecozon@*, vol. 3, no. 2, 2012, pp. 1-10.

Hejazi, M. I., J. Edmonds, L. Clarke, P. Kyle, et al. "Integrated Assessment of Global Water Scarcity Over the 21st Century Under Multiple Climate Change Mitigation Policies." *Hydrology and Earth System Sciences*, vol. .18, 2014, 2859-83.

Hempel, Carl H. *Aspects of Scientific Explanation and Other Essays in the Philosophy of Science*. Free Press, 1965.

- Herrnstein Smith, Barbara and Arkady Plotnitsky. "Introduction: Networks and Symmetries, Decidable and Undecidable." *Mathematics, Science, and Postclassical Theory*, edited by Barbara Herrnstein Smith and Arkady Plotnitsky. Duke University Press, 1997, pp. 1-16.
- Hoppe, Robert. "Lost in Translation? Boundary Work in Making Climate Change Governable." *From Climate Change to Social Change: Perspectives on Science-Policy Interactions*, edited by Peter P.J. Driessen, Pieter Leroy and Wim van Vierssen. International Books Utrecht, 2010, pp. 109-30.
- Hulme, Mike. *Why We Disagree About Climate Change*. Cambridge University Press, 2009.
- Husserl, Edmund. *The Crisis of the European Sciences and Transcendental Phenomenology*, translated by David Carr. Northwestern University Press, 1970.
- Immerzeel, Walter. "Historical Trends and Future Predictions of Climate Variability in the Brahmaputra Basin." *International Journal of Climatology*, vol. 28, no. 2, 2008, pp. 243-54.
- Immerzeel, Walter, Ludovicus P. H. van Beek, Marc F. P. Bierkens. "Climate Change Will Affect the Asian Water Towers." *Science*, vol. 328, no. 5984, 2010, pp. 1382-85.
- Intemann, Kristen. "Distinguishing Between Legitimate and Illegitimate Values in Climate Modeling." *European Journal for Philosophy of Science*, vol. 5, no. 2, 2015, pp. 217-32.
- . "Feminism, Underdetermination, and Values in Science." *Philosophy of Science*, vol. 71, 2006, pp. 1001-12.
- Irigaray, Luce. *An Ethics of Sexual Difference*, translated by Carolyn Burke and Gillian C. Gill. Cornell University, 1993.
- . "Starting from Ourselves as Living Beings." *Journal of the British Society for Phenomenology*, vol. 46, no. 2, 2015, pp. 101-08.

- Jacobs, Katherine, James Buizer, and Susanne Moser. "The Third US National Climate Assessment: Innovations in Science and Engagement." *The US National Climate Assessment: Innovations in Science and Engagement*, edited by Katherine Jacobs, Susanne Moser, and James Buizer. Springer, 2016, pp. 1-8.
- Jayal, Niraja Gopal. "Locating Gender in the Governance Discourse." *Essays on Gender and Governance*, edited by Human Development Resource Center, United Nations Development Programme, 2003, pp. 96-134.
- Jeffrey, Richard. "Valuation and Acceptance of Scientific Hypotheses." *Philosophy of Science*, vol. 23, no. 3, 1956, pp. 237-46.
- Jenkins, Willis. *The Future of Ethics: Sustainability, Social Justice, and Religious Creativity*. Georgetown University Press, 2013.
- Joseph, Betty. "Women's Time, Historical Discourse, and a Text of Indian Nationalism." *Feminist Time Against Nation Time: Gender, Politics, and the Nation-State in an Age of Permanent War*, edited by Victoria Hesford and Lisa Diedrich. Lexington Books, 2008, pp. 107-30.
- Joshi, Deepa. "Caste, Gender and the Rhetoric of Reform in India's Drinking Water Sector." *Economic and Political Weekly*, vol. 46, no. 19, 2011, pp. 56-63.
- Joshi, Meenakshi. "Women Empowerment through a Watershed Development Project in Uttarakhand." *Women in India: Issues, Perspectives, and Solutions*, edited by Rameshwari Pandya. New Century Publications, 2007, pp. 188-210.
- Kahan, Dan. "Climate Science Communication and the Measurement Problem." *Advances in Political Psychology*, vol. 36, no. S1, 2015, pp. 1-43.

- Kahan, Dan, Hank Jenkins-Smith, and Donald Braman. "Cultural Cognition of Scientific Consensus." *Journal of Risk Research*, vol. 14, no. 2, 2011, pp. 147-74.
- Kahil, Mohamed Taher, Ariel Dinar and Jose Albiac. "Modeling Water Scarcity and Droughts for Policy Adaptation to Climate Change in Arid and Semiarid regions." *Journal of Hydrology*, vol. 522, 2015, pp. 95-109.
- Kannabiran, Kalpana. "Feminist Deliberative Politics in India." *Women's Movements in the Global Era: The Power of Local Feminisms*, edited by Amrita Basu, Westview Press, 2010, pp. 119-56.
- Keller, Evelyn Fox. *Secrets of Life, Secrets of Death: Essays on Language, Gender and Science*. Routledge, 1992.
- . *Three Cultures: Fifteen Lectures on the Confrontation of Academic Cultures*. Universitaire Pers Rotterdam, 1989.
- Kerridge, Richard. "The Single Source." *Ecozon@: European Journal of Literature, Culture and Environment*, vol. 1, no. 1, 2010, pp. 155-61.
- Kingsolver, Barbara. *Flight Behavior*. Harper Perennial, 2012.
- Kitcher, Philip. *Science, Truth, and Democracy*. Oxford University Press, 2001.
- Knox, Hannah. "Affective Infrastructures and the Political Imagination." *Public Culture*, vol. 29, no. 2, 2017, pp. 363-84.
- Kousky, Carolyn, Olga Rostapshova, Michael Toman, and Richard Zeckhauser. "Responding to Threats of Climate Change Mega-Catastrophes." World Bank Policy Research Working Paper No. 5127, 2009.
- Kulkarni, Seema. "Women and Decentralized Water Governance Issues, Challenges and the Way Forward." *Economic and Political Weekly*, vol. 46, no. 18, 2011, pp. 64-72.

Kumar, Krishna K., S. K. Patwardhan, A. Kulkarni, A., Kamala, K. Koteswara Rao, and R.

Jones. "Simulated Projections for Summer Monsoon Climate over India by a High-Resolution Regional Climate Model (PRECIS)." *Current Science*, vol. 101, no. 3, 2011, pp. 312–26.

Kumar, Radha. *The History of Doing: An Illustrated Account of Movements for Women's Rights and Feminism in India, 1800-1990*. Kali for Women, 1993.

Lahiri-Dutt, Kuntala. "Nadi O Nari: Representing the River and Women of the Rural Communities in the Bengal Delta." *Fluid Bonds: Views on Gender and Water*, edited by Kuntala Lahiri-Dutt. STREE, 2006, pp. 386-408.

Lahiri-Dutt, Kuntala and Gopa Samanta. *Dancing with the River: People and Life on the Chars of South Asia*. Yale University Press, 2013.

Lahsen, Myanna. "Seductive Simulations? Uncertainty Distributions Around Climate Models." *Social Studies of Science*, vol. 35, no. 6, 2005, pp. 895-922.

Latour, Bruno. "How to Talk About the Body? The Normative Dimension of Science Studies." *Body & Society*, vol. 10, no. 2-3, 2004, pp. 205-29.

---. "On Actor-Network Theory: A Few Clarifications." *Soziale Welt*, vol. 47, 1996, pp. 369-81.

---. *Politics of Nature: How to Bring the Science into Democracy*, translated by Catherine Porter. Harvard University Press, 2004.

Laudan, Larry. "The Epistemic, the Cognitive, and the Social." *Science, Values, and Objectivity*, edited by Peter Machamer and Gereon Wolters. University of Pittsburgh Press, 2004, pp. 14–23.

- Leiserowitz, Anthony, Edward Maibach, Connie Roser-Renouf, Jay Hmielowski. *Global Warming's Six Americas, March 2012 & Nov. 2011*. Yale Project on Climate Communication, 2012.
- Lele, Sharachchandra and Geetanjoy Sahu. "Environmental Governance in Future India: Principles, Structures, and Pathways." *Alternative Futures: India Unshackled*, edited by Ashish Kothari and K. J. Joy, AuthorsUpFront, 2017, pp. 46-62.
- Leopold, Aldo. *A Sand County Almanac*. Oxford University Press, 1966.
- Litfin, Karen. *Ozone Discourses: Science and Politics in Global Environmental Cooperation*. Columbia University Press, 1994.
- Longino, Helen. "Can There Be A Feminist Science?" *Hypatia*, vol. 2, no. 3, 1987, pp. 51-64.
- Lyotard, Jean-François. *The Postmodern Condition: A Report on Knowledge*, translated by Geoff Bennington and Brian Massumi. University of Minnesota Press, 1984.
- Malcolm, David. *Understanding Ian McEwan*. University of South Carolina Press, 2002.
- Martin, Hermínio. *Technocene: Reflections on Bodies, Minds, and Markets*, edited by S. Ravi Rajan. Anthem Press, 2018.
- Marzec, Robert P. "Climate Change and the Evolution of the 9/11 Security State: The Fantasy Adaptation of Ian McEwan's *Solar*." *Narrating 9/11: Fantasies of State, Security, and Terrorism*, edited by John N. Duvall and Robert P. Marzec, John Hopkins University Press, 2015, pp. 70-97.
- . *Militarizing the Environment: Climate Change and the Security State*. University of Minnesota Press, 2015.
- Masco, Joseph. "The Six Extinctions: Visualizing Planetary Ecological Crisis Today." *After Extinction*. Edited by Richard Grusin. University of Minnesota press, 2018, pp. 71-105.

Mazumdar, Vina. "Women's Studies and the Women's Movement in India: An Overview."

Women's Studies Quarterly, vol. 22, no. 3-4, 1994, pp. 42-54.

McEwan, Ian. *A Move Abroad: "Or Shall We Die" and The Ploughman's Lunch*. Picador, 1989.

---. *Solar*. Anchor Books, 2010.

McKibben, Bill. *Eaarth: Making a Life on a Tough New Planet*. Times Books, 2010.

Meeting the Energy Challenge: A White Paper on Energy. UK Department of Trade and Industry, 2007

Merchant, Carolyn. *The Death of Nature: Women, Ecology, and the Scientific Revolution*. Harper & Row, 1980.

Miller, Ethan. *Reimagining Livelihoods: Life Beyond Economy, Society, and Environment*. University of Minnesota Press, 2019.

Millet, Lydia. *How the Dead Dream*. Mariner Books, 2008.

Mitchell, Sandra. "The Prescribed and Proscribed Values in Science and Policy." *Science, Values, and Objectivity*, edited by Peter Machamer and Gereon Wolters. University of Pittsburgh Press, 2004, pp. 245-55.

Mizra, M. Monirul Qader, R. A. Warrick, and N. J. Ericksen. "The Implications of Climate Change on Floods of the Ganges, Brahmaputra, and Meghna Rivers in Bangladesh." *Climatic Change*, vol. 57, no. 3, 2003, pp. 287-318.

Morgan, Mary S. and Margaret Morrison, editors. *Models as Mediators: Perspectives on Natural and Social Science*. Cambridge University Press, 1999.

Morrison, Jago. "Narration and Unease in Ian McEwan's Later Fiction." *Critique: Studies in Contemporary Fiction*, vol. 42, no. 3, 2001, pp. 253-68.

- Morton, Timothy. *Hyperobjects: Philosophy and Ecology after the End of the World*. University of Minnesota Press, 2013.
- Moser, Susanne. "Reflections on Climate Change Communication Research and Practice in the Second Decade of the 21st Century: What More Is There to Say?" *WIREs – Climate Change*, vol. 7, no. 3, 2016, pp. 345-69.
- Moser, Susanne and Lisa Dilling. "Introduction." *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change*, edited by Susanne Moser and Lisa Dilling. Cambridge University Press, 2007, pp. 1-27.
- Mukherjee, Tutun, editor. *Staging Resistance: Plays by Women in Translation*. Oxford University Press, 2005
- Neale, W. C. *Economic Change in Rural India: Land Tenure and Reform in UP, 1800-1955*. Yale University Press, 1962.
- Nelson, Linda Hankinson. "Epistemological Communities." *Feminist Epistemologies*, edited by Linda Alcoff and Elizabeth Potter, Routledge, 1993, pp. 121-59.
- Nepal, Santosh and Arun Bhakta Shrestha. "Impact of Climate Change on the Hydrological Regime of the Indus, Ganges and Brahmaputra River Basins: A Review of the Literature." *International Journal of Water Resources Development*, vol. 31, no. 2, 2015, pp. 201-18.
- Nepal, Santosh., P. Krause, W. A. Flügel, M. Fink, C. Fischer. "Understanding the Hydrological System Dynamics of a Glaciated Alpine Catchment in the Himalayan Region Using the J2000 Hydrological Model." *Hydrological Processes*, vol. 28, no. 3, 2014, pp. 1329-44.
- Nuttall, Mark. "Tipping Points and the Human World: Living with Change and Thinking About the Future." *Ambio*, vol. 41, no. 1, 2012, 96-105.

- O'Reilly, Kathleen. "Insider/Outsider Politics: Implementing Gendered Participation in Water Resource Management." *Gender and Natural Resources Management: Livelihoods, Mobility and Interventions*, edited by Bernadette Resurreccion and Rebecca Elmhirst, Earthscan, 2008, pp. 195-212.
- . "'They Are Not of This House': The Gendered Costs of Drinking Water's Commodification." *Economic & Political Weekly*, vol. 46, no. 18, 2011, pp. 49-55.
- Ostrom, Elinor. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press, 1990.
- Otto, Eric. *Green Speculations: Science Fiction and Transformative Environmentalism*. Ohio State University Press, 2012.
- Our Energy Future: Creating a Low Carbon Economy*. UK Department of Trade and Industry, 2003.
- Oxford English Dictionary*. "Negotiate, V." *OED Online*. Oxford University Press, 2008.
- Pandey, Annapurna. "Globalization, *Swadeshi*, and Women's Movements in Orissa, India." *The Gender of Globalization: Women Navigating Cultural and Economic Marginalities*, edited by Nandini Gunewardena and Ann Kingsolver. School for Advanced Research, 2007, pp. 257-76.
- Pateman, Carol. *The Disorder of Women: Democracy, Feminism and Political Theory*. Stanford University Press, 1989.
- Pervez, Md. Shahriar and Geoffrey M. Henebry. "Projections of the Ganges-Brahmaputra Precipitation—Downscaled From GCM Predictors," vol. 517, no. 19, 2014, pp. 120-34.
- Plumwood, Val. *Environmental Culture: The Ecological Crisis of Reason*. Routledge, 2000.

- Pottier, Johan. "Negotiating Local Knowledge: An Introduction." *Negotiating Local Knowledge: Power and Identity in Development*, edited by Johan Pottier, Alan Bicker, Paul Sillitoe. Pluto Press, 2003, pp. 1-29.
- Premchand, Munshi. *The World of Premchand: Selected Short Stories*, translated by David Rubin. Oxford University Press, 2001.
- Prokopy, Linda Stalker. "Women's Participation in Rural Water Supply Projects in India: Is It Moving Beyond Tokenism and Does It Matter?" *Water Policy*, vol. 6, no. 2, 2004, pp. 103-16.
- Prügl, Elizabeth and Audrey Lustgarten Schönfeld. "Mainstreaming Gender in International Organizations." *Women and Gender Equity in Development Theory and Practice: Institutions, Resources, and Mobilization*, edited by Jane S. Jaquette and Gale Summerfield. Duke University Press, 2006, pp. 53-70.
- Rancière, Jacques. *The Emancipated Spectator*, translated by Gregory Elliott. Verso, 2009.
- Rao, Brinda. "Struggling for Production Conditions and Producing Conditions for Emancipations: Women and Water in Rural Maharashtra." *Capitalism, Nature, Socialism*, vol. 1, no. 2, 1988, pp. 65-82.
- Renewable Energy Association. *Renewable Energy Review*. Renewable Energy Association, 2015.
- Rodell, Matthew, Isabella Velicogna, and James S. Famiglietti. "Satellite-Based Estimates of Groundwater Depletion in India." *Nature*, vol. 460, no. 7258, 2009, pp. 999-1002.
- Rooney, Phyllis. "The Borderlands Between Epistemic and Non-Epistemic Values." *Current Controversies in Values and Science*, edited by Kevin C. Elliott, and Daniel Steel, Taylor and Francis, 2017, pp. 31-45.

Rothbart, Daniel. *Philosophical Instruments: Minds and Tools at Work*. University of Illinois Press, 2007.

Rotman, Brian. "Thinking Dia-Grams: Mathematics, Writing, and Virtual Reality."

Mathematics, Science, and Postclassical Theory, edited by Barbara Herrnstein Smith and Arkady Plotnitsky. Duke University Press, 1997, pp. 1-16.

Rotmans, Jans. *Targets in Transition*, Rijksinstituut voor Volksgezondheid en Milieu, 1995.

Rousseau, Jean-Jacques. *Politics and the Arts: A Letter to M. D'Alembert on Theatre*, translated by Allan Bloom, Cornell University Press, 1968.

Sakellari, Maria. "Cinematic Climate Change: A Promising Perspective on Climate Change Communication." *Public Understanding of Science*, vol. 24, no. 7, 2015, pp. 827-41.

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

Schiermeier, Quirin. "Holding Back the Tide." *Nature*, vol. 508, April 2014, pp. 164-66.

Schmidt, Gavin A. "Of Buckets and Blogs." *RealClimate*, 1 Jun 2008,

<http://www.realclimate.org/index.php/archives/2008/06/of-buckets-and-blogs/>. Accessed 3 Jun 2019.

Schönfeld, Martin. "Field, Being, Climate: Climate Philosophy and Cognitive Evolution."

Climate Change and Philosophy: Transformational Possibilities, edited by Ruth Irwin. Continuum, 2010, pp. 21-31.

Seacrest, Susan, Robert Kuzelka, and Rick Leonard. "Global Climate Change and Public Perception: The Challenge of Translation." *Journal of American Water Resources Association*, vol. 36, no. 2, 2000, pp. 253-63.

Select Committee on Environmental Audit Tenth Report. Environmental Audit Committee, 11 Aug. 2004,

www.publications.parliament.uk/pa/cm200304/cmselect/cmenvaud/490/49004.htm#note13. Accessed 23 Oct. 2018.

Serres, Michel. *The Birth of Physics*, translated by Jack Hawkes. Clinamen Press, 2001.

---. *The Five Senses: A Philosophy of Mingled Bodies*, translated by Margaret Sankey and Peter Cowley. Bloomsbury, 2008.

---. *Genesis*, translated by Genevieve James. University of Michigan Press, 1997.

---. *Hermes: Literature, Science, Philosophy*, translated by Josué V. Harrari and David F. Bell. Johns Hopkins University Press, 1982.

---. *The Natural Contract*, translated by Elizabeth MacArthur and William Paulson. University of Michigan Press, 1995.

---. *Thumbelina: The Culture and Technology of Millennials*, translated by Daniel W. Smith. Rowman and Littlefield, 2015.

---. *Variations on the Body*, translated by Randolph Burks. Univocal, 2011.

Serres, Michel and Bruno Latour. *Conversations on Science, Culture, and Time*, translated by Roxanne Lapidus. The University of Michigan Press, 1995.

Shackley Simon and Brian Wynne. "Representing Uncertainty in Global Climate Change Science and Policy: Boundary-Ordering Devices and Authority." *Science, Technology, & Human Values*, vol. 21, no. 3, 1996, pp. 275-302.

Shah, Anil C. "Women and Water: Perceptions and Priorities in Rural India." *Fluid Bonds: Views on Gender and Water*, edited by Kuntala Lahiri-Dutt. STREE, 2006, pp. 172-84.

- Shah, Mihir. "Water: Towards a Paradigm Shift in the Twelfth Plan." *Economic and Political Weekly*, vol. 48, no. 3, 2013, pp. 40-52.
- Sharma, Keshav P., Charles J. Vorosmarty, and Berrien Moore III. "Sensitivity of the Himalayan Hydrology to Land-Use and Climatic Changes." *Climatic Change*, vol. 47, no. 1-2, 2000, pp. 117-39.
- Shiva, Vandana. *Earth Democracy: Justice, Sustainability, and Peace*. South End Press, 2005.
- . "The Greening of the Global Reach." *Global Ecology: A New Arena of Political Conflict*. Edited by Wolfgang Sachs. Fenwood Books, 1993, pp. 149-56.
- . *Water Wars: Privatization, Pollution, and Profit*. North Atlantic Books, 2002.
- Sibertin-Blanc, Guillaume. *State and Politics: Deleuze and Guattari on Marx*, translated by Ames Hodges. Semiotext(e), 2016.
- Sjöberg, Lennart. "Risk Perception Is Not What It Seems: The Psychometric Paradigm Revisited." *VALDOR Conference 2003*, edited by K. Andersson. VALDOR, 2003, pp. 14-29.
- Slovic, Peter and Ellen Peters. "The Importance of Worldviews in Risk Perception." *Risk Decision and Policy*, vol. 3, no. 2, 1998, pp. 165-70.
- Spivak, Gayatri. Afterword. *Imaginary Maps*, by Mahasweta Devi, Routledge, 1995, pp. 197-205.
- . *A Critique of Postcolonial Reason: Toward a History of the Vanishing Present*. Harvard University Press, 1999.
- . "Responsibility." *boundary 2*, vol. 21, no. 3, 1994, pp. 19-64.
- . "Scattered Speculations on the Subaltern and the Popular." *Postcolonial Studies*, vol. 8, no. 4, 2005, pp. 475-86.

- . Translator's Preface. *Imaginary Maps*, by Mahasweta Devi, Routledge, 1995, pp. xxiii-xxix.
- Stengers, Isabelle. *Power and Invention: Situating Science*, translated by Paul Bains. University of Minnesota Press, 1997.
- Stiegler, Bernard. *Technics and Time: The Fault of Epimetheus*, translated by Richard Beardsworth and George Collins. Stanford University Press, 1998.
- Still, Clarinda. "Dalit Women in the Social Justice Revolution in India." *Public Policy Research*, vol. 15, no. 2, 2008, pp. 93-96.
- Suhag, Roopal. *Overview of Ground Water in India*. Institute for Policy Research Studies, 2016.
<https://www.prindia.org/administrator/uploads/general/1455682937~~Overview%20of%20Ground%20Water%20in%20India.pdf>. Accessed 11 Feb 2019.
- Svetlova, Ekaterina. "Modeling Beyond Application: Epistemic and Non-Epistemic Values in Modern Science." *International Studies in the Philosophy of Science*, vol. 28, no. 1, 2014, pp. 79-98.
- The National Academy of Sciences. "Informing an Effective Response to Climate Change." 2010, https://www.nap.edu/resource/12784/Informing_Report_Brief_final.pdf.
- The U.S. Global Change Research Program. The National Global Change Research Plan 2012-2021. A Strategic Plan for the U.S. Global Change Research Program. 2012.
<https://downloads.globalchange.gov/strategic-plan/2012/usgcrp-strategic-plan-2012.pdf>.
- Trexler, Adam. *Anthropocene Fictions: The Novel in a Time of Climate Change*. University of Virginia Press, 2015.
- Tsing, Anna Lowenhaupt. *Friction: An Ethnography of Global Connection*. Princeton University Press, 2005.

- United Nations Development Programme. "Reconceptualizing Governance." Discussion Paper 2, Management Development and Governance Division, 1997.
- Van Dooren, Thom. *Flight Ways: Life and Loss at the Edge of Extinction*. Columbia University Press, 2014.
- van Koppen, Barbara. "Water rights, Gender, and Poverty Alleviation: Inclusion and Exclusion of Women and Men Smallholders in Public Irrigation Infrastructure Development." *Agriculture and Human Values*, vol. 15., no. 4, 1998, pp. 361-74.
- Vandenbergh, Michael P. and Jonathan A. Gilligan. "Macro-Risks: The Challenge for Rational Risk Regulation." *Duke Environmental Law and Policy Forum*, vol. 21, no. 401, 2011, pp. 401-31.
- Vinodini, M. M. "Thirst." *Staging Resistance: Plays by Women in Translation*, edited by Tutun Mukherjee. Oxford University Press, 2005, pp. 492-512.
- Virilio, Paul. *The Futurism of the Instant: Stop-Eject*, translated by Julie Rose. Polity Press, 2010.
- . *The Original Accident*, translated by Julie Rose. Polity Press, 2007.
- Walker, Brian and David Salt. *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*. Island Press, 2006.
- Wallace, Tina and Anne Coles. "Water, Gender and Development: An Introduction." *Gender, Water and Development*, edited by Tina Wallace and Anne Coles. Berg Publishers, 2005, pp. 1-20.
- Weber, Max. *The Protestant Ethic and the Spirit of Capitalism*, translated by Talcott Parsons. Routledge, 2001.

Weiner, Mark. "Climate Change Denial as the Historical Consciousness of Trumpism: Lessons from Carl Schmitt." *Defending the Open Society*, 17 Nov. 2017,

<https://niskanencenter.org/blog/climate-change-denial-historical-consciousness-trumpism-lessons-carl-schmitt/>. Accessed 5 Feb 2019.

Weitzman, Martin L. "On Modeling and Interpreting the Economics of Catastrophic Climate Change." *The Review of Economics and Statistics*, vol. 91, no. 1, 2009, pp. 1-19.

Whitmarsh, Lorraine. "Skepticism and Uncertainty About Climate Change: Dimensions, Determinants and Change Over Time." *Global Environmental Change*, vol. 21, 2011, pp. 690-700.

Wiltshire, A. J. "Climate Change Implications of the Glaciers of the Hindu Kush, Karakoram and Himalayan Region." *The Cryosphere*, vol. 8, 2014, 941-58.

Winsberg, Eric. *Philosophy and Climate Science*. Cambridge University Press, 2018.

---. *Science in the Age of Computer Simulation*. The University of Chicago Press, 2010.

---. "Values and Uncertainties in the Predictions of Global Climate Models." *Kennedy Institute of Ethics Journal*, Vol. 22, No. 2, 2012, pp. 111-37.

Wintour, Patrick and David Adam. "Blair Presses the Nuclear Button." *The Guardian*, 16 May 2006, www.theguardian.com/environment/2006/may/17/energy.business. Accessed 11 Oct. 2018.

World Bank. "Governance and Development." *The World Bank*, 30 Apr. 1992, <http://documents.worldbank.org/curated/en/604951468739447676/Governance-and-development>. Accessed 21 Apr. 2019.

Young, Iris Marion. "The Ideal of Community and the Politics of Difference." *Social Theory and Practice*, vol. 12, no. 1, 1986, pp. 1-26.

- Yusoff, Kathryn. *A Billion Black Anthropocenes Or None*. University of Minnesota Press, 2018.
- Zehr, Stephen. "Scientists' Representations of Uncertainty." *Communicating Uncertainty: Media Coverage of New and Controversial Science*, edited by Sharon M. Friedman, Sharon Dunwoody, and Carol L. Rogers. Lawrence Erlbaum Associates, 1999, pp. 3-21.
- Zylinska, Joanna. *The End of Man: A Feminist Counterapocalypse*. University of Minnesota Press, 2018.