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Climate science at the interface with law- and policy-making

Any book attempting to establish a Climate Justice and Disaster Law framework for protecting human and non-human Capabilities must inevitably begin with an overview of the latest climate science.[1] The conclusions reached by climate scientists explain the influence of human-induced climate change on what might otherwise be regarded as ‘natural disasters’ or even ‘Acts of God’, across timescales which reach as far into the future as 2100, and even 2300 in the case of sea level rise. Climate scientists explain that the world has begun to experience the impacts of climate change at a time when natural resources are already severely degraded through processes of: air, water and land pollution; land degradation; water scarcity and overallocation of water resources (usually to agriculture); the destruction of tropical rainforests and native vegetation; overfishing and the by-catch of dolphins, turtles and sea birds; the destruction of coral reefs; and impacts on biodiversity, to the point of extinction, in some cases. Meanwhile, climate scientists and insurers highlight that the costs of climate disasters are escalating beyond anything experienced before, largely due to the intersection of the risk of the hazard of extreme weather and slow onset events, vulnerability and exposure. The vulnerability of humans living in circumstances of multi-dimensional poverty, combined with the concentrations of people living in hazard exposed places, helps to explain the scale of climate disaster losses.

One might imagine, then, that the evidence provides the imprimatur for urgent global, national, state and local responses to all stages of climate disasters: mitigation of the risk (emissions reduction, adaptation and disaster risk reduction); disaster response management; recovery, rehabilitation and reconstruction; and compensating the victims. However, as this chapter will show, the pathway from available evidence to

[1] The author is not a scientist and relies on the IPCC’s Summaries for Policymakers for this discussion.

regulation is far from clear. Climate science lies at a complex interface with law- and policy-making, where the complexities and uncertainties have been deliberately exacerbated by vested interests especially the fossil fuel industry. Vested interests have undermined public and government acceptance of climate science, so placing those most vulnerable to the impacts of climate change at ever greater disadvantage. The implications for Climate Justice of a failure to respond urgently and appropriately to climate change, so increasing existing vulnerability and exposure, are obvious. A serious question at this time is whether it is possible to 'rescue (climate) science from politics'.[2]

The scientific information relied upon to advance the thesis of this chapter is undoubtedly rather technical and therefore the chapter includes a discussion of the most recent scientific findings included in Intergovernmental Panel on Climate Change's Fifth Assessment Report (AR5), and elsewhere, while also engaging with the Assessment Report's inherent certainties and uncertainties. Hopefully, the information is presented in a way that will neither offend the scientists nor deter other readers from understanding the platform from which the entire book project is launched.

1.1. Establishment of the Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1988 to provide a clear scientific view of the current state of knowledge about climate change and its potential environmental and socio-economic impacts. The IPCC comprises three distinct Working Groups: Working Group I (WG I), which assesses the physical scientific aspects of the climate system and climate change; Working Group II (WG II), which assesses the vulnerability of socio-economic and natural systems to climate change, the negative and positive consequences of climate change, and options for adapting to it; and Working Group III (WG III), which assesses options for mitigating climate change through limiting or preventing GHG emissions and enhancing activities that remove them from the atmosphere.[3] The IPCC

[2] This is a deliberate reference to Wendy Wagner and Rena Steinzor (eds.), *Rescuing Science from Politics: Regulation and the Distortion of Scientific Research* (Cambridge: Cambridge University Press, 2006) with my addition of the word (climate).

[3] See www.ipcc.ch/organization/organization_structure.shtml (accessed 9 December 2014).

operates under the auspices of the United Nations (UN). It does not conduct any research or monitor climate related data, but rather conducts periodic reviews and assessments of the most recent worldwide scientific, technical and socio-economic information on climate change. Thousands of scientists from all over the world contribute to the work of the IPCC on a voluntary basis and the IPCC's reports are based on a consensus view amongst them of the most recent science. All of the IPCC's reports are subject to peer-review after which the IPCC responds to the comments it has received.[4] As well as being a scientific body, the IPCC is also an intergovernmental body. It is open to all member countries of the UN and WMO; currently there are 195 member countries. Governments participate in the review process before the final reports are published and also in the plenary sessions, where the main decisions about the IPCC work program are taken and reports are accepted, adopted and approved.

An important function of the IPCC is to provide scientific information on climate change to decision makers. Hence, every major report is accompanied by a Summary for Policymakers. By endorsing the IPCC reports, governments acknowledge the authority of their scientific content. The IPCC reports, since their inception, have proved influential in the ongoing international climate change negotiations prior to, and since, the establishment of the *United Nations Framework Convention on Climate Change* (UNFCCC) in 1992. The IPCC's reporting cycle[5] includes the following stages: the IPCC approves the outline; governments and organisations nominate experts; the WG bureaus[6] select authors; authors prepare a zero order draft for internal review by authors on other chapters and then the first draft; the draft is sent for expert review; a second draft is prepared after considering the comments; the report is then subject to further expert and government review; authors prepare a final draft; the Summary for Policymakers is reviewed by governments; the WG accepts and approves the report and the Summary for Policymakers; and the report is published.

[4] For example, WG II's Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) involved 220 authors, 62 countries and received 18,611 review comments; see www.ipcc-wg2.gov/SREX/ (accessed 22 July 2014).

[5] For a full explanation of this process see www.ipcc.ch/pdf/ipcc-principles/ipcc-principles-appendix-a-final.pdf (accessed 22 July 2014).

[6] The bureaus comprise elected members of the WG and are chaired by co-chairs; see Note 3 at 3.

In 2013 and 2014, the WGs of the IPCC released their Fifth Assessment Report (AR5). Prior to this, the First Assessment Report[7] was released in 1990, the Second Assessment Report[8] in 1995, the Third Assessment Report[9] in 2001 and the Fourth Assessment Report[10] in 2007, which won the Nobel Peace Prize that year. Each Assessment Report has reported with increasing confidence levels the IPCC's observations and models on: the physical basis for climate change; impacts, vulnerability and adaptation; and mitigation. As Chapter 2 will demonstrate, these Reports have been highly influential in shaping the conclusions reached and decisions made by the Conference of the Parties to the UNFCCC. Before delving into the specific findings contained in the IPCC's AR5, it is important to uncover the many difficulties which climate scientists have faced for decades. The ensuing discussion highlights the numerous tactics which have been used by those wishing to deny the science of climate change – especially that it is human-induced – in order to delay regulation.

1.2. The science, law- and policy-making interface

Accepting that climate change is human-induced requires global leaders to take action to reduce emissions, to commit to adaptation, and, for developed countries, to fund developing countries in their efforts. More recently, it has required the international community to begin facing the prospect that the loss and damage resulting from climate change will not be avoided through adaptation alone and that developing countries most vulnerable to climate change need to be protected, including financially. The threat of human-induced climate change requires national governments to regulate GHGs, thus posing a threat to all fossil fuel industries, big emitters, individuals who resist any changes to their lifestyles, and to governments which choose to reject the science on ideological grounds and for short-term political gain. The question arises whether climate science is unique or whether scientists immersed in other areas of endeavour have faced the same level of harassment. While the evidence

[7] See www.ipcc.ch/publications_and_data/publications_ipcc_first_assessment_1990_wg1.shtml (accessed 22 July 2014).
[8] See www.ipcc.ch/pdf/climate-changes-1995/ipcc-2nd-assessment/2nd-assessment-en.pdf (accessed 22 July 2014).
[9] See www.ipcc.ch/ipccreports/tar/ (accessed 22 July 2014).
[10] See www.wmo.int/pages/partners/ipcc/index_en.html (accessed 22 July 2014).

is clear that scientists, and their findings, have always been discredited by those threatened with regulation, climate science is particularly threatening as it demands a global economic restructuring. The stakes are very high if this restructuring does not occur, but also high in terms of what a decarbonised world really means. It is interesting, therefore, to engage in an analysis of the interrelationship between science and law- and policy-making to try to understand the dynamics and challenges.

Science has seemed, certainly in the area of Environmental law- and policy-making, to have the authority to make definitive and universal statements about what is and what is not dangerous for people and societies, and ultimately the world.[11] The public still seems to expect science and, in the present context, climate science to adjudicate between competing claims to truth and to be able to make robust statements about the likelihood of certain future physical events occurring.[12] Likewise, it has seemed in the past that law-makers (in other words Congress or Parliaments) and government agencies have nothing but respect for the sanctity and wisdom of the scientific process and its results.[13] Yet these are difficult times for science where it converges with public policy- and law-making. For even though peer-reviewed science will be a commanding presence in policy discussions, other matters, such as cost–benefit analyses,[14] or distributive justice implications, or fossil fuel lobbying, or climate scepticism in government, may be more decisive.[15]

Scientists may be fairly naive about the path of their research from the laboratory to policymakers. However, those who have been drawn reluctantly out of their research laboratories into political or courtroom battles, over the last few decades,[16] have learnt that the adversarial nature of litigation, and even law-and policy-making, requires that

[11] M. Hulme, *Why We Disagree About Climate Change* (Cambridge University Press: 2009) at 74.

[12] Hulme, see Note 11 at 73.

[13] W. Wagner, ‘Introduction’ in *Rescuing Science from Politics*, edited by Wagner and Steinzor (Cambridge: Cambridge University Press, 2006) at p.1.

[14] A limitation on reliance only on scientific experts in striking the cost–benefit balance is that they have no particular knowledge of what benefits the public wants and what risks they are willing to assume to achieve those benefits; see Harold P. Green, ‘The Law–Science Interface in Public Policy Decisionmaking’ (1990) 51 *Ohio State Law Journal* 375 at 399.

[15] Donald Kennedy, ‘Prologue’ in *Rescuing Science from Politics*, edited by Wagner and Steinzor at xix, although the author has adapted the work to address climate science more specifically.

[16] Wagner, see Note 13 at 3.

scientific evidence is interpreted and reinterpreted by the parties to prove that they should 'win'. This oppositional method of decision-making is largely alien to scientific practice and counterproductive to the production of reliable research, and now poses a substantial threat to climate scientists. Likewise, the dramatic expansion of the regulatory state, characterised by a growing body of statutory and administrative law, means that those potentially affected by regulation have every incentive to counter and control the content and production of climate science. These trends, and their complex interactions, have multiplied the opportunities for destructive collisions between the worlds of science, law- and policy-making, and encouraged a number of scholars to analyse the different epistemological approaches adopted by the disciplines of science, law and policy to assess the reliability of empirical evidence and establish the 'facts'.

1.2.1. The normative underpinnings of science

The normative structure of science, beginning with the Enlightenment, has evolved over centuries and encompasses the notion of peer-review which recognises that science demands openness and transparency of claims and evidence, and the commitment 'to an epistemology that embodies a standard of empirical verifiability for certifying knowledge claims'.[17] Indeed, science might be regarded as being the domain of systematic verification to which social purposes are quite irrelevant, compared, say, with law or politics,[18] and where politics is 'terra incognita'.[19] Science also harbours a deep aversion to populist legitimations of decision-making authority,[20] although, as discussed later, climate scientists confront challenges to the science 'Republic', with the result that science may no longer be the self-contained, autonomous enclave that it once was. Particularly in the realm of climate science, scientists must increasingly interact with and satisfy a range of external stakeholders.[21]

More specifically, the normative underpinnings of science encompass the following:

[17] S. Krimsky, 'Publication Bias, Data Ownership and the Funding Effect in Science: Threats to the Integrity of Biomedical Science' in *Rescuing Science from Politics*, edited by Wagner and Steinzor at 61.
[18] Peter Schuck, 'Multiculturalism Redux: Science, Law, and Politics' (1993) 11 *Yale Law and Policy Review* 1 at 15.
[19] Ibid. at 18. [20] Ibid. at 19. [21] Ibid. at 20.

A community of inquirers

Scientific claims about the physical universe, including both natural and social phenomena, must be certified through a community of inquirers. This distinguishes science from other forms of fixing belief by appeal to authority, or sacred texts.[22] In science, there is no room for 'unquestionable authority' and no one can claim infallibility. For each subfield of science, the community of inquirers shares a methodology that is transparent and available to anyone familiar with the art of inquiry in that subdiscipline, and which might include measuring instruments, theoretical frameworks, nomenclature, quantitative methods of analysis and canonical principles for interpreting data.[23]

Science as a communitarian enterprise

The methods or discoveries of science should not be restricted to private use. That outcome is inconsistent with its communitarian enterprise.[24]

Freedom to advance theories and self-correction

In a healthy scientific environment, even marginalised and unpopular theories should have access to publication, because science must be open to alternative hypotheses, interpretations of data and theories that account for similar observations or facts, as those theories and explanations may someday become orthodoxy.[25] Science must also be able to correct itself as, unlike the static, doctrinaire norms of religion or political ideology (which might be regarded as immutable to new information and refractory to contradictory evidence), science must be self-reflecting of its own biases and limitations. Unlike political institutions, scientific culture must have systematic processes for admitting mistakes and reporting them, while striving for logical consistency.[26]

Science as universal truths and 'disinterestedness'

In healthy science, the results must be universal rather than support distinct truths about natural phenomena according to different cultures.

[22] See for example, Art. 23 of Pope Francis' *Encyclical Letter* where he calls for action on climate change stating that humanity must 'recognize the need for changes of lifestyle, production and consumption, in order to combat this warming or at least the human causes which produce or aggravate it'; available at http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html (accessed 8 July 2015).

[23] Krimsky, see Note 17 at 63. [24] Ibid. at 64. [25] Ibid. at 64. [26] Ibid. at 66.

Trust plays an essential role in the healthy functioning of science. To the maximum extent possible, scientists should have no stake in the outcome of the research and should record their data accurately. Although, according to Fischer, the scientific endeavour is impossible without passion about an idea. Scientists are not without opinions but they agree to subject those opinions, or subjective influences, to the accepted scientific method.[27] The procedural approach adopted by scientists to produce knowledge relies on controlled experiments and standardised descriptions which are designed and performed to test a hypothesis. Where the results are inconsistent with the hypothesis, the hypothesis (and not the results) should be modified to account for the data, and new experiments should be designed to test the new hypothesis. This iterative procedure is dispositive of the fact that science proceeds under a positivistic supposition that the scientist is studying a phenomenon that has an objective reality.[28] Furthermore, in the published manuscript, the researcher must describe the methodological decisions about how data is collected and analysed, describe the expert judgements made during the research, identify the findings and their meaning and, most importantly, identify the limitations of the study. Consequently, the final published paper becomes the record of the research[29] so that another individual in the field can duplicate the study.[30] Research results that meet these high procedural standards have a high epistemological quality.[31]

Ultimately, the complex interplay of originality and scepticism that operates in the scientific research community requires absolute impersonal trust on matters of empirical 'fact'. When scientists are working in an environment replete with incentives for secrecy and misconduct, this trust can be undermined. Where personal interests compromise the penultimate scientific goal of discovering the 'truth', the integrity of, and public confidence in, the scientific enterprise will begin to diminish.[32] As discussed later, in 2009, deliberate efforts to undermine the work of climate scientists, now referred to as 'Climategate', attempted

[27] See Eric A. Fischer, *Public Access to Data from Federally Funded Research: Provisions in OMB Circular A-110* (Washington: Congressional Research Service, 2013) available at http://fas.org/sgp/crs/secrecy/R42983.pdf (accessed 25 July 2014) at 96.

[28] Deborah M. Hussey Freeland, 'Speaking Science to Law' (2013) 25 *Georgetown International Environmental Law Review* 289 at 296.

[29] Fischer, see Note 27 at 96. [30] Ibid. at 92. [31] Freeland, see Note 28 at 292.

[32] Krimsky, see Note 17 at 66. See also Katherine S. Squibb, 'Basic Science at Risk: Protecting the Independence of Research Interests' in *Rescuing Science from Politics*, edited by Wagner and Steinzor at 47.

to demonstrate that the goal of discovering the 'truth' had been compromised by personal interests.

Uncertainty and science

Many sources of uncertainty pervade the scientific endeavour including: natural variation and the inherent stochasticity, or randomness, of ecological systems; inaccurate measurement of the state of ecological systems; use of abstract and simplified models to predict the response of systems to management actions; misunderstanding of variables; interpretation of incomplete data; and uncertainty in predicting future stressors to the system.[33] As Freeland states:

> Uncertainty drives scientific questions. Scientists use the scientific method to reduce uncertainty, the goal of science is to approach the truth by subjecting alternative hypotheses to rigorous test . . . Scientific dissent that arises from uncertainty is often regarded as a positive aspect of science – but not so in policy or the public arena.[34]

The relative insouciance demonstrated by scientists towards uncertainty is not necessarily shared by the law. For example, in the case of criminal prosecutions, the state must prove its case 'beyond reasonable doubt', while tort law relies on 'a balance of probabilities'. Law- and policy-makers may be satisfied to regulate based on the 'best available science'. Clearly, the various standards are not easily interchangeable across disciplines.[35]

Tendencies towards deviant science

Social determinants and an ideology that views science as a means to an end rather than as an end in itself can derail the pursuit of objective and verifiable knowledge, in which case deviance from the normative standards can be observed.[36] The factors that foster scientific deviance are complex and might include: ideology, religion, the exigencies of war, the lust for power and prestige, the pursuit of wealth and commercial interests. Authoritarian and undemocratic societies, for example, are incompatible with open, unfettered science and it is likely that such societies will impose false beliefs regardless of what the data show.[37] These tendencies are immediately observable in the ensuing discussion.

[33] Deborah M. Brosnan, 'Science, Law, and the Environment: The Making of a Modern Discipline' (2007) 37 *Environmental Law Review* 987 at 1000.
[34] Freeland, see Note 28. [35] Brosnan, see Note 33 at 1001.
[36] Krimsky, see Note 17 at 62. [37] Ibid. at 71.

On the one hand, the 'Climategate' scandal, discussed later in this chapter, attempted to establish deviant climate science in operation, while, on the other hand, climate-sceptic governments in the United States and Australia have deliberately subverted climate science to pursue a conservative agenda, from time to time.

Meanwhile, privately funded research, like that sponsored by the tobacco and fossil fuel industries, reveals another kind of deviance which is a research bias in favour of financial interests. Healthy science requires that this potential bias effect be disclosed to reviewers, editors and readers of articles submitted for publication. As Krimsky notes, presciently in the case of the fossil fuel industry as it happens, the practice of suppressing data unfavourable to an industry's bottom line 'is not illegal but it delays the science and can cost lives'.[38]

1.2.2. *The normative underpinnings of law*

In contrast to the overriding principles of disinterestedness and collaboration that dominate scientific inquiry, the legal system is founded on the premise that the clash between equally represented disparate interests metes out justice.[39] In producing justice, law appeals to universal, abstract and binding principles,[40] and it uses traditional methods to resolve complex scientific disputes because these methods encode its most cherished and distinctive values.[41] The law must solicit input from precisely the opposite types of participant – those who are sorely affected or aggrieved, and who stand to lose or win from the outcome. Although documented facts and empirical knowledge are generally welcome, the law can proceed on negotiated truths and tentative assumptions as long as the affected parties are all participating vigorously in the process.[42] Indeed, versions of the truth encapsulated in law are quite different from those found in science, because, while scientific truths are positive statements about how the natural world works, legal principles find their justification in an array of social policy goals including: fairness; efficiency; administrative costs; wealth distribution and morality, among others. Essentially, while science pursues the truth, law pursues justice,[43] and the legitimacy of law depends on reaching decisions which reflect the common morality and common sense of the lay community, and command the respect of the relevant communities

[38] Krimsky, Ibid. at 74. [39] Wagner, see Note 13 at 6. [40] Schuck, see Note 18 at 5.
[41] Ibid. at 6. [42] Wagner, see Note 13 at 6. [43] Schuck, see Note 18 at 21.