1. Introduction

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Over the next few decades, tens of trillions of dollars will be needed for the development and dissemination of a wide range of new technologies to upgrade infrastructure and to mitigate and adapt to the effects of climate change (climate change technologies).\(^1\) As the Executive Secretary of the United Nations Framework Convention on Climate Change (UNFCCC) put it, human ‘survival depends on our improvement of technology’.\(^2\) Climate change is expected to cause dramatic changes to weather patterns; to adversely affect health (particularly for vulnerable populations), ecosystems, food production and water availability; to displace populations and disrupt land and resource ownership; and to interfere with existing patterns of satisfying basic human needs.\(^3\) These developments, and the ability of society to mitigate and adapt to climate changes, will be affected in numerous ways by intellectual property rights. This book provides an introduction to the interactions of climate change with the global intellectual property, innovation, human rights and international trade systems.

The book is designed for policy makers, academics and students, business people, and other members of civil society. Its principal purpose is educational in a broad sense – it may be used in negotiating strategy rooms and corporate boardrooms as well as in classrooms. The goal is to provide a short and useful overview of the concerns and social challenges that have arisen or are likely to arise at the intersections of environment law, public policy, international trade, government regulation and private markets, and intellectual property. It also seeks to provide a readily accessible tool for future reference, identifying the principal texts and academic papers (in each addressed topic area) that have been generated to date.

Although technology, and its effective and efficient development and transfer, is a central focus of the book, many chapters are devoted to issues and concerns that do not address technology. Rather, they focus on social interactions and concerns, and on government regulation and protection of non-technological interests or price concerns, such as false commercial representations regarding ‘green’ products and protection of the public’s privacy when using climate-friendly smart-grid technologies.

As will be evident from reading the various chapters, the issues raised by the intersection of climate change and intellectual property are numerous, and the conflicts that will be engendered will consume substantial amounts of public attention and money. The concerns generated will also direct social activity and activism in new and likely unforeseen ways. As with any short review at the inception of major social developments, it is necessarily incomplete and cannot anticipate many (much less all) future events. Further, significant delays were encountered from the initiation of the project in the 2010 timeframe, and since the chapters were written some things have changed and additional analyses of the issues have appeared. Editing of the book was completed just after the adoption by the United Nations Framework Convention on Climate Change of the Paris Agreement on November 2015.
Climate Change (UNFCCC) of the Paris Agreement at the end of 2015. Nevertheless, the issues identified and the approaches discussed should provide the basic outlines on which these future developments will unfold, particularly as the Paris Agreement itself contains only voluntary national emission reduction commitments that are to be periodically reviewed (separately and collectively) and revised as needed to assure the goal of keeping temperature rise ‘well below 2°C above pre-industrial levels’. Further, the Agreement contemplates that governments will continue to rely on both public-sector non-market approaches and private-sector market approaches to financing and technology transfer in order to achieve climate change mitigation and adaptation goals. Thus, analyses presented herein should remain highly cogent. The book should withstand the test of time.

The book chapters are organized into five broad and general categories. The first set (Chapters 2 to 7) provides basic information on climate science and the international environmental and intellectual property treaty context, as well as some views on the geo-politics of climate change and international enforcement of intellectual property, environmental and climate change-specific treaties. The second set (Chapters 8 to 10) discusses underlying philosophical perspectives, addressing human rights, religious concerns, and developmental considerations relating to climate change. The third set (Chapters 11 to 15) addresses the differing approaches to the development and transfer of technologies, focusing on government technology funding choices (including reliance on private markets and intellectual property rights), university-based technology development and transfer, and competition law policies and concerns. These chapters also include a detailed discussion of relevant international trade principles and concerns, and a separate discussion of government procurement. The fourth set (Chapters 16 to 22) focuses on specific doctrinal areas of intellectual property law, specifically patents, trade secrets, copyrights and digital rights, data access and sharing, trademarks and certification marks, and related legal subjects – specifically standard-setting and privacy protection – that are likely to engender concerns and disputes in regard to climate change technologies. The final set (Chapters 23 to 26) describes some of the most important contexts in which climate change-related intellectual property concerns are likely to arise – energy, transportation, agriculture and natural resources/forestry. These chapters focus on four economic sectors where technology development, use and dissemination are likely to be critical to mitigation and adaptation strategies. A very limited preview of each chapter follows.

In Chapter 2, which begins the materials on basic information and context, David Hunter provides an overview of climate science and of the myriad effects of climate change. He then relates the science and effects to general environmental regulatory, economic, technological, and financial policy options for mitigation of and adaptation to climate change. These basic facts frame the concerns regarding which climate policy and law have developed – as discussed in subsequent chapters – and to which they will continue to respond.

In Chapter 3, Sanford Gaines describes the international environmental law treaty framework that relates to climate change. He provides a brief history of the development of the relevant international environmental law through the UNFCCC Paris Agreement of 2015, including the Vienna Convention for the Protection of the Ozone Layer and its associated Montreal Protocol and adoption of the general approach of...
differentiating responsibilities between developed and developing countries. He then offers a more detailed overview of central treaties for climate change – the UNFCCC and its associated Kyoto Protocol – and discusses some of the climate obligation flexibility and technology transfer mechanisms of its operation (in particular, the Clean Development Mechanism and Joint Implementation). Finally, he sketches some of the major features of the Paris Agreement that will govern international climate change law going forward and that are relevant to intellectual property and technology transfer issues.

In Chapter 4, Daniel Gervais discusses the international intellectual property treaty law context in which climate change issues will be addressed, focusing in detail on the World Trade Organization (WTO) Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS Agreement) and referencing important provisions of other intellectual property treaties (specifically the World Intellectual Property Organization’s Paris Convention on Industrial Property and Berne Convention on Copyrights and Related Rights). He then explains the political dynamics at play in the development of these treaties, which will remain at play in regard to climate change issues in their continued operation through intergovernmental administrative and negotiating bodies.

In Chapter 5, Carlos Correa articulates developing countries’ concerns with the international environmental treaty approach of relying on intellectual property rights without change from the current intellectual property treaty regime. In particular, he describes prior (and controversial) measures to modify the approach to such rights that have been proposed in the context of UNFCCC negotiations, which are likely to recur in implementing efforts to address climate change. These measures focus on: compulsory licensing; efforts to exclude climate change technologies from the patent system; revoking patents; and limiting patent duration.

In Chapter 6, Peter Drahos discusses the lessons for climate change negotiators that can be learned from the much longer history of international intellectual property negotiations and treaty developments, which might assist states to negotiate new commitments to reduce greenhouse gas emissions. In particular, he notes the need for more time for the climate regime to develop – as well as the lack of time available to avoid serious consequences of climate change – and identifies reinforcing mechanisms of a networked series of multilateral and bilateral treaties, sectoral approaches and business organization involvement that could lead countries to better address the negative externalities of climate change.

In Chapter 7, Peter Yu discusses the difficulties of enforcing international intellectual property and environmental treaties, and the lessons these experiences may provide for climate change treaty enforcement. He focuses on three levels. The first is enforcing state adoption and implementation of the relevant substantive treaty obligations, which might assist states to negotiate new commitments to reduce greenhouse gas emissions. In particular, he notes the need for more time for the climate regime to develop – as well as the lack of time available to avoid serious consequences of climate change – and identifies reinforcing mechanisms of a networked series of multilateral and bilateral treaties, sectoral approaches and business organization involvement that could lead countries to better address the negative externalities of climate change.

In Chapter 8, which begins the discussion of human rights, religious and economic development concerns, excerpts from a report by the International Council on Human Rights Policy (ICHRP). The ICHRP report focuses on technology transfer and the human rights dimensions of climate change, and was principally drafted by Stephen

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Humphries based on research commissioned by ICHRP. In particular, the work of Simon Caney commissioned for the report identifies three different normative claims for the transfer of climate change technologies from developed countries to the least privileged in the world, which differ in their implications and in regard to the human rights they affect. The affected rights include: the right to life; the right to health; and the right to the basic means of subsistence. The different types of normative claims are: (1) adaptation-based claims, to permit individuals to enjoy their human rights despite experiencing climate harms; (2) mitigation-based claims, to permit enjoyment of human rights without contributing to climate change; and (3) restitution-based claims, to provide compensation to those who have been unfairly deprived of their ‘fair share’ of the public good of the atmosphere’s absorptive capacity. The different claims imply different forms, allocations, and uses of transferred technology. Significantly, relying on human rights principles may help with both negotiation and implementation of international climate change obligations.

In Chapter 9, Robert Musil addresses the religious dimensions of climate change, with specific reference to the context of American religion and politics. He describes the growth of Christian and Jewish concerns with the environment and with climate in particular, and the influence that religious activism has had on climate politics and policy development in the United States. His focus on religious views re-emphasizes the moral choices posed by climate change that are framed in the ICHRP report.

In Chapter 10, Dalindyebo Shabalala provides a developing country perspective on technology transfer obligations of developed countries, pursuant to the principles of historical responsibility for climate change and of common but differentiated responsibilities as enshrined in the UNFCCC. In particular, he focuses on causes of past failures of technology transfer, the linkages of human rights to technology transfer obligations, and concerns over intellectual property rights posing a barrier to the development and transfer of climate change technologies. His chapter thus sets the stage for the next two sections of the book, which address the different market and governmental approaches to promoting the development and transfer of technologies, as well as the institutions involved in and choices of approach to specific intellectual property doctrines and the concerns that these alternatives raise.

Chapter 11 transitions to general considerations regarding how technology can be developed, and the different issues that can arise from both governmental and market-based approaches. Chapter 11 excerpts from a previous article that I wrote addressing the broad set of governmental choices regarding how to promote the development and transfer of climate change technologies. These choices can be broadly classified into five general categories, although many forms of government technology promotion have similar features and thus could be fitted into multiple categories. The five categories are: subsidies; procurement; development by government entities; creation of commons; and market regulation in its various forms, including the creation of intellectual property rights, regulation of products and market behaviors, and regulation of prices and competition. The excerpt discusses the rudimentary state of comparative analysis of the relative effectiveness of these choices of approach, and develops a taxonomy of the choices that identifies some of their particular and overlapping features.
In Chapter 12, Jorge Contreras and Charles McManis discuss the role of universities in technology development and transfer. They focus on the different modes of university technology development and licensing, the effects of the US Bayh-Dole Act on university efforts to obtain intellectual property in and to commercialize technologies, and important legal and intellectual property considerations that affect university-based technology development and commercialization. In particular, they note the important role that the experimental use exception to patent infringement can play in technology development, the effects of the Bayh-Dole Act on publication and release of data that affect knowledge diffusion for further development, and the growth of socially responsible licensing strategies by university intellectual property owners.

In Chapter 13, Michael Carrier addresses government regulation of market failures, explaining the relationship between intellectual property and antitrust (competition) law and policy in regard to climate change. He focuses on four areas where antitrust consideration is most likely to arise: (1) the scope and definition of markets and findings of market power; (2) monopoly concerns (such as refusals to license) with specific technologies (such as carbon capture and sequestration, known as CCS); (3) standard-setting efforts by governments, market-dominant firms and standard setting organizations (SSOs), including their approaches to interoperability, market entry, and licensing terms; and (4) the potential benefits of patent pools to bring new technologies to the market, and concerns over what rights the pools include (such as combinations of patents on substitute technologies that reduce competition and fix prices).

In Chapter 14, David Gantz and Padideh Ala’i canvas the wide range of trade-related issues that may arise in regard to climate change. They focus on the need to balance environmental and free trade concerns in regard to border taxes, subsidies and intellectual property rights, domestic content requirements, mandatory transfer of technology and restrictions on exports. They analyze general trade concerns and specific provisions of the WTO’s General Agreement on Tariffs and Trade (GATT) of 1994 (including Article XX exceptions for human and environmental protection and natural resource conservation measures), the WTO’s Technical Barriers to Trade Agreement (TBT), the WTO’s Agreement on Trade Related Investment Measures (TRIMS), the WTO’s General Agreement on Trade in Services (GATS), the WTO’s Antidumping Agreement (ADA), and the WTO’s Agreement on Subsidies and Countervailing Measures (SCM), as well as the WTO Government Procurement Agreement (GPA) and national trade laws (using American examples) with regard to various climate-friendly national mitigation and adaptation measures such as carbon taxes and emissions trading; tax measures and price and investment supports; technical regulations and voluntary standards. They conclude by discussing the importance of reaching an international agreement on reducing tariffs on international trade in environmentally friendly goods, and of reducing greenhouse gas emissions so that national actions are less likely to be unilateral measures.

In Chapter 15, Denis Borges Barbosa and Charlene de Avila Plaza explain in more detail the role of government procurement in technology development and transfer. They focus on the role of government procurement in promoting both specific technologies and markets, and the manner in which the WTO (through the GPA and the SCM) seeks to assure greater fairness and transparency and to address domestic preferences. In particular, they note the freedom of governments to subsidize university
research, the development of explicit environmental considerations in government procurement policies, and the technology development successes that have resulted from government procurement for national defense.

Chapter 16 marks the transition to discussing specific intellectual property doctrines and their relationship to climate change. Chapter 16 excerpts from an article that I wrote\(^9\) addressing concerns over the patent system’s relationship to climate change. These concerns include the unbalanced worldwide pattern of innovation and patenting, as well as controversial measures to compel licensing of patented technologies, to treat the exercise of patent rights as competition violations, and to directly regulate the price of patented goods. In the article, I identified six less-controversial policies that both developing and developed countries may be more likely to use to regulate access to and prices of patented climate change technologies. These are: (1) restrictive interpretations of patent-eligible inventions, requiring creative applications of scientific discoveries for patent rights; (2) robust experimental use and reverse-engineering and inter-operability exceptions; (3) retaining research and ‘humanitarian’ licensing powers for both privately owned and government funded technologies; (4) revising presumptions of exclusive licensing; (5) clarifying grounds for government ‘march-in’ interventions in regard to government funded technologies; and (6) adopting permissive international exhaustion standards.

In Chapter 17, Sharon Sandeen and David Levine discuss trade secrecy law, which also regulates innovation and access. They identify ten different policy levers that can be adjusted to promote the public interest in regard to climate change and technology development. Among the most significant of these measures are: encouraging leakage of information through adjustments to the qualifying criteria for a trade secret; recognizing certain public uses, particularly regulatory disclosures, as legitimate rather than as a misappropriation of trade secrets; creating searchable public databases of technologies so as to test claims of trade secret status, to reduce litigation, and to promote technology transfer; using government demands for information to drive owners towards preferring patents to trade secrecy; and limiting remedies for trade secret misappropriation to damages rather than providing injunctive relief.

In Chapter 18, Estelle Derclaye discusses copyrights and digital rights, particularly from a European perspective. After noting the broad scope of original copyrighted works that may be relevant to climate change concerns (including maps, architectural plans, software and databases, and other information goods), she identifies concerns over: the idea/expression dichotomy (particularly with regard to photographs); licensing openness (and compulsory licensing), and the ability to reuse works and to permit works to interoperate, particularly with regard to public sector information (PSI) – such as environmental data – that is subject to a European Union Directive; moral rights of attribution and integrity; and so-called ‘para-copyright’, or technological protection measures and anti-circumvention provisions that can restrict access to and reuse of environmental works (and the relationship of such measures to exhaustion principles). She concludes with various recommendations and discusses the difficulties of achieving them at the international treaty level.

In Chapter 19, Michael Carroll addresses concerns over the ownership and sharing of data on climate and climate change-related activities. After noting various norms that
may interfere with data sharing, he discusses intellectual property-based and contractual barriers to accessing and using climate data, as well as measures to increase access and use. In particular, he focuses on: copyrights in databases and satellite imagery based on climate data; the European Database Directive, which provides rights for databases made with substantial investments; contractual restrictions on use imposed as conditions of gaining access; public licenses – such as various Creative Commons licenses – that seek to assure greater access to data; and PSI policies. These PSI policies include presumptions of access, public domain treatment of content, licensing and cost-recovery terms, commons approaches like the Polar Information Commons (PIC), and policies for publicly funded private research.

In Chapter 20, Christine Farley addresses the proliferation of green trademarks and certification marks and the role that they may play in regard to climate-friendly technologies. After noting the efforts of governments and businesses to address climate change, she emphasizes the important role played by consumers and their buying power in forcing companies and industries to meet environmental standards, so long as consumers possess good information about environmental standards and companies adhere to those standards. She then discusses: barriers to registration of eco-friendly marks (as descriptive or merely informational) and the use of certifications to indicate compliance with environmental standards (and international variations over their recognition); the problems of ‘green fatigue’ and ‘greenwashing’ as consumers are overwhelmed by the sheer amount of or by false (and insufficiently regulated) information regarding environmental compliance; and recommendations for improvement, including clarifying certification standards, periodic review of compliance, more transparent application procedures, and adherence to guidelines on environmental benefit claims.

In Chapter 21, Jorge Contreras discusses the important role that standard setting plays in the development and use of an increasing range of technologies, and the concerns that may arise in regard to such technology development. After describing the various types of standards, their mandatory or voluntary nature, and conformity to them, he addresses standards specific to climate change such as emissions, fuel efficiency, biofuels, renewable energy, energy efficiency, the smart grid and building sustainability. He then canvasses intellectual property issues relating to the differing kinds of standards, including: copyrights in the standards themselves; patents on standard technologies, patent stacking and patent pools; patent policies of standard development organizations (SDOs), including requirements to disclose rights in technologies, royalties and disclosure of licensing terms; and standards for certification marks.

In Chapter 22, Jennifer Urban describes the privacy (and cyber-security) concerns that can arise in regard to climate change-related technologies, with a focus on the experience in California with the development and deployment of the smart-grid and advanced electrical metering technologies. After describing the world-wide development and deployment of these technologies, she identifies a number of privacy concerns that they raise, including: changes in the kinds of personal data collected from traditionally private areas (particularly homes); changes in the uses to which such data can be put (not just for energy use reductions but also for marketing, consumer profiling in insurance, credit, and other fields, etc.); changes to data flows (and the
numbers of data recipients); and cyber-security risks from multiple locations in the expanding information network. She then describes some measures that pre-existed the smart grid or that were subsequently adopted in California and in the European Union to address these concerns, including: constitutional privacy protections; adoption of the Fair Information Practice Principles developed by the US Department of Health, Education and Welfare in 1973; and other measures.

In Chapter 23, which transitions from the specific intellectual property doctrines and related concerns to discussion of some of the most important industrial sectors in which climate issues may arise, Steven Ferrey discusses energy use and the increasing contribution of the electric sector to climate change. He canvases a wide range of energy technologies that can affect greenhouse gas emissions in four energy sectors: non-renewable and low-carbon generation technologies; carbon capture and storage from conventional power generation; the new smart-grid; and innovations in power usage and control, including demand side management efforts by utilities. By identifying the dramatic technological changes that will be forthcoming from the massive new investments in infrastructure, he provides concrete context for the many intellectual property issues (including meeting technology standards, trade secret protection, patenting and licensing behaviors, privacy protections, and integration within regulated electric power monopolies) that will likely arise from development, ownership, transfer, and use of energy technologies. He diagrams how not only the technology but also the institutional mechanism through which we deliver that technology and retail power – the utility – is undergoing new legal pressures and regulatory redesign.

In Chapter 24, Paulo Bifani, David Vivas-Eugui and Haifeng Wang address the transportation sector and greenhouse gas emissions relating to it. After noting increasing greenhouse gas emissions and pressures to reduce them in the transportation sector (as well as other reasons to reduce reliance on fossil-fuel-based technologies), they focus on two important subsectors where significant technological innovation to reduce such emissions will occur. These are: the automobile sector, where they discuss the development of electric vehicles and battery technologies; and the airplane sector, where they discuss the highly complex and inter-connected industrial and government relations that will shape innovation in this area and in many countries around the world.

In Chapter 25, Geoff Tansey discusses the important effects of agricultural production and consumption on climate change, and vice-versa. After noting existing inadequacies and disparities regarding worldwide nutrition and the large contributions of agricultural practices to climate change, he describes the likely adverse effects of climate change on agricultural practices and on increasing nutritional insecurity. He then discusses the changing funding for agricultural research; the growing global concentration of control over production and distribution, including the effects of both over-production and over-consumption; and the use of intellectual property rights (including trademarks for branding and plant variety protection rights) to direct these developments. He concludes with a discussion of various scenario-planning alternatives, the need to shift paradigms and to change assumptions to avoid adverse outcomes, and the role that intellectual property will play in influencing negotiations, directing research and development, and shaping markets and consumer behaviors to determine who will benefit from or bear the risks of climate change.
Finally, in Chapter 26, Baskut Tuncak explains how forests and other natural resources will contribute to climate change and affect the services provided by ecosystems, and how management of these resources will be critical to both mitigation of and adaptation to climate change effects. He first describes technologies for the management and conservation of forests, for monitoring and measuring stocks of forests, and for managing and monitoring aquatic ecosystems. He then identifies the background context and decisions of various institutions that have led to the development of the principal mechanisms addressing reduction of emissions relating to forests and aquatic ecosystems: the UNFCCC CDM (Clean Development Mechanism); the UNFCCC REDD+ (Reducing Emissions from Deforestation and Forest Degradation and the role of Conservation, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks in Developing Countries); and the Intergovernmental Oceanographic Commission (IOC) GOOS (Global Ocean Observing System). He also briefly addresses various cross-cutting issues, such as: biological diversity and prior informed consent for access and benefit sharing (noting the Convention on Biological Diversity (CBD)); food security; and trade and the environment. Finally, he discusses the need for future developments in regard to technical capacity, international environmental governance mechanisms, and the mobilization of financial resources.

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NOTES


10 Research handbook on intellectual property and climate change


6. See ibid. Art. 6, ¶ 8, 9, Art. 9, ¶ 1, 2, Art. 10, ¶ 4–6.

