Climate Change and International Relations (after Kyoto)

Arild Underdal

Department of Political Science, University of Oslo, and

Center for International Climate and Environmental Research – Oslo (CICERO)

E-mail: arild.underdal@stv.uio.no

Regular mail: Department of Political Science,

University of Oslo,

P.O.Box 1097 Blindern,

0317 Oslo, Norway

Office phone: (+47) 2285 5241

Table of Contents

Keywords

Climate change, diagnostics, cures, global governance, bottom-up approaches

Abstract

This review has two sections, one "diagnosing" climate change as an international governance challenge, the other exploring the political feasibility of alternative "cures." Human activities' growing effect on Earth's climate system is extremely challenging, characterized by, inter alia, very long time lags between mitigation measures (~costs) and environmental effects (~benefits) and by stark asymmetries between "guilt" in causing the problem and vulnerability to climate change. Two main cures have been suggested. One argues that since climate change is a global process, adequate solutions must likewise be global. The other shifts attention from the challenge's format to the sources of human motivation, arguing that a decentralized (bottom-up) approach will more directly engage a wider spectrum of motivations and actors. These cures are neither mutually exclusive nor easily combined. IR research contributes more to the former cure than to the latter but can play a constructive role also in linking them.

> "Humanity has the capacity, ingenuity, technologies and resources to create a better world. However, the lack of *appropriate institutions, coordination mandates, political will and governance structures* make the task difficult" *Global Energy Assessment* 2012, p. 8 (italics AU).

INTRODUCTION

In 2014, the American Political Science Association (APSA) honored Robert O. Keohane by awarding him the James Madison Award. In his acceptance lecture at APSA's annual conference, Keohane urged political scientists to be more active in addressing global climate change. While recognizing several "outstanding" contributions from senior political scientists such as David G. Victor and Oran R. Young in the United States and Thomas Bernauer and Frank Biermann in Europe, he found it "distressing to observe the slow response from political science *as a discipline*" (Keohane 2015, p. 19, italics added). Keohane then outlined a research agenda addressing important governance challenges where "political scientists are best-placed to reframe climate issues in incentive-compatible ways" and thus help governments and stakeholders stand up to the challenge (Keohane 2015, p. 25).

Keohane's observations refer to the political science discipline at large (see Bernauer's review (2013)). Do they apply also to international relations (IR)?

In support of his "slow response" observation, note that none of five major multi-authored volumes published in the heyday of international regime theory development (Haas et al. 1993, Victor et al. 1998, Brown Weiss & Jacobson 1999, Young 1999, Miles et al. 2002) analyzes climate change. These studies were perhaps too early to assess the emerging climate change regime, but a survey of recent publication patterns in leading IR journals yields similar results. Judged on the basis of titles and abstracts, the proportion of articles from 2011 to 2015 focusing on climate change was 0% in *International Organization*, 0.3% in *International Studies Quarterly*, and 1.6% in *European Journal of International Relations*.

Other indicators, however, point towards a more positive score. First, in their introduction to an edited volume on comparative environmental politics, Steinberg & VanDeveer (2012, p. 10) refer to IR as "[B]y far the most prolific source of political science research on the environment…." Second, new opportunities for IR scholars to publish also climate-related research were provided by the establishment of two new journals – *Global Environmental Politics* (GEP) and *International Environmental Agreements* (INEA) in 2001. Since 2010, about 50% of regular articles published in them dealt with some aspect of climate change politics or policies. Two former GEP editors recently warned that climate change-related studies risk "crowding out analysis of other important environmental issues" (Dauvergne & Clapp 2016, p. 8). Finally, although few political scientists have served as lead authors on the Intergovernmental Panel on Climate Change (IPCC), the IR community is at least recognized as a place for research-based assessments on topics like "International Cooperation: Agreements and Instruments" (IPCC 2014, WGIII, Chap. 13).

The following review has two sections. I begin with problem "diagnostics," i.e., an overview of natural science and social science contributions to understanding the interplay between biophysical and political aspects of climate change. I conclude that human activities' growing effect on Earth's climate system constitutes an extremely demanding multi-level governance challenge. The second section concerns contributions of IR research to developing and implementing "cures" in the form of effective and politically feasible institutions and policies. Here, I review IR research strands that specify important criteria for assessing solutions and examine the roles of intergovernmental institutions and non-state actors in governance processes. I conclude by highlighting some important achievements and remaining challenges.

"DIAGNOSTICS": UNDERSTANDING POLITICAL DIMENSIONS OF CLIMATE CHANGE

In (applied) social science as in medicine, diagnosing a problem logically precedes prescribing a cure. Following Young (2008, p. 120) I use "diagnostics" to refer to "a systematic process in which diagnostic queries probe the nature of specific issues," the purpose of that probing being to build a knowledge base for designing effective response strategies and measures. I proceed in two steps, turning first to natural sciences – in particular what is known as "earth system science" (Schellnhuber & Wenzel 1998, Steffen et al. 2004) – for elementary knowledge about the climate system's biophysical properties.

The political implications of biophysical properties

I begin with the natural sciences because at least three of their contributions have important implications for political science analysis of climate change as a governance challenge. One is the conception of Earth as an integrated, complex and dynamic system. The word *integrated* tells us (a) that Earth has distinct boundaries towards its surroundings, and (b) that its major components are linked through multiple relationships of interdependence – some weak, others strong. The reference to *complexity* says that given these intricate webs of interdependence, exploring likely trajectories of future climate change requires models that couple theories and empirical observations from many disciplines to study a *diverse* range of consequences. For example, a certain increase in GHG atmospheric concentrations may well play a role in causing more devastating floods in one region, more severe droughts in another, and more pleasant living conditions in a third. *Dynamic* reminds us that many biophysical and socio-ecological relationships are non-linear (Steffen et al. 2004, Rockström et al. 2009), characterized by "tipping points" at which abrupt, perhaps irreversible change will likely occur (Lenton et al. 2008).

Second, the concluding summary of findings from the International Geosphere-Biosphere Programme (IGBP) observed that human activities have become "equal to some of the great forces of nature in their extent and impact" (Steffen et al. 2004, p. 257). Consequently, the Earth system now operates in a "no-analogue state," meaning that experience may no longer reliably aid in forecasting developments (Steffen et al. 2004, p. 262). In support of this message, Nobel Laureate Paul Crutzen and others have suggested that the world is entering a new geological

epoch, the *Anthropocene* (Crutzen & Stoermer 2000). Recently, teams consisting of social and natural scientists have joined in trying to identify "planetary boundaries" and define "a safe operating space for humanity" (Rockström et al. 2009, Steffen et al. 2015).

Third, time lags between human activities and their full effect on the climate system often extend well beyond one human generation (IPCC 2014, p. 4). The main anthropogenic drivers have been population growth (P), increasing affluence (A) and technological development (T), interacting multiplicatively: I(mpact) = P·A·T (Holdren & Ehrlich 1974, Chertow 2001)[1]. Future generations will face the *combined* effect of accumulated GHG atmospheric concentrations and shrinking capacity of some natural sinks in the biosphere and the hydrosphere. Today, long-term environmental governance arguably amounts to "reorganising the overall relationship between humans and natural systems" (Pattberg & Widerberg 2015, p. 684). For some, that task requires more centralized capacity, notably the formation of a UN World Environment Organization (Biermann & Bauer 2005); for others, polycentric governance is a more promising strategy (Ostrom 2009).

Individually, and even more so together, these biophysical and biogeochemical characteristics of the Earth system have profound implications for understanding climate change as an international governance challenge. Most importantly, they tell us that we are dealing with an extremely demanding challenge – described as "politically malign" (Miles et al. 2002, Keohane & Victor 2016) or even "super wicked" (Levin et al. 2012). The main explanation can be found in the incentive structures and power configurations generated by the kind of system described above.

Consider first the Earth system as *integrated*. In political economy terms, Earth's climate system is a global collective good recently subjected to increasing risks of depreciation by a wide range of human activities (Barrett 2003, Aldy & Stavins 2009). Aggregate GHG emissions and diminishing capacity of important natural sinks negatively affect humanity's "safe operating space" and will hurt parties who can legitimately claim to be victims of myopic behavior by the rich. Conversely, measures that reduce GHG emissions or enhance sinks contribute to damage prevention that benefits also free riders. To the extent actors are motivated by self-interest, their incentive structures will be "distorted" in both instances. This asymmetrical configuration of incentives fairly well reflects the cleavage structure characterizing – and at times paralyzing – UNFCCC conference diplomacy (Victor 2011).

Consider next the very long time lags existing between anthropogenic inputs and biophysical effects. All else constant, uncertainty tends to increase the farther into the future we look. Consequently, long-term benefits of mitigation will appear more uncertain than immediate costs to be paid as measures are implemented. Moreover, two findings from social science research point to psychological and political mechanisms that can further enhance this bias. Experimental research indicates that – even for events occurring simultaneously – most people are inclined to react more strongly to the prospects of a given loss than to the prospect of an equally large gain (Kahneman & Tversky 1979). Political science studies have found that, all else constant, effects concentrated to a particular economic sector or a particular social group tend to generate more effective stakeholder mobilization than effects that diffuse throughout society

[1] For the world at large, this formula correlates almost perfectly (.99) with CO_2 emission trajectories during the 1990-2013 period (author's estimate).

(Wilson 1973). Through these and other mechanisms, long time lags between behavior and effect tend to work *against* ambitious mitigation policies, doing so mainly by leading into asymmetrical modes of assessment that make immediate and concentrated costs loom larger than remote and dispersed benefits.

Making things worse, long time lags deprive future generations of opportunities to participate in decision-making that may be critically important to them. In temporal terms, we are dealing with a starkly asymmetrical upstream–downstream relationship that leaves future stakeholders heavily dependent on their ancestors. Most parents care about the well-being of their children and grandchildren and behave accordingly. But once we shift from micro- to macro-level analysis, the short-term material self-interest of the present generation(s) will be less well-aligned with the interests of future generations. Lacking institutions capable of "correcting" incentive structures and power discrepancies, the contributions of upstream generations to GHG mitigation will likely fail to optimize cross-generational welfare.

Humanity's response capacity

To be effective, a cure must "fit" the challenge (Young 2008, Folke et al. 2007). Fit can be assessed on a theoretical level. Thus, from its beginning, mainstream international regime theory "borrowed" well-established issue-structure concepts from game theory and, in doing so, adopted the main propositions game theorists have derived about actor strategies and outcomes (Stein 1982, Hasenclever et al. 1997). But fit can also be assessed with reference to more specific features not developed as constitutive elements of one particular approach or theory (see Young 2008). For both approaches, most IR scholars conclude that existing global governance institutions fail to supply sufficient capacity to reach the ambitious targets declared by the Paris Conference (Biermann 2014, Victor 2015, Keohane & Victor 2016). More specifically, the world's collective action capacity is significantly constrained by at least three system properties not easily changed.

One is *fragmentation*. The world has about 200 countries, differing widely in population, income levels, political systems, GHG emissions, vulnerability to climate change, etc. In important respects, the international political system reflects this fragmentation. IR (structural) realists describe the system as anarchical: "states have no central authority above them" (Mearsheimer 1994–1995, p. 10). Other IR research strands offer more nuanced, less pessimistic descriptions. Scholars associated with the neoliberal institutionalist approach cite growth in intergovernmental and transnational organizations and networks, seeing this development as transformative change (e.g., Pattberg & Widerberg 2015; Abbott et al. 2016). In focusing on cognitive more than material components, constructivists present a less deterministic understanding of politics, cogently expressed in the title of a much-cited article by Wendt (1992): "Anarchy is what states make of it." A third strand, including scholars within political economy, contributes by exploring the role that unilateral leadership and small "climate clubs" may play to encourage or coerce reluctant countries to upgrade their mitigation efforts (Olson 1965, Barrett 2007, Nordhaus 2015, Young 1991). A common conclusion is that no single state is sufficiently dominating to be willing and able to control the human effect on the climate system through unilateral action. On the positive side, climate change is not such that the weakest link determines the outcome. Several studies, using computer simulations or field

experiments to compensate for scarce empirical evidence, report that an initially small group of concerned and powerful states can – under favorable circumstances – grow and significantly enhance its collective-action capacity either by providing exclusive benefits to other countries that join the club (Hovi et al. 2016, Sælen 2015) or by sanctioning those who do not join (Nordhaus 2015).

Another important constraint is the *stark asymmetries* existing between "guilt" in causing the problem and capacity to alleviate it on one hand and social-ecological vulnerability to climate change on the other. Citing this gap, developing countries have insisted that widely accepted norms of distributive fairness – notably those referring to responsibility for damage, capacity to mitigate, and basic human needs – guide global climate change negotiations (Mattoo & Subramanian 2012, Gupta 2015). Given these equity norms, most developing countries have committed to GHG mitigation *contingent* upon significantly deeper emission cuts by rich countries and/or adequate compensation. In UNFCCC conferences, the G-77 group can easily mobilize significant support for a resolution expressing these demands as UN policy. Doing so will, however, hardly change developed countries' material interests nor their control over activities needing regulation. In fact, experience from UNCTAD and the early days of UN climate policy negotiations shows that the dynamics of coalition-building sometimes impede progress by fostering polarization along ideological cleavages or by using simple addition to aggregate member state interests into a collage of coalition demands (Rothstein 1984, pp. 316–318, Castro et al. 2014).

A third obstacle, *path dependency*, sometimes generates *lock-in* effects (Pierson 2000, GEA 2012, Levin et al. 2012, Jordan & Matt 2014). Existing systems of energy production, distribution and consumption have been built over decades, sometimes over centuries. These processes have involved large investments in infrastructure, provided profit for investors and income for employees and their communities, and interacted with developments in other sectors (e.g., transport and energy-intensive industries). In this setting, actors compete and cooperate, sometimes forming coalitions with the like-minded to promote or defend core components of the system. Incremental change is integral to such systems but profound transformation driven by environmental concern is not. Consequently, transforming an *existing* fossil-fuel-based energy system into one relying mostly on renewables or other low-carbon sources requires more political power, clever policy design and civil-society support than building a low-emission system from the very beginning would.

A similar observation can be made about reforms of international institutions. The climate system's basic dynamics, including the biogeochemical mechanisms constituting the carbon cycle, have been known over a century. Yet, since GHG emissions and land-cover change from anthropogenic sources are unintended side effects of human activities undertaken for other and essentially legitimate purposes, concern about negative effects of climate change did not automatically translate into support for regulatory intervention. The UN Framework Convention on Climate Change was signed in 1992, and can best be seen as a corrective add-on to existing international regimes and organizations. For the evolving climate change regime, entering as a relative newcomer – with an ambitious agenda of *transformative* change – is daunting.

"CURE": DESIGNING EFFECTIVE, POLITICALLY FEASIBLE SOLUTIONS

In this section I first introduce four criteria frequently used to evaluate environmental policy measures and programs, indicate how these criteria relate to each other, and explore where IR research can best contribute. In the second part, I focus on central IR topics and highlight major achievements made by various IR research strands. This part deals mostly with the UNFCCC, and observations about consensus rule constraints are not equally valid for IGOs such as the EU and the World Bank. Recognizing the increasingly important roles of non-governmental (or "non-nation-state") actors and transnational networks in climate change politics, I conclude by briefly exploring types of contributions IR research has made in this field.

Criteria

Ideal cures should meet four basic requirements. First and foremost is ecological sustainability. The second criterion is fulfillment of basic human needs. In a world where one billion people live in extreme poverty fulfillment of basic human needs is widely considered a moral imperative trumping all other criteria. The third criterion is cost-effectiveness (i.e., minimizing the costs of achieving goals), sometimes supplemented or replaced by efficiency (maximizing the net benefits).

The fourth criterion – political feasibility – stands out by serving an *auxiliary* function, i.e., by being a necessary condition for fulfilling other substantively important criteria. In that role, the political feasibility requirement often blocks options having (very) high scores on sustainability and/or cost-effectiveness standards (Victor 2013, Hovi et al. 2013). The mission of political feasibility studies is to enable decision-makers to identify and escape these hurdles and achieve as much as possible in terms of other and substantively important criteria. For this and other reasons, developing a framework for assessing political feasibility is hailed as "political scientists' unique contribution to policy analysis" (Webber 1986, p. 545, Keohane 2015).

Policy options are politically feasible if they can be adopted and effectively implemented. To meet those demands, they must escape all veto players (Tsebelis 2002) and attract support from at least one coalition capable of winning the game (Sabatier 1988). We can determine the political feasibility of an option by feeding it into a model of the political system to see if or to what extent it survives the process thereby generated. For adoption it must do better than current policy. The model of the political system must include at least two sets of principal variables. One set describes the institutional setting, specifying "the rules of the game," including access rules, procedural rules, and decision rules. The other set identifies actors and describes each according to preferences/beliefs and relevant resources. With such information about actors we can "derive" two new variables: the *configuration* of preferences (interests) and the *distribution* of power. Moreover, by combining the two new variables we can derive a third that uses relative power to weight preferences: the distribution of power over the configuration of preferences (Bueno de Mesquita 2009a, Stokman et al. 2013, Miles et al. 2002).

Feasibility estimates can be made only regarding a particular policy option and a given setting. In international relations the adoption threshold often differs from the implementation threshold. The former depends primarily on the decision rule (consensus being the default rule for "binding" decisions in UNFCCC conferences), the configuration of actor preferences, and the

quality of leadership. Also, the implementation threshold depends on the configuration of preferences and the quality of leadership, but even more critical is the distribution of control over regulated activities (i.e., power in the "basic game").

The UNFCCC consensus rule strongly favors opponents of measures that deviate from current policies and practices. In some final sessions, presidents have, with broad tacit acceptance, been allowed to ignore objections from one or a few delegations to proposals supported by an overwhelming majority, including the most powerful actors. Some UN conferences have another mode of operation, opening for non-binding resolutions through simple majority voting. In the climate change case, neither consensus nor simple majority voting comes close to reflecting the distribution of power in the basic game. A measure failing to meet the consensus requirement may well be implemented by powerful supporters, while a resolution adopted by a wide margin in majority voting may equally well be ignored or blocked by pivotal opponents.

The kind of feasibility analysis described above addresses one seemingly simple question: in a binary choice between a proposal for a given policy change and continuation of current policies and practices, which option would win? The researcher ranks proposals for change in terms of ambition levels(s), feeds these options into a model of the political system, and tries to identify the most ambitious proposal – or set of proposals – that passes the critical threshold. This (set of) proposal(s) constitutes the upper limit of international cooperation. A proposal at (or close to) this limit will, though, not necessarily emerge as winner; aggregate support for a less ambitious proposal may well be stronger. To predict negotiation outcomes more precisely requires a model that can help select winners, or at least narrow the range of strong candidates.

Such models exist. At least two – Bueno de Mesquita's "Predictioneer's Game" (Bueno de Mesquita 2009a, 2009b) and Stokman et al.'s "Exchange Model" (Stokman et al. 2009; Stockman et al. 2013, 2015) – have been applied to climate change negotiations. The two models share important features. In both, the constitutive elements are a set of issues, a group of actors ("players," "stakeholders"), and an institutional setting specifying the rules of the game. Each actor assigns a certain importance to each issue ("salience") and, for each issue, a certain value to each potential outcome considered. Moreover, actors are weighted according to their power (or influence), and outcomes are generally expected to favor strong interests of powerful (coalitions of) actors. Most data required to assign scores to these variables are collected through interviews with experts involved in, or closely observing, negotiations. To facilitate computational simulation, these scores are standardized on a scale ranging from 0 to 1, or 0 to 100. Simulations may be run issue by issue or allow for issue linkage and package deals, and be undertaken for trend predictions and for point predictions.[2] Applied to the UNFCCC, both models have fairly well predicted outcomes of the 15th plenary conference (COP15) (Bueno de Mesquita 2009, Stokman et al. 2009) and – given preliminary reports – also COP21 (Sprinz & Bueno de Mesquita 2015, Stockman & Thomson 2015). In both cases, though, fairly short timespans between data collection and the conferences made prediction somewhat easier than it would otherwise have been.

Accurate problem diagnosis is nearly a necessary, though not sufficient, condition for developing effective cures. In the climate change case, the diagnosis suggests that effective cures

[2] One of Bueno de Mesquita's simulations runs alternative scenarios for about 125 years and finds that "support for tougher regulations falls almost relentlessly as the world closes in on 2050" (Bueno de Mesquita 2009a, p. 221).

must combine two components. One component builds on the conception of Earth as an integrated, complex, and dynamic system. In Ciplet et al.'s words (2015, p. 36), "Climate change is a global problem, and any adequate solution must be global." Below, I refer to this reasoning as the "global problem -> global solution" approach. The other component shifts attention from the challenge's format to sources of human motivation. Here, searching for solutions starts from recognizing that anthropogenic drivers of GHG emissions and land-cover change are found in a wide range of human activities. These activities differ in important respects and many are, at most, loosely connected. This diversity suggests that mitigation policies' effectiveness may be enhanced by *differentiating* specific measures to fit distinct activity system characteristics (Young 2008), or different perceptions of the problem and available options (Verweij et al. 2006). Below, I refer to this reasoning as the "decentralized diversity" approach.

The "global problem -> global solution" approach

The global problem -> global solution approach builds on two sets of premises. One links the natural science conception of the world's climate as an integrated system to the political economy understanding of climate change as a global collective "bad" calling for treatment at the same level. Most of IR research on international environmental cooperation conceives of regimes as institutional devices for protecting or supplying collective goods (e.g., Stein 1982, Keohane 1982, Barrett 2007). The other set of premises builds on a notion of "good governance" rooted in political science and philosophy (Rothstein & Holmberg 2011, Stevenson & Dryzek 2014), and subscribed to by many governments and stakeholders. The principal argument says that since the climate change problem and policies for controlling anthropogenic sources of climate change can affect people worldwide, such policies should be designed and implemented by the world community, ideally through universal participation in democratic processes. Although somewhat modified through the Paris COP21 agreement(s), the basic architecture of the UNFCCC regime remains designed for this approach.

Most IR scholars who have assessed the UNFCCC regime's effectiveness up until the Paris Conference converge on low scores on most dimensions (Barrett 2003, Victor 2011, Young 2011, Hovi et al. 2013). The most important part of the explanation is found in the diagnosis of the problem as politically extremely demanding (see above). Other parts can be found in the institutional arrangements set up through the Framework Convention, the Kyoto Protocol and later COP decisions, the distribution of power, and the dynamics of global conference diplomacy. In reviewing these features of the UNFCCC regime, I follow Stokke's (2012) advice to distinguish between three main functions that an international regime may perform: (a) develop a well-founded and consensual understanding of the problem and available policy options, (b) establish behavioral rules or incentive systems consistent with the policy implications derived from this knowledge base, and (c) ensure compliance with these rules or incentives.

Knowledge platform

With a few exceptions (Susskind 1994, p. 63) most empirical studies of international environmental regimes have found that a science-based platform of (largely) consensual knowledge facilitates negotiations and often enables parties to conclude somewhat more

ambitious agreements than they would have otherwise (Haas 1992, Andresen et al. 2000, Mitchell et al. 2006). In exploring similarities and differences between the databases used and the findings reported in two previous volumes (Breitmeier et al. 2006, Miles et al. 2002), Breitmeier et al. (2011) searched for *combinations* of factors associated with regime effectiveness in both databases. A solid knowledge base emerged as integral in all but one of twenty QCA model runs. The usefulness of science-based knowledge is also indicated by the sequence in which many international environmental regimes are developed, beginning with an agreement to cooperate in knowledge-building.

For the UNFCCC regime, the principal supplier of science-based knowledge is the Intergovernmental Panel on Climate Change (IPCC), established in 1988 by the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO), and subsequently endorsed by the UN General Assembly. IPCC's main task is to "provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts" (IPCC 2016). Fulfilling this mandate is less straightforward than the formulation suggests. Science and politics are different activities, pursuing different purposes by different means. IPCC therefore must delicately balance between responding to decision-makers' requests for policy-relevant framing of reports and protecting the scientific undertaking's integrity and autonomy. In general, the delicacy of this kind of balancing tends to increase with the political malignancy of the problem and with uncertainties in the knowledge base, and these factors often interact synergistically (Miles et al. 2002, p. 469). Moreover, as illustrated by the changes made in approving WGIII's contribution to the fifth assessment report, tension tends to increase where the contents becomes not merely science-based and problem-driven but also solution-oriented. Applied political science research cannot fully deliver without exploring policy options.

IPCC is making adjustments but its own capacity to deal with the problem is severely constrained by rules requiring government involvement in selecting participants and in line-by-line plenary approval for summary documents (Haas & Stevens 2011, Victor et al. 2015). Suggestions for deeper reforms have come primarily from external sources. Noting that "[D]isentangling IPCC from politics is impossible," Victor et al. (2015, p. 36) recommend focusing more attention on "author-approved technical and policy summary documents." Carraro et al. (2015, p. 35) suggest "increasing the IPCC's focus on policy assessment." A report prepared by the InterAcademy Council (2010) offer several recommendations regarding, inter alia, IPCC's internal governance and management, review processes, and communication of uncertainty.

Regime outputs: regulations and incentive systems

International regimes are considered effective to the extent they solve problems they were designed to solve. Increasingly refined measurements are being developed and applied (see Mitchell 2008). One, the "Oslo-Potsdam solution," conceives of effectiveness (E) in terms of a regime's success (AP) in moving a system from the "no-regime counterfactual" (NR) to the "collective optimum" (CO), i.e., E = (AP – NR) / (CO – NR) (see Helm & Sprinz 2000, Miles et al. 2002). This formula has generated some valid criticism (Hovi et al. 2003, Young 2003) but at least the no-regime counterfactual is a common reference also in qualitative case studies.

This subsection focuses on three determinants of regime effectiveness: institutional structure, distribution of power among actors, and supply of non-coercive leadership by conference leaders, the secretariat, or regime members.

The decision rule seems to be the institutional dimension most scrutinized in empirical studies of the UNFCCC. The message is clear: the consensus rule favors "laggards," and at worst ties a large conference to "the law of the least ambitious program" (Underdal 1980, p. 36, Ward et al. 2001). This is indeed an important constraint, but conference presidents have some leeway in interpreting the consensus rule. More importantly, the rule does not prevent countries with more ambitious mitigation plans from taking unilateral action or joining forces with like-minded countries in a coalition of "enthusiasts" (Victor 2011). Therefore, a broader assessment of strengths and weaknesses of global conference diplomacy is required to better understand UNFCCC's failures and successes (Michaelowa & Michaelowa 2012).

So what may we expect global conference diplomacy, UNFCCC style, to achieve? The good news is that even when faced with an extremely demanding challenge, global conference diplomacy can help by serving at least one of four functions. One is that of setting agendas and focusing public attention on the same problem worldwide, simultaneously, thereby facilitating civil-society participation in "democratizing global climate governance" (Stevenson & Dryzek 2014). Another function involves organizing joint efforts to build a consensual platform of research-based knowledge. As mentioned, this task was completed before the Framework Convention was signed, thanks primarily to WMO and UNEP, and to international networks of scientists promoting the idea. A third useful function is that of providing arenas for diffusion of policy ideas and (best) practices. Informal learning from frontrunners often provides delegates from other countries with ideas they can introduce at home, often adjusted for local circumstances (Rietig 2014, Klingler-Vidra & Schleifer 2014). Finally, for some delegates long involved in the negotiations, time and energy invested – and cooperative relations established with delegates from other countries – will likely generate *private* stakes in having the UNFCCC succeed. Informal networks of deeply committed senior delegates may be able to help move the process forward when deadlock appears likely.

The bad news is that in fostering agreement on deep cuts in GHG emissions, global conference diplomacy faces at least four hurdles. One is the large number of veto players empowered by the decision rule of consensus. Another is the risk of ideological confrontations leading to deadlock over cherished principles and worldviews (Rothstein 1984). The stark asymmetries existing between rich and poor countries are reflected in positions and arguments about, inter alia, guilt in causing the problem and responsibility for repairing and preventing damage. On the positive side we should note that at least three interpretations of equity – referring to responsibility for damage, capacity to mitigate or adapt, and basic human needs – are frequently invoked and rarely disputed (Mattoo & Subramanian 2012, Dannenberg et al. 2010). Yet, parties' interpretations of these principles often diverge, reflecting conflicts of interest. The "nationally intended contribution" approach adopted for COP21 seemingly moved negotiations in a more integrative direction but left important distributive issues for future conferences.

A third hurdle is embedded in internal group and coalition dynamics that sometimes generate further polarization (Castro et al. 2014, Sunstein 2002, Rothstein 1984). Morgenthau (1985, p. 579) overstated the case when he wrote, "Not only is a publicly conducted diplomacy unable to reach agreement or even to negotiate for the purpose of reaching agreement, but each public

meeting leaves international relations in a worse state than before." Yet, plenary sessions, particularly those devoted to statements by political leaders, provide fertile ground for ideological posturing and for supporting important domestic constituencies.

Finally, UNFCCC conferences have suffered from sprawling agendas and asymmetrically cascading attendance. Schroeder et al. (2012) found that the number of official delegates increased from 757 at the first COP in 1995 to 10,591 at COP15 in 2009 (and to about 15,000 at COP21 in Paris). Paradoxically, during a period that witnessed a 14-fold increase in the number of official delegates, some small developing countries downsized their delegations. In the most vulnerable region that effect may, though, have been muted by significant strengthening of collective action capacity through the African Group of Negotiators (Roger & Belliethathan 2016). Cascading attendance can be found also amongst observers. At COP15, 13,482 representatives from 937 organizations, most from rich countries, were admitted as observers and engaged in numerous side-events.

Power is critical in weighting actor preferences. Thus, to predict or explain a conference's outcome we must know how much the positions and preferences of each party count. In technical terms, we want to know the distribution of power over the configuration of party positions and preferences. At least three aspects of power should be included in the assessment (Barnett & Finnemore 1999, Biermann 2014). One, here referred to as structural power, includes the authority ascribed to formal roles in the negotiation game (such as the conference president's role) and the power derived from a party's control over basic game goods or events important to others. Another aspect is ideational power, related to a leading role in providing important knowledge, conceptually framing a certain issue, or to the moral clout of a party's positions and arguments (Stevenson & Dryzek 2014, Haas 1992, 2004). Finally, power has a behavioral component, more or less effectively activating the potential derived from a party's scores on other aspects. The behavioral component's importance was illustrated by the difference between the contributions of host-country leaders under COP15 in Copenhagen and COP21 in Paris (Victor 2015).

Studying UNFCCC from that perspective, the discrepancy between the power distribution in the negotiation game and the power distribution in the basic game becomes striking. In the negotiation game, the consensus rule enables small and lone laggards to have disproportionate power. Regular voting procedures for substantive issues are not yet agreed but all proposals would significantly reduce the number of veto players and favor large coalitions (notably G77). In the basic game, large emitters – particularly those recognized as Great Powers – are key players. Moreover, while the consensus rule builds a strong basis for exerting negative power in the negotiation process, power in the basic game also has a positive dimension, enabling major emitters to unilaterally contribute to GHG mitigation or to initiate joint efforts with like-minded countries.

Such discrepancies probably influence member states' orientations towards the UNFCCC. To indicate plausible patterns, I have formulated eight tentative hypotheses (Table 1). For simplicity, I have dichotomized the two power variables and focused on two aspects of member state orientations: preferences regarding the "strength" (mandate, resources, decision rules) of the organization, and parties' own engagement in the organization's work.

Table 1 about here

Some remarks made above regarding power apply also to *leadership* understood as "an asymmetrical relationship of influence in which one actor guides or directs the behavior of others toward a certain goal" (Underdal 1994, p. 178, cf. Young 1991). In conference diplomacy certain modes of leadership, particularly those referred to as ideational (or intellectual) and instrumental (or entrepreneurial), can be provided by conference presidents and secretariats. The French hosts' performance in COP21 has been applauded by delegates and observers. To paraphrase Victor (2015, p. 3), the conference leadership and hosts helped to build good will and to focus delegates' minds on the harmful consequences of failure. Having experienced severe difficulties at COP15, many delegates and high-level policymakers seemed especially receptive to the French approach. The UNFCCC Secretariat – although initially constrained to operating largely as a "technocratic bureaucracy" (Busch 2011, cf. Michaelowa and Michaelowa 2016) – also provided useful services. Yet, as important as (perhaps even more important than) these contributions was the change gradually approved by regime members to move from centralized bargaining over distributive issues to a bottom-up procedure in which each country announces its commitments, known as its "(intended) nationally determined contribution" to mitigating climate change. The sum of the national contributions submitted fails by a large margin to meet the conference's ambitious overall goals (Rogelj et al. 2016), but the Paris Agreement includes a fairly well-specified follow-up procedure, adopted by consensus and designed to encourage and facilitate more demanding steps later (Victor 2015, see also Bodansky et al. 2015).

Leadership in global governance is often provided by one or a few powerful "enthusiasts." A recent survey of "followers'" assessment of likely candidates concludes that "the world currently lacks a single undisputed leader in the field of climate change" (Parker et al. 2015, p. 443). Although respondents' choices varied significantly during the period covered (2008–2011) and across regions, the aggregate scores for the three candidates – the European Union, the United States, and China (51, 43, and 49%, respectively) – do not indicate a clear winner. Without a dominant actor capable of acting as world leader, progress in UNFCCC negotiations seemingly depends on the willingness and ability of a handful of major actors to work together as informal co-leaders, pulling largely in the same direction.

Regime outcomes: behavioral change

Most scholars studying international cooperation find that most parties deliver largely as promised most of the time (Chayes & Chayes 1995, Brown Weiss & Jacobson 1998). Since, other things being equal, compliance tends to decline as costs of delivering increase, good news about compliance need not be good news for the environment (Downs et al. 1996, cf. Bernauer et al. 2013). This warning seems pertinent also to the climate change case.

In IR research, two models for securing or enhancing compliance with treaties and other agreements have emerged. One model assumes that states behave as rational actors motivated exclusively or at least primarily by self-interest, meaning they will honor commitments as long as they benefit from doing so (Barrett 2008). If compliance no longer pays, rational actors will

modify their commitments by, for example, declaring unilateral adjustments, demanding re-negotiation of terms, or leaving the regime. Coercive enforcement is seen as the most effective response to defection and other radical forms of "de-commitment" (hence, the enforcement school). The other model (known as the managerial school) assumes that "the principal source of noncompliance is not willful disobedience but the lack of capability or clarity or priority" (Chayes & Chayes 1995, p. 22). According to this diagnosis, the problem is politically largely benign, implying that an effective cure should involve compliance-enabling assistance to help with tasks such as interpreting ambiguous texts and mobilizing sufficient funding or technical expertise.

Hovi et al. (2013, p. 138; see also Barrett 2008) specify three conditions that must be met for a new (global) agreement to substantially reduce GHG emissions: (1) comprehensive and stable participation, (2) deep commitments by participating countries, and (3) high compliance rates. Observing that such a system would take the world far beyond the rules and organizational arrangements established to support the Kyoto Protocol, the authors conclude that any system fully meeting their requirements will likely be politically infeasible. Aakre (2013, pp. 156–157) concludes the same for regimes including *all* major emitters but adds that "agreement on potent enforcement is more likely if negotiated among a coalition of the willing, and if countries that do not expect to comply (fully) are not represented at the negotiating table." Making agreements legally binding seems not to help. Spilker & Koubi (2016), Böhmelt & Spilker (2016), and some other studies find that treaties characterized as hard law tend to deter or prevent ratification, particularly in systems requiring a supermajority. Focusing on outcomes rather than outputs, Breitmeier et al. (2011) report negative correlations between legally binding rules and regime effectiveness.

Aakre's observation is in line with Victor's (2011, p. 6, p. 265) recommendation to start "with what nations are willing and able to implement" and "with the interests of the most powerful countries." Several scholars have emphasized other, but mostly compatible, options. For example, Barrett (2008) recommends negotiating separate but linked agreements for each important gas and sector, always using existing tools helpful in strengthening enforcement. Jurpelainen (2013) favors gradualist strategies focusing on "transformation potentials" in politics and in technologies. Verweij et al. (2006) suggest that innovation can be fostered by combining four perspectives of what the problems are and how they can be resolved. Levin et al. (2012, p. 123) suggest an "applied forward reasoning" approach to help develop a set of "path-dependent policy interventions that can 'constrain our future selves'." Somewhat similarly, Jordan and Matt (2014) explore how a "forward tracing" approach may be used to design "policies that intentionally stick." These and many other scholars seem to share a perception of climate change as (1) an exceptionally demanding problem where the conventional UNFCCC approach to regime development will, even with COP21 improvements, be insufficient, but also as (2) a multidimensional problem where widely varied non-state actors can contribute by changing some of their *own* activities.

The "decentralized diversity" approach

The decentralized diversity approach shifts attention from the challenge's format to *sources of human motivation*. Moreover, it focuses on bottom-up measures that can be taken (also) by non-

governmental actors and at sub-national levels. Most subnational activities elude the radar of IR research or call for collaboration with comparative politics (Steinberg & VanDeveer 2012). Yet, the basic argument – highlighting the merits of diversity and polycentric governance (Ostrom 2009) – is important also for IR research. The recent interest in potential contributions of international "climate clubs" and the more mature interest in transnational organizations and networks merit particular attention.

The decentralized diversity approach seems to build on three premises. One says that since the human effect on the climate system is an unintended side effect of a wide range of activities, global-level governance focused primarily on negotiated goals and timetables for countries' mitigation efforts will most likely lead to suboptimal outcomes. A second premise claims that – in a decentralized and differentiated system – effective mitigation can sometimes be achieved through measures that will be attractive to a critical mass of actors also (or even primarily) for "private" reasons *unrelated* to climate change. Such private reasons may include improving health through reducing local pollution, enhancing green technological development, or improving one's public image. Some win-win measures can be adopted and implemented by initially small coalitions, particularly those that can bridge gaps between environmentalists and industry/business (DeSombre 2000). Finally, some bottom-up initiatives may be able to take advantage of *existing* institutional capacity, even when this capacity has been developed for other purposes. Europe would hardly have been able to develop and implement GHG mitigation policies at the present level without the political engineering and administrative expertise of the European Union – an organization initially established by six Western European countries to promote economic growth and peaceful integration after the devastation of two world wars.

The immediate impression of such a collage of decentralized and differentiated measures may well be one of poor coordination resulting in multiple inefficiencies. Yet, one plausible advantage of the decentralized diversity approach is that it can more directly engage *multiple* motivational sources of GHG mitigation.

International "climate clubs"

Nordhaus (2015, p. 1340) defines a club as "a voluntary group deriving mutual benefits from sharing the costs of producing an activity that has public-good characteristics." In club theory, benefits derived are generally assumed to be excludable (i.e., for members only) and non-rival (meaning that members do not compete over shares). Victor's (2011) two-step conception of the role that enthusiasts can play in climate change negotiations indicates how a "climate club" may develop. First, a small group of enthusiastic countries will outline what each is willing and able to do, conditional on a positive response from other enthusiastic countries. Second, this group of enthusiasts will cooperate in inviting more reluctant countries to join, and use "exclusive and contingent" measures to reward those who join.

Few if any of the international groups established to deal with climate change have been formed according to this recipe. Empirical research (Weischer et al. 2012, Andresen 2014) has concluded that so far these groups have served primarily as forums for political consultations. This applies also to multi-purpose groups such as G20. As forums they may be useful but regarding achievements such as (additional) cuts in GHG emissions, their records seem meagre. Given limitations inherent in their designs, more can hardly be expected; the actor capacity of a

forum for political dialogue cannot compete with the capacity of well-established organizations such as the European Union and the World Bank.

Lacking sufficient empirical evidence, researchers have turned to hypothetical scenarios and formal models. These approaches enable researchers to systematically address two questions. First, what would it take for a climate club to emerge and grow? Second, how does club design affect achievements?

The answers to both questions depend upon a set of assumptions. An instructive illustration of the importance of one of these assumptions can be found by comparing Nordhaus (2015) and Hovi et al. (2016). Nordhaus adopts a top-down approach, assuming that the club regime already exists and has been "optimized to attract large numbers of participants and attain high levels of abatement, and then countries decide whether or not to join" (Nordhaus 2015, p. 1344). He finds that even small trade penalties on non-participants can induce a large and stable coalition to form and achieve high levels of abatement. By contrast, Hovi et al. (2016) start by building a climate club bottom-up and exploring how different types of incentives – notably club goods, conditional commitments, and side payments – may be used by a small group of enthusiastic and powerful founders to attract initially more reluctant members. Unsurprisingly, their findings are less optimistic than those reported by Nordhaus. Nevertheless, their simulations suggest that clubs covering a substantial share of global emissions *can* form even in an imperfect world, and under a fairly wide range of circumstances. Side payments, calibrated specifically for each new potential member, appear to be the most effective of the three instruments (Sælen 2015).

Non-state actors (NSA) and networks

In at least one important respect, non-state actors' roles in global climate change governance fit the diagnosis of the problem: a large number of NSAs, covering most anthropogenic sources of GHG emission and representing particularly vulnerable climate change victims, is engaged in at least one of two activities. One involves efforts to influence intergovernmental climate policy processes. The other involves developing and operating "private regimes," as alternatives or supplements to intergovernmental institutions. These are not mutually exclusive categories; many NGOs, businesses and other civil-society organizations participate in both activities.

Attendance of NSAs as observers and lobbyists is common at major international environmental conferences, but judged by the growing numbers and diversity of these NSAs, UNFCCC is a particularly important arena. Nasiritousi et al. (2016) provide information about the profiles and reputations of six categories of NSAs. Focusing on COP17 (2011) and COP18 (2012), they surveyed government delegates (N = 125) and non-state observers (N = 417) and compared the self-assessments of respondents in each NSA category with the corresponding assessments made by government representatives and other observers. In all three groups of respondents, environmental NGOs scored higher than any other NSA category on raising awareness and representing public opinion (except for marginalized groups). Research NGOs scored highest on providing information and expertise, evaluating consequences, and proposing solutions. Business NGOs scored highest on influencing decisions and agendas, while local governments scored highest in adaptation and mitigation "action." For some NSA categories – particularly,

business and local authorities – self-assessments of contributions to actual mitigation were far more positive than were corresponding assessments by the other two groups.

The growth of *private* regulation – defined as voluntary standards, rules, and practices created by NSAs to govern participants' behavior within certain domains (Auld & Gulbrandsen 2013, p. 397) – is a more recent and arguably more important development in climate change governance. Private regulation is introduced in different contexts, ranging from established settings such as the International Organization for Standardization (ISO) to recent arrangements such as transnational municipal networks (TMNs). Their tools differ, from clearly specified process or product standards to declaratory mitigation commitments. The wide range of variance calls for caution in generalizing findings but at least three observations seem interesting and robust.

One pertains to performance *standards*, usually confirmed via certification. Benefits that a company or other actor can harvest via certification are mostly reputational (Potoski & Prakash 2005) and hence associated with high quality standards. In such settings, we should expect a race to the top (Green 2013, p. 12). Several studies seem to support that hypothesis (Potoski & Prakash 2005, Green 2013, Auld & Gulbrandsen 2013).

Another observation is that many private regulatory schemes interact – often synergistically – with (inter)governmental rules and regulations. For example, Auld & Gulbrandsen (2013, p. 407) find that the "evolutionary potential" of private regulation "depends critically on synergy with government regulations." Green (2013, p. 2) suggests that, despite its shortcomings, Kyoto serves as the functional equivalent of a coral reef, attracting private rule makers to further develop the regime complex. All authors cited in this subsection agree that more research is needed to map the dynamic interaction between (inter)governmental regimes and private regulatory programs.

Finally, effectiveness assessments of NSA regulations diverge. Studying thirteen TMNs, Bansard et al. (2016) find (a) that countries from the Global South are underrepresented, and (b) that the few TMNs that commit to quantified emission reductions do not go beyond UNFCCC commitment levels. In a broader review, Auld & Gulbrandsen (2013, p. 407) find that private programs overall represent "a remarkable policy innovation by non-state actors" but add that synergistic interaction with government regulations is critical. The contrast between these two observations may indicate that NSAs' main contributions will likely be in developing and operating certification schemes and other market-oriented regulations.

CONCLUDING REMARKS

The two cures explored above are neither mutually exclusive nor easily combined. IR research can play a constructive role in further specifying cure domains and in exploring the merits of top-down and bottom-up approaches. In doing so, it can build on theory and empirical findings from its own domain. Within this domain, significant progress has been made in at least four areas. One involves understanding causal *mechanisms* and pathways whereby international institutions and politics influence actor behavior and process outcomes (Young et al. 2008),

leading in some cases to constructive collaboration between (soft) rationalists and (moderate) constructivists (Haas et al. 1993). Another involves identifying *combinations* of factors that enhance regime effectiveness or block progress (Breitmeier et al. 2011). A third area focuses on describing and explaining institutional interplay and *dynamics of regime complexes* (Keohane & Victor 2011, Oberthür & Stokke 2011). Fourth, we see more sophisticated use of the *methodological repertoire* of social science, including qualitative comparative analysis (Stokke 2012), statistics (Spilker & Koubi 2016), game theory (Barrett 2003), and agent-based modeling (Hovi et al. 2016).

Yet, the climate change challenge also calls for multilevel linkages (Steinberg & VanDeveer 2012, p. 44-46) and polycentric governance (Ostrom 2009). A constructive response from IR research to these challenges will have to involve further development of collaboration with other fields of political science (such as comparative politics and public administration) and with neighbor disciplines (including sociology and human geography as well as economics and law). Some pioneer involvement in studying regulatory schemes established and operated by non-state actors and interacting with governmental regulations is one promising step in that direction.

Table 1. Likely orientations of IGO members as a function of power configurations

		Power in the basic game	
		Weak	Strong
Power in the negotiation game	Strong	Prefers strong organization. Contributes more than expected given its capabilities.	Prefers moderately strong organization. Contributes at about the level expected given its capabilities.
	Weak	Sees for itself few, if any, benefits from membership. Passive member, paying at most a small contribution to organizational activities	Prefers: 1. Organizational reform, 2. A weak organization. Contributes less than expected given its capabilities; may well work through other channels or at least explore alternative arrangements.

References

Aakre S. 2016. The political feasibility of potent enforcement in a post-Kyoto climate agreement. *Int. Environ. Agreements*, 16(1):145-159.

Abbott KW, Green JF, Keohane RO. 2016. Organizational Ecology and Institutional Change in Global Governance. *Int. Organ*., available on CJO 2016 doi: 10.1017/S0020818315000338.

Aldy JE, Stavins RN, eds. 2009. *Post-Kyoto International Climate Policy: Implementing Architectures for Agreement.* New York: Cambridge Univ. Press.

Andresen S. 2014. Exclusive approaches to climate governance: More effective than the UNFCCC? In Cherry TL, Hovi, J, McEvoy DM, eds. *Toward a New Climate Agreement: Conflict, Resolution and Governance*. London: Routledge.

Auld G, Gulbrandsen LH. 2013. Private Regulation in Global Environmental Governance. In Falkner R, ed. *The Handbook of Global Climate and Environment Policy*, New York: John Wiley & Sons.

Bansard JS, Pattberg PH, Widerberg O. 2016. Cities to the rescue? Assessing the performance of transnational municipal networks in global climate governance. *Int. Environ. Agreements*. Online: DOI 10.1007/s10784-016-9318-9.

Barnett MN, Finnemore M. 1999. The Politics, Power, and Pathologies of International Organizations. *Int. Organ*. 53(4):699-732.

Barrett S. 2008. Climate treaties and the imperative of enforcement. *Oxford Rev. Econ. Policy* 24(2):239-258.

Barrett S. 2007. *Why Cooperate? The Incentive to Supply Global Public Goods*. Oxford, UK: Oxford Univ. Press.

Barrett S. 2003. *Environment and Statecraft: The Strategy of Environmental Treaty-making*. Oxford, UK: Oxford Univ. Press.

Bernauer T. 2013. Climate Change Politics. *Ann. Rev. of Pol. Sci*. 16:428-461.

Bernauer T, Kalbhenn A, Koubi V, Spilker G. 2013. Is there a "depth versus participation" dilemma in international cooperation? *Rev. of Int. Organ*. 8(4):477-497.

Biermann F. 2014. *Earth System Governance: World Politics in the Anthropocene*. Cambridge, MA: MIT Press.

Biermann F, Bauer S, eds. 2005. *A World Environment Organization: Solution or Threat for Effective International Governance?* Aldershot, UK: Ashgate.

Bodansky D, Hoedl S, Metcalf G, Stavins R. 2015. Facilitating linkages of climate policies through the Paris outcome. *Climate Policy*, published online, DOI: 10.1080/14693062.2015.1069175.

Breitmeier H, Young OR, Zürn M. 2006. *Analyzing International Environmental Regimes: From Case Study to Database.* Cambridge, MA: MIT Press.

Breitmeier H, Underdal A, Young OR. 2011. The effectiveness of international environmental regimes: Comparing and contrasting findings from quantitative research. *Int. Stud. Rev*. 13(4):579-605.

Brown Weiss E, Jacobson HK, eds. 1998. *Engaging Countries: Strengthening Compliance with International Environmental Accords*. Cambridge, MA: MIT Press.

Bueno de Mesquita B. 2009a. *The Preditioneer's Game: Using the Logic of Brazen Self-Interest to See and Shape the Future*. New York: Random House.

Bueno de Mesquita B. 2009b. Recipe for failure. *Foreign Policy*, 175:76-81.

Busch P-O. 2009. The climate secretariat: Making a living in a straightjacket. In Biermann F, Siebenhüner B, eds. *Managers of Global Change: The Influence of International Environmental Bureaucracies.* Cambridge, MA: MIT Press.

Böhmelt T, Spilker G. 2016. The interaction of international institutions from a social network perspective. *Int. Environ. Agreements* 16(1):67-89.

Carraro C, Edenhofer O, Flachsland C, Kolstad C, Stavins R, Stowe R. 2015. The IPCC at a crossroads: Opportunities for reform. *Science*, 350(6256):34-35.

Castro P, Hörnlein L, Michaelowa K. 2014. Constructed peer groups and path dependence in international organizations: The case of the international climate change negotiations. *Global Environ. Change* 25:109-120.

Chayes A, Chayes AH. 1995. *The New Sovereignty: Compliance with International Regulatory Agreements.* Cambridge, MA: Harvard Univ. Press.

Chertow MR. 2001. The IPAT equation and its variants: Changing views of technology and environmental impact. *J. of Ind. Ecol*. 4(4):13-19.

Ciplet D, Roberts JT, Khan MR. 2015. *Global Politics of Climate Change and the Remaking of Environmental Inequality.* Cambridge, MA: MIT Press.

Crutzen PJ, Stoermer EF. 2000. The "Anthropocene". *IGBP Newsletter*, 41:17-18.

Dauvergne P. Clapp J. 2016. Researching global environmental politics in the 21st century. *Glob. Environ. Polit.* 16(1):1-12.

Dannenberg A, Sturm B, Vogt C. 2010. Do equity preferences matter for climate negotiators? An experimental investigation. *Environ. and Res. Econ*. 47(1):91-109.

DeSombre ER. 2000. *Domestic Sources of International Environmental Policy: Industry, Environmentalists, and US Power*. Cambridge, MA: MIT Press.

Downs GW, Rocke DM, Barsoom PN. 1996. Is the good news about compliance good news for the environment? *Int. Organ.* 50(3):379-406.

Folke C, Pritchard L, Berkes F, Colding J, Svedin U. 2007. The problem of fit between ecosystems and institutions: Ten years later. *Ecol. and Society* 12(1).

GEA 2012. *Global Energy Assessment – Towards a Sustainable Future (Summary).* Cambridge, UK: Cambridge University Press and the International Institute for Applied Systems Analysis, Laxenburg, Austria.

Green JF. 2013. Order out of chaos: Public and private rules for managing carbon. *Glob. Environ. Polit.* 13(2):1-25.

Gupta, J. 2015. The North-South Divide. In Bäckstrand K, Lövbrand E, eds. *Research Handbook on Climate Change.* Cheltenham, UK: Edward Elgar.

Haas PM. 2004. When does power listen to truth? A constructivist approach to the policy process. *J. of Eur. Publ. Policy* 11(4):569-992.

Haas PM. 1992. Introduction: Epistemic Communities and International Policy Coordination. *Int. Organ.* 46(1):1-36.

Haas PM, Keohane RO, Levy MA, eds. 1993. *Institutions for the Earth: Sources of Effective International Environmental Protection*. Cambridge, MA: MIT Press.

Haas P, Stevens C. 2011. Organized Science, Useable Knowledge, and Multilateral Environmental Governance. Chapter 5 (125-162) in Lidskog R, Sundqvist G, eds. *Governing the Air: The Dynamics of Science, Policy, and Citizen Interaction.* Cambridge, MA: MIT Press.

Hasenclever A, Mayer P, Rittberger V. 1997. *Theories of International Regimes*. Cambridge, UK: Cambridge Univ. Press.

Helm C, Sprinz D. 2000. Measuring the effectiveness of international regimes. *J. of Confl. Resolution* 44(5):630-652.

Holdren JP, Ehrlich PR. 1974. Human population and the human environment. *Am. Scient.* 62:282-292.

Hovi J, Skodvin T, Aakre S. 2013. Can Climate Change Negotiations Succeed? *Polit. and Governance* 1:138-150.

Hovi J, Sprinz DF, Sælen H, Underdal A. 2016. Climate change mitigation: a role for climate clubs? *Palgr. Communications* (open access).

Hovi J, Sprinz DF, Underdal A. 2003. The Oslo-Potsdam Solution to Measuring Regime Effectiveness: Critique, Response, and the Road Ahead. *Glob. Environ. Polit*. 3(3):74-96.

InterAcademy Council. 2010. Climate change assessments: An evaluation of the procedures and processes of the IPCC. Amsterdam: IAC committee.

IPCC. 2016. Organization. http://www.ipcc.ch/organization/organization.shtml (accessed 1 June, 2016).

IPCC. 2014. 5th Assessment Report. https://www.ipcc.ch/report/ar5/

Jordan A, Matt E. 2014. Designing policies that intentionally stick: policy feedback in a changing climate. *Policy Sci.* 47(3):227-247.

Jurpelainen, J. 2013. A model of dynamic climate governance: dream big, win small. *Int. Environ. Agreements* 13(2):107-125.

Kahneman D, Tversky A. 1979. Prospect theory: an analysis of decisions under risk. *Econometrica* 47(2):263-291.

Keohane RO. 2015. The global politics of climate change: Challenges for political science. *PS* Jan:19-26.

Keohane RO. 1982. The demand for international regimes. *Int. Organ*. 36(2):325-355.

Keohane RO, Victor DG. 2016. Cooperation and discord in global climate policy. *Nat. Clim. Change.* DOI: 10.1038/NCLIMATE2937.

Keohane RO, Victor DG. 2011. The regime complex for climate change. *Perspect. Polit*. 9(1):7-23.

Klingler-Vidra R, Schleifer P. 2014. Convergence more or less: Why do practices vary as they diffuse? *Int. Stud. Rev*. 16(2):264-274.

Lenton TM, Held H, Kriegler E, Hall JW, Lucht W, Rahmstorf S, Schellnhuber HJ. 2008. Tipping elements in the Earth's climate system. *PNAS* 105(6):1786-1793.

Levin K, Cashore B, Bernstein S, Auld G. 2012. Overcoming the tragedy of super wicked problems: constraining our future selves to ameliorate global climate change. *Policy Sci.* 45(2):123-152.

Mattoo A, Subramanian A. 2012. Equity in climate change: An analytical review. *World Dev*. 40(6):1083-1097.

Mearsheimer JJ. 1994-1995. The false promise of international institutions. *Int. Security* 19:5-49.

Michaelowa K, Michaelowa A. 2016. The growing influence of the UNFCCC Secretariat on the clean development mechanism. *Int. Environ. Agreements*. Online first, 2 April 2016.

Michaelowa K, Michaelowa A. 2012. Negotiating climate change. *Clim. Policy* 12(5):527-533.

Miles EL, Underdal A, Andresen S, Wettestad J, Skjærseth JB, Carlin EM. 2002. *Environmental Regime Effectiveness: Confronting Theory with Evidence*. Cambridge, MA: MIT Press.

Mitchell RB. 2008. Evaluating the Performance of Environmental Institutions: What to Evaluate and How to Evaluate It? In Young OR, King LA, Schroeder H, eds. *Institutions and Environmental Change: Principal Findings, Applications and Research Frontiers*. Cambridge, MA: MIT Press.

Mitchell RB, Clark WC, Cash DW, Dickson NM, eds. 2006. *Global Environmental Assessments*. Cambridge, MA: MIT Press.

Morgenthau HJ. 1948 (revised by Thompson KW. 1985). *Politics Among Nations: The Struggle for Power and Peace*. New York: Alfred A. Knopf.

Nordhaus W.D. 2015. Climate clubs: Overcoming free-riding in international climate policy. *Am. Econ. Rev*. 105(4):1339-1370.

Oberthür S, Stokke OS, eds. 2011. *Managing Institutional Complexity: Regime Interplay and Global Environmental Change.* Cambridge, MA: MIT Press.

Olson M. 1965. *The Logic of Collective Action*. Cambridge, MA: Harvard Univ. Press.

Ostrom E. 2009. A Polycentric Approach for Coping with Climate Change. New York, NY: The World Bank, *Policy Research Working Paper 5095*.

Parker CF, Karlsson C, Hjerpe M. 2015. Climate change leaders and followers: Leadership recognition and selection in the UNFCCC negotiations. *Int. Rel.* 29(4):434-454.

Pattberg P, Widerberg O. 2015. Theorising global environmental governance: Key findings and future questions. *Millennium* 43(1):684-705.

Pierson P. 2000. Increasing Returns, Path Dependence, and the Study of Politics. *Am. Polit. Sci. Rev*. 94(2):251-267.

Potoski M, Prakash A. 2005. Green clubs and voluntary governance: ISO 14001 and firms' regulatory compliance. *Am. J. of Pol. Science* 49(2):235-248.

Rockstrom J, Steffen W, Noone K, Persson Å, Chapin FC, Lambin EF, Lenton TM, Scheffer M, Folke C, Schellnhuber HJ, Nykvist B, de Wit CA, Hughes T, van der Leeuw S, Rodhe H, Sørlin S, Snyder PK, Constanza P, Svedin U, Falkenmark M, Karlberg L, Correll RW, Fabry VJ, Hansen J, Walker B, Liverman D, Richardson K, Crutzen P, Foley JA. 2009. *Nature* 461:472-475.

Rietig K. 2014. Reinforcement of multilevel dynamics: creating momentum for increasing ambitions in international climate negotiations. *Int. Environ. Agreements* 14(2):371-389.

Rogelj J, den Elzen M, Höhne N, Fransen T, Fekete H, Winkler H, Schaeffer R, Sha F, Riahi K, Meinshausen M. 2016. Paris Agreement climate proposals need a boost to keep warming well below 2°C. *Nature* 534:631-639.

Roger C, Belliethathan S. 2016. Africa in the global climate change negotiations. *Int. Environ. Agreements* 16(1):91-108.

Rothstein B, Holmberg S, eds. 2011. *Good Governance: The Relevance of Political Science*. Cheltenham: Edward Elgar.

Rothstein RL. 1984. Regime creation by a coalition of the weak: Lessons from the NIEO and the integrated program for commodities. *Int. Stud. Quarterly* 28(3):307-328.

Sabatier, PA. 1988. An advocacy coalition framework for policy change and the role of policy-oriented learning therein. *Policy Sci*. 21(2-3):129-168.

Schellnhuber H-J, Wenzell V, eds. 1998. *Earth System Analysis: Integrating Science for Sustainability*. Berlin, Heidelberg, New York: Springer.

Schroeder H, Boykoff MT, Spiers L. 2012. Commentary: Equity and state representations in climate negotiations. *Nat. Climate Change* 2: 834-836.

Spilker G, Koubi V. 2016. The effects of treaty legality and domestic institutional hurdles on environmental treaty ratification. *Int. Environ. Agreements* 16(2):223-238.

Sprinz, DF, Bueno de Mesquita B. 2015. Predicting Paris: Forecasting the outcomes of UNFCCC COP-21 with the Predictioneer's Game. Unpublished paper.

Steffen W, Richardson K, Cornell SE, Fetzer I, Bennett EM, Biggs R, Carpenter SR, de Vries W, de Wit C, Folke C, Gerten D, Heinke J, Mace GM, Persson LM, Ramanathan V, Reyers B, Sørlin S. 2015. Planetary boundaries: Guiding human development on a changing planet. *Science* 347:1286-1287.

Steffen W, Sanderson A, Tyson PD, Jäger J, Matson PM, Moore B III, Oldfield F, Richardson K, Schellnhuber HJ, Turner BL II, Wasson RJ. 2004. *Global Change and the Earth System: A Planet under Pressure*. New York: Springer.

Steinberg PF, VanDeveer S, eds. 2012. *Comparative Environmental Politics: Theory, Practice, and Prospects*. Cambridge, MA: MIT Press.

Stern N. et al. 2006. *The Stern Report: The Economics of Climate Change*. Prepared by a team of economists led by Professor Stern for HM Treasury. Cambridge, UK: Cambridge Univ. Press.

Stevenson H, Dryzek JS. 2014. *Democratizing Global Climate Governance*. Cambridge, UK: Cambridge Univ. Press.

Stokke OS. 2012. *Disaggregating International Regimes: A New Approach to Evaluation and Comparison*. Cambridge, MA: MIT Press.

Stokman FN, Thomson R. 2015. Forecasting the Paris 2015 UNFCCC negotiations: The exchange model's analysis of developments and potential obstacles to reaching an agreement. Univ. of Groningen/Univ. of Strathclyde: Unpublished paper dated October 16, 2015.

Stokman FN, van der Knoop J, van Oosten RCH. 2013. Modeling collective decision-making. In Nee V, Snijders TAB, Wittek R, eds. *Handbook of Rational Choice Social Research*. Sanford CA: Stanford Univ. Press.

Sunstein CS. 2002. The Law of Group Polarization. *J. of Polit. Philos.* 10(2):175-195.

Susskind LE. 1994. *Environmental Diplomacy: Negotiating More Effective Global Agreements.* New York and Oxford: Oxford University Press.

Sælen H. 2015. Side-payments: An effective instrument for building climate clubs? *Int. Environ. Agreements*. Online: DOI 10.1007/s10784-015-9311-8.

Tsebelis G. (2002). *Veto Players: How Political Institutions Work*. Princeton, NJ: Princeton Univ. Press.

Underdal A. 1994. Leadership theory: rediscovering the arts of management. In Zartman IW, ed. *International Multilateral Negotiation,* 178-197. San Francisco, CA: Jossey-Bass Publ.

Underdal A. 1980. *The Politics of International Fisheries Management: The Case of the Northeast Atlantic*. Oslo: Universitetsforlaget.

Urpelainen J. 2013. A model of dynamic climate governance: Dream big, win small. *Int. Environ. Agreements,* 13(2):107-125.

Verweij M, Douglas M, Ellis R, Engel C, Hendriks F, Lohmann S, Ney S. 2006. Clumsy solutions for a complex world: The case of climate change. *Publ. Adm*. 84(4):817-843.

Victor DG. 2015. Why Paris worked: A different approach to climate diplomacy. New Haven, CT: Yale University School of Forestry and Environmental Studies. *Yale Environ. 360* (15 Dec. 2015).

Victor DG. 2013. A Political Theory of Water Governance. San Diego, CA: UC San Diego, Laboratory on International Law and Regulation (ILAR), *Work. Paper* 19.

Victor DG. 2011. *Global Warming Gridlock: Creating More Effective Strategies for Protecting the Climate.* Cambridge, UK: Cambridge Univ. Press.

Victor DG, Gerlagh R, Balocchi G. 2015. Getting serious about categorizing countries. *Science* 345(6192):34-36.

Victor DG, Raustiala K, Skolnikoff EB, eds. 1998. *The Implementation and Effectiveness of International Environmental Commitments: Theory and Practice.* Cambridge, MA: MIT Press.

Ward H, Grundig F, Zorick ER. 2001. Marching at the pace of the slowest: A model of international climate change negotiations. *Polit. Stud.* 49(3):438-461.

Webber DJ. 1986. Analyzing political feasibility: Political scientists' unique contribution to policy analysis. *Policy Stud. J.* 14(4): 545-553.

Weischer L, Morgan J, Patel M. 2012. Climate clubs: Can small groups of countries make a big difference in addressing climate change? *Rev. of Eur. Comm. and Int. Environ. Law* 21(3):177-192.

Wendt A. 1992. Anarchy is what states make of it: The social construction of power politics. *Int. Organ.* 46(2):391-425.

Wilson JQ. 1973. *Political Organization*. New York: Basic Books.

Young OR. 2011. Effectiveness of international environmental regimes: Existing knowledge, cutting-edge themes, and research strategies. *PNAS* 108:19853-19860.

Young OR. 2008. Building Regimes for Socioecological Systems: Institutional Diagnostics. In Young OR, King LA, Schroeder H, eds. *Institutions and Environmental Change: Principal Findings, Applications, and Research Frontiers.* Cambridge, MA: MIT Press.

Young OR. 2003. Determining Regime Effectiveness: A Commentary on the Oslo-Potsdam Solution. *Glob. Environ. Polit*. 3(3):97-104.

Young OR. ed. 1999. *The Effectiveness of International Environmental Regimes: Causal Connections and Behavioral Mechanisms.* Cambridge, MA: MIT Press.

Young OR. 1991. Political leadership and regime formation: On the development of institutions in international society. *Int. Organ.* 45(3):281-309.