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Abstract

Preserving the Epistemic Authority of Science in World Politics

by Peter M. Haas

Governments rely extensively on expertise, and arguably many of the major accomplishments over the last 50 years reflect the ideas and involvement of experts. Yet expertise in world politics is increasingly contested. What are the factors which influence the future of state to defer to expertise in world politics?

Keywords: World politics, expertise, science, legitimacy

Zusammenfassung

Bewahrung der Epistemischen Autorität der Wissenschaft in der Weltpolitik

von Peter M. Haas

Regierungen vertrauen in hohem Maße auf Expertise und viele der großen Errungenschaften der letzten 50 Jahre wurden durch Ideen und Miteinbeziehung von Experten erreicht. Dennoch ist Expertise in der Weltpolitik heutzutage immer häufiger umstritten. Was sind die Faktoren, die die Staaten in Zukunft dazu bringen können, sich der Expertise in der Weltpolitik anzunehmen?

Schlüsselwörter: Weltpolitik, Expertise, Wissenschaft, Legitimität

I. Introduction

World Politics rests on science and expertise for maintaining a functioning multilateral system of governance. The liberal world order rests on numerous foundations, including the recognition of the authority of expertise and science (Ezrahi 1990; Stokes 1997; Zurn 2018). Without the regular provision of objective and impartial advice (or at least the confidence in the warrants behind technical advice) the governance of highly technical issues such as climate change, finance, and public health, among others, would fail and the international system would lose legitimacy in the eyes of those who value the effective delivery of public goods and the enhancement of social welfare. Indeed, until recently the reliance on science as a source of technical advice had become an institutionalized social fact. Scientists and politicians speak of the need for scientific governance for making sound policy decisions (Holdgate 1982; Sebek 1983; Gore 1996; Watson 2005; Leemans 2008; Jasanoff 2011, 20; OECD 2015; United Nations 2015, ch 2; Scientific Advisory Board 2016).

Science is an institution which confers a source of governance in opposition to rule by force or theology or plutocracy derived from dynasties, monarchies, or organized religion (Lasswell 1965; De Solla Price 1975; Hirschman 1977; Ezrahi 1990; Sagan and Druyan 1995; Knorr-Cetina 1999, 8; Ziman 2000; Drori 2003). Scientists are accorded authority because of the benefits they are believed to provide. In practice scientists are recruited by states to serve as national advisors and to serve on international science panels.

In the environmental realm, 140 global environmental assessments have been conducted since 1977 (Jabbour and Flachsland 2017), and over 32 international science advisory panels operate (Haas and Stevens 2011; Haas 2017). It has become an almost a taken for granted assumption in diplomatic circles that regimes would be designed with formal science advisory components, or what is now called the science-policy interface. National environmental ministries have become ubiquitous, as has offices of science advisors (Holdgate 1982; Smith 1990; Golden 1991; Smith 1992; Skolnikoff 1994; Meyer 1997; Drori 2003).

Science and expertise contributed to many of the major multilateral achievements of the post-World War 2 global order, such as: reductions in infant mortality, improvements in life expectancy, macroeconomic coordination and sustained economic growth, nuclear nonproliferation, advances in public health, and environmental protection.

And yet the authority of science to meaningfully contribute to global governance/world politics is now contested to an unprecedented degree since the Dark Ages. This challenge is but one new feint in a war of interests in world politics, where science is being threatened by populists in conjunction with corporate interests who have been threatened by the policy implications of scientific findings (For a thorough documentation of US federal efforts to suppress science and scientists see http://columbiaclimatelaw.com/silencing-science-tracker/). But the effects may be more pernicious than just undermining the technical foundations of effective global governance. As Hannah Arendt wrote:

> *The result of a consistent and total substitution of lies for factual truth is not that the lie will now be accepted as truth, and truth be defamed as lie, but that the sense by which we take our bearings in the real world is being destroyed.*

Still, science enjoys authority in global governance because of science's social reputation for usable expertise. Its power rests on its ability to exercise influence over states. But it does not enjoy uniform influence. Its influence – or power - depends upon the extent of legitimacy which scientific institutions command in the eyes of the relevant audiences. While science operates within a political space (Jasanoff 2004; Jasanoff and Martello 2004; Le Prestre 2016, 58-60), there are clearly identifiable criteria by which political actors accord science and scientists with authority and legitimacy, and choose to defer to scientific advice. Science's legitimacy can be defended through rigorous contestation based on the roots which have supported its authority over the years. In particular, I focus on the authority of international science panels in global environmental governance.

II. The Nature of Scientific Influence: When knowledge is power

Knowledge is power (Foucault 1972; Haas 1990). Through persuasion and learning, it leads other actors to recognize, and often pursue, new goals and policies by updating understandings of how the world works and how actors are affected by conditions in the world (Haas 2015). Concretely, Science influences governance by shaping frames and discourses, setting agendas, privileging policies, shaping the determination of who is entitled to representation in deliberations about technical and environmental issues, privileging reasoned discourse over emotional or purely interested discourses, and contributing to social learning. But it is a fragile power, which rests on the social foundations of Weberian deference. But because the

reasons for deference to it rest on social beliefs, its influence may be rehabilitated by reasserting those foundational beliefs.

Science exercises power because it leads to behavior which would not have occurred in its absence. Science has a demonstrable influence on governance, and exercises multiple forms of power in the sense of inducing actors to do things they would not otherwise have done. But this power is not exercised through direct influence over the choices of other parties. Rather it occurs by shaping beliefs and expectations, and understandings about how the world works and how national interests are affecting by conditions in the world (Lukes 1974; Guzzini 2016). Science helps frame choices and collective understandings through path dependent lock-in social mechanisms as the resources commanded by the formal institutions scientists shape get deployed based on scientific understanding. Science also tends to accumulate more authority through such institutions, as the institutions amplify the respect for the informal institutions of science. Barnet and Duvall call these influences the institutional and productive forms of power (Lukes 1974; Barnett and Duvall 2005, 12-22). The social mechanisms by which such authority yields collective outcomes involve persuasion, learning, and also institutionalized socialization of actors through new incentives and constraints deployed on behalf of the authoritative beliefs exercised by institutions which were themselves affected by the authority and legitimacy of the science. Steven Lukes was hesitant to call such influence power (Lukes 1974, 32), as it seemingly rests on consensus and there is no public evidence of manipulation. Yet the effects are powerful, because they lead to outcomes which would not have occurred otherwise and may be counter to state's ex ante preferences.

While most of these social mechanisms are permissive or enabling, scientists' ideas can be causal in the necessary sense. For instance, without the ideas actors would not have a plausible understanding of what to do, or of the "map" of available options and policy destinations. Ideas, be they warranted or not, can cause outcomes. Consider stock market scares and runs on banks which are triggered by rumors, or various Cold War scenarios, where an idea generates behavioral effects. Or consider alarms about global warming – something which cannot be confirmed by individual observation – where once accepted the ideas give rise to actions.

Scientific authority also has constitutive effects (Shackley and Wynne 1996; Allan 2017). By privileging the expertise of "science" at the expense of other possible claimants, and thus contributing to forms of social stratification, as well as privileging presumptive policies

through the frames which experts help instill. Relying on science promotes reasoned and scientific deliberation. Relying on scientific institutions reinforces the legitimacy of the institutions of science, and vice versa. This latter constitutive effect appears to be well understood by the Conservative anti-science movement in the USA and UK, which have systematically launched attacks at science after the IPCC was awarded the 1998 Nobel Prize in order to undermine the legitimacy and authority of the IPCC.

Because reliance on science is voluntary, adherence to its dictates operate in the absence of any explicit coercion, and the nature of scientific power or influence rests on its authority and legitimacy. Without any material capabilities to influence decisions, or direct responsibility for making decisions, experts' influence is indirect. It rests ultimately on their social authority and the willingness of states to voluntarily defer to the advice of experts and to be persuaded by it.

Thus scientific "power" rests on scientists' authority, and the willingness of principals – be they states, IOs or firms – to willingly defer to their claims. Steven Bernstein writes that "legitimacy is the glue that links authority and power" (Bernstein 2011, 20). Scientists enjoy privileged agency. Weberian Legal-Rational authority comes with its own inherent logic (Weber 1958). It enjoins willing compliance with scientific or bureaucratic dictates because of the perceived impartiality and reason of the source.

Legitimacy is thus a social construct that relates a group of presumptive experts to an audience willing to accede to their expertise. Ian Hurd writes that "legitimacy is the belief by an actor that a rule or institution ought to be obeyed." (Hurd 2007, 30). Allen Buchanan and Robert Keohane speak of "the right to rule." (Buchanan and Keohane 2006). Michael Zurn uses the more nuanced language "believed to have the right to rule" (Zurn 2005, 136).

This notion of legitimacy combines the traditional distinction between "normative" and "empirical" legitimacy. The distinction is a false dichotomy (Flathman 1980, ch 1; Zaum 2013, 10) Zaum (2013, 10) writes:

> *It is problematic to neatly distinguish between … the normative dimension (the right to rule) and the sociological dimension of legitimacy (a widely held belief in the right to rule). However, one cannot just assert universal criteria against which legitimacy claims can be judged, as these criteria are depending on the particular audience making a normative judgement on an institution's legitimacy. They are the consequence of social processes of argumentation, persuasion and socialization, and subject … to social change. Similarly, judgements on an institution's sociological legitimacy, ascribed as*

> *the result of the congruence of the institutions' objectives and practices with the beliefs, values and expectations that provide a justification for its power, are made on the basis of certain normative suppositions. Thus, in practice both the normative and sociological dimensions of legitimacy are closely interlinked.*

Legitimacy in practice is the consequence of the normative expectations embraced by diverse audiences (Zurn 2005; Johnson, Dowd et al. 2006). Their authority ultimately rests on a social relationship with the presumptive audience (Avant, Finnemore et al. 2010, 9; Zaum 2013; Zaum 2016). The question, addressed in the following section, is what expectations of legitimacy are held in practice by states about science's role in global environmental governance specifically, although the legitimacy criteria are generalizable to other areas of technical policy making.

III. Legitimacy Criteria

The general concept of legitimacy is contested by scholars (Hurrell 2005), but there is broad consensus on a variety of components that contribute to legitimacy. While it is unknown if these components are widely endorsed by audiences, and to what extent different audiences hold different criteria of legitimacy satisfying more criteria is better than fewer, legitimacy is a social fact, created by the actors who confer legitimacy on others (Johnson, Dowd et al. 2006; Bernstein 2011). Indeed Steven Bernstein writes that "there are no universally shared criteria of legitimacy in global governance." (Bernstein 2011, 22). There is very limited empirical work on the legitimacy of science, or general criteria of legitimacy at the global level (Borzel and Risse 2005; Zurn, Binder et al. 2012, 75 ff; Kanie, Haas et al. 2014, 16–17, 211–214; Rittberger and Schoeer 2016).

It is not just a matter of what is legitimate, but it is also a matter of who is legitimate to whom (McNamara 2010). The granting of legitimacy depends on a social audience: "although legitimacy is mediated by the perceptions and behaviors of individuals (and one might add corporate entities) it is fundamentally a collective process." (Johnson, Dowd et al 2006: 57). Such a question of audience is particularly important given the increasing number of multi-actor networks involved in global governance where actors' legitimacy may not be the same in the eyes of every other actor (Kahler 2009; Avant, Finnemore et al. 2010; Kanie, Haas et al. 2014).

Many criteria for legitimacy are invoked; many from democratic theory and normative theory. Legitimacy has been most widely studied in the EU and, more generally applied to global governance by David Held and Koenig-Archibugi's edited work on global governance more generally (Held and Koenig-Archibugi 2005). The terms "authority" and "legitimacy" tend to be used interchangeably. Below I distinguish between input, process, output and outcome criteria of legitimacy. This taxonomy is informed by Fritz Sharpf's the study of the legitimacy of the EU (Scharpf 1999; Scharpf 2009) and of climate change governance (Karlsson-Vinkhuyzen 2013). Alternative formulations weight input, output and substantive legitimacy (Nasiritousi, Hjerpe et al. 2016, 926). Some of the categories are a bit arbitrary, as fairness can be considered a process or an output. Despite slightly different taxonomies, the intents are similar.

These definitions also span a variety of a number of different but overlapping sources of legitimacy criteria which are commonly identified by different theoretical traditions. Essentialist or rationalist criteria involve inputs having to do with respect for expertise and generative norms, which Constructivists regard as social facts (Ruggie 1983; Ruggie 1993) and which more essentialists treat in terms of their functional utility. In terms of process, theoretical traditions interpret the same variable in different ways (McCarthy and Fluck 2017). Rationalist analysis looks at transparency and accountability in terms of their functional contribution to solving public action problems, whereas Constructivists tend to treat them in terms of signaling and expressing the performative competence of experts (Adler and Pouliot 2011; Adler and Pouliot 2011) and their discursive practices. Regardless of the differences in social mechanisms associated with these factors, cross tradition consensus exists about the validity of the factors in the eyes of states.

Because science is imparted to global environmental governance by international science panels, I consider here the various legitimacy criteria which states apply to international science panels. While science serves multiple purposes, including such indirect functional effects as public publicity and concern by mass publics, here I focus on its direct legitimacy in the eyes of states, as states are the primary constituency which convenes and funds international science panels.

Practitioners and high profile science panel architects have reflected about the legitimacy needs for scientific institutions, reflecting an awareness of many of the features of legitimacy expressed in the academic literature (Kullenberg 1995; Watson 2005; Tuinstra, Hordijk et al. 2006; Bolin 2007; Leemans 2008; United Nations 2015, ch 2; Kowarsch, Garard et al. 2016;

Reid and Mooney 2016). They stress the value of science in mitigating uncertainty and providing a range of policy options for states to choose between.

The institutional designers and members of the science policy community are acutely aware of the need to maintain and preserve the legitimacy of their institutions, and design them accordingly (Watson 2005). Attention to legitimacy has informed the design of international science panels. They emphasize the need for scientists recruiting on professional reputation, as well as geographic distribution.

The Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) has been consciously designed in order to enhance its legitimacy, including inviting multiple stakeholders through two legitimate institutions (International Council of Scientific Unions (ICSU) and the International Union for the Conservation of Nature (IUCN)) to contribute to IPBES deliberations (Esguerra, Beck et al. 2017, 63). At the Fourth Session of the IPBES the USA and Switzerland emphasized the needs for science to conform to IPBES' principles of usable knowledge, focusing on scientific independence. credibility and timeliness (Earth Negotiations Bulletin 2016, 1).

The IPCC has received the greatest attention of international science panels. Paul Edwards and Stephen H. Schneider describe the IPCC, and notes its need to preserve legitimacy (Edwards and Schneider 2001, 225):

> *…a hybrid science–policy, the IPCC must maintain credibility and trust vis–à–vis two rather different communities: the scientists who make up its primary membership, and the global climate policy community to which it provides input. Independent self–governance is one of the primary mechanisms by which it achieves this goal.*

The IPCC has been repeatedly criticized by states and analysts for favoring scientists from the developed world (Biermann 2002; Biermann 2006; Morin and Orsini 2015, 40-41). The Second Assessment Report (1996) withstood accusations that it had violated peer-review standards and of transparent procedures (Miller and Edwards 2001). The Fourth Assessment Report (2007) was criticized for inaccuracies in presenting data on the contribution of glacial melt to regional flooding, and for its slow response to criticism.

In 2010 The InterAcademy Council of Science (IAC) was asked by UN Secretary General Ban Ki Moon to conduct a review of the mounting IPCC legitimacy crisis, and to offer suggestions for improving the IPCC's legitimacy. In passing, the IAC noted that "the IPCC's reputation (is) at risk and contributed to a decline in public trust of climate science." (InterAcademy Council

2010, 62). The IAC noted that "transparency is an important principle for promoting trust by the public, the scientific community, and governments." (InterAcademy Council 2010, 63). The IAC identified challenges to the IPCC's legitimacy which included inaccurate data summary, a slow response to its revelation, the nontransparent governance of the institution, and inconsistent treatment of uncertainty among the different working groups (InterAcademy Council 2010).

The IAC raised a number of suggestions for improving the legitimacy of the IPCC in its 2010 recommendations, including: revamping the management structure, strengthening the review process, characterizing uncertainty, improving communication with the media and the public, increasing transparency, clarifying peer review, engaging the best experts (InterAcademy Council 2010, ch 5). In particular they recommended establishing a permanent Executive committee, electing an Executive Director with a fixed term, clarifying the responsibilities of key Secretariat members, and developing a "rigorous conflict of interest policy." Review editors were encouraged to ensure that reviewer's comments are better considered when revising chapters. An "effective communication strategy" was recommended to emphasize "transparency, rapid and thoughtful responses, and relevance to stakeholders, that includes guidelines about who can speak on behalf of IPCC and how to represent the organization appropriately." (InterAcademy Council 2010, 62). The IAC emphasized the need for transparency in selecting and identifying authors and reviews, as well as the relevant scientific and technical information on which the assessments depend, (InterAcademy Council 2010, 63) while also engaging the "best regional experts" for the regional chapters of the IPCC assessments (InterAcademy Council 2010, 64).

The recommendations included establishing an executive committee, with members "including individuals from outside the IPCC and even the climate change community." It also called for upgrading the status of the IPCC executive director with the "status...of a senior scientist." These proposals were intended to "enhance its credibility and independence." It also recommended term limits for the IPCC chair (or executive director) and for the chairs of the working groups. It also called for the development of a new "communication strategy" to streamline responses to criticism. The IAC report called for several changes to enhance transparency: clearer elaboration and enforcement of reliance on peer reviewed or gray literature; and a greater consistency and clarity in how the Working Groups characterize uncertainty (InterAcademy Council 2010).

The IAC proposals reflect numerous input and process based legitimacy criteria. By focusing on the official science managers, the process of deliberation, and the presentation of consensus these reform proposals instantiate a host of specific state-held legitimacy criteria.

The IPCC adopted many of these reform proposals. In 2011 the IPCC established an executive committee composed of the IPCC Chair, Working Group co-chairs, and vice chairs of the task forces, as well as the Head of Secretariat, and four heads of the Technical Support Units (http://www.ipcc.ch/meetings/session35/IAC_ExCom.pdf). In 2016 it recruited a new Secretary, who had formerly been the WMO Vice President. Such an appointment highlights the tensions in promoting scientific legitimacy. The institutional reforms draw from other legitimate institutions, although they did little to embellish its legitimacy by encouraging involvement from outside the insular climate change assessment community. Efforts were undertaken to finance the training of developing country scientists, and to include them in preparing IPCC assessments.

Most importantly, Guidance procedures were developed in 2010 to standardize the treatment of uncertainty for the Fifth Assessment Report (Intergovernmental Panel on Climate Change 2010). While the Fifth Assessment Report diligently recorded the confidence with which elements of scientific understanding enjoyed consensus, on a five-point scale ranging from 20% to 9% confidence intervals, the criteria by which authors judged their own confidence was never firmly established. Confidence estimates were applied inconsistently in different chapters of the report (Gleditch and Nordas 2014).

These reforms addressed much of the IPCC's legitimacy crisis by addressing many of the more general legitimacy criteria for science and science panels involving input and procedural measures of legitimacy. Increased professionalism engaged input criteria, and transparency reforms engaged with process measures.

Underlying the reforms was a pervasive respect for embedded liberalism by subordinating scientific independence to state imperatives. Efficiency changes were implemented so that states would be better able to review the scientific reports, ensure that submitted comments (most of which are solicited by states), and still conduct line by line reviews of the Summaries for Policy Makers. Chapter writers were still nominated and appointed by states. Thus the entire IPCC science assessment project remains subordinated to state concerns about minimizing the domestic economic costs of mitigating and adapting to climate change.

Since "legitimacy" is itself contested, and there are many plausible criteria for legitimacy, I here provide a number of them which states are likely to apply to measure the legitimacy of

scientific institutions. In practice, institutions are likely to be regarded as legitimate if they conform to multiple criteria (Fung 2006; Bernstein 2011). Usable knowledge (Cash, Clark et al. 2003, 8086; Haas 2004; Mitchell, Clark et al. 2006; Haas and Stevens 2011)– knowledge which is credible, legitimate[1] and salient – is an example of multiple legitimacy criteria. The greater the legitimacy the more influence and the broader the deference by states to scientific advice and likelihood of converting advice to policy and governance.

Inputs:

Input legitimacy relates to the background beliefs which other actors apply to the role of science in modern governance and societal relations. Input criteria are typically expressed as functional roles, as broader sociological social facts, and through their affinity with broader generative norms and principles.

Input 1: Functional Inputs

Historically "science" has enjoyed a social reputation for providing useful information to the state and decision makers. Science performs a number of functional roles in modern governance. Sociologists of science argue that science helps ameliorate risk and uncertainty, while also establishing categories to be governed and consolidating the social authority of scientists (Barnes, Bloor et al. 1996; Gieryn 1999; Nowotny 2016). Economic historians attribute its legitimacy to the instrumental value that science provides for promoting capitalist power and wealth accumulation (Mowery and Rosenberg 1989; North 2005; Mokyr 2016). Sociologists of knowledge attribute it to the power science grants to the state for controlling its society (Porter 1986; Hacking 1990). Moreover, scientists *cum* scientists have been socially recognized as possessing valuable skills in public administration and governance which politicians in the modern regulatory state regard as essential (Lindblom and Cohen 1979; Ezrahi 1990; Drori, Meyer et al. 2003; Drori and Meyer 2006; Lentsch and Weingart 2011). Science, along with other bodies of expertise that are overtly non-political allow politicians to resolve debates without "overt expressions of interests and threats of violence." (Kennedy 2016, 48).

Science's legitimacy is also a social fact, in so far as the social prestige and authority of science enjoys a taken for granted aspect. Its reputation for expertise underlies its legitimacy (Dunlop 2000; Committee on the Science of Science Communication 2016, 2-16), just as sci-

[1] Legitimacy in this context refers to input criteria.

entists role as experts rest on their legitimacy. Yet, just as they are experts because they enjoy perceived legitimacy, they are also legitimate because they are seen to be experts in a given domain (Sending 2015). However, here I focus on the legitimacy of scientific expertise in the eyes of states.

Input 2: Reputation

Scientists' legitimacy rests on their social credibility, which in rests on the presumptive competence and expertise of actors. Dan Bodansky argues that scientific expertise enjoys legitimacy in international deliberations because it confers trust in the warranted foundations of collective decisions. Scientists professional pedigrees and reputation for mastery of technical material confers legitimacy (Bodansky 1999).

Usable knowledge focuses attention on the credibility of the scientist's expertise, based on reputation, accuracy, track record, and presumptive impartiality. Reputation, as well as confidence derives from publications in highly regarded peer reviewed journals, positions at prestigious institutions, and advanced degrees and experience in relevant disciplines. Individuals need not be prominent in their fields, though (Anderegg, Prall et al. 2010). Impartiality is measured by independence from state sponsors.

However, expertise alone appears to be insufficient for commanding authority. Intuitively, experts must command specialized knowledge in the domain in which they are providing policy advice, as reputation is highly issue specific. Consider the numerous letters to the editor by Nobel Laureates on a broad array of issues of global politics, with little impact. Or the failed campaign by Linus Pauling, claiming the benefits of vitamin C, which was well beyond the scope of his professional recognition. When scientists claim authority their claims must reflect competence, which is related to their areas of expertise and experience.

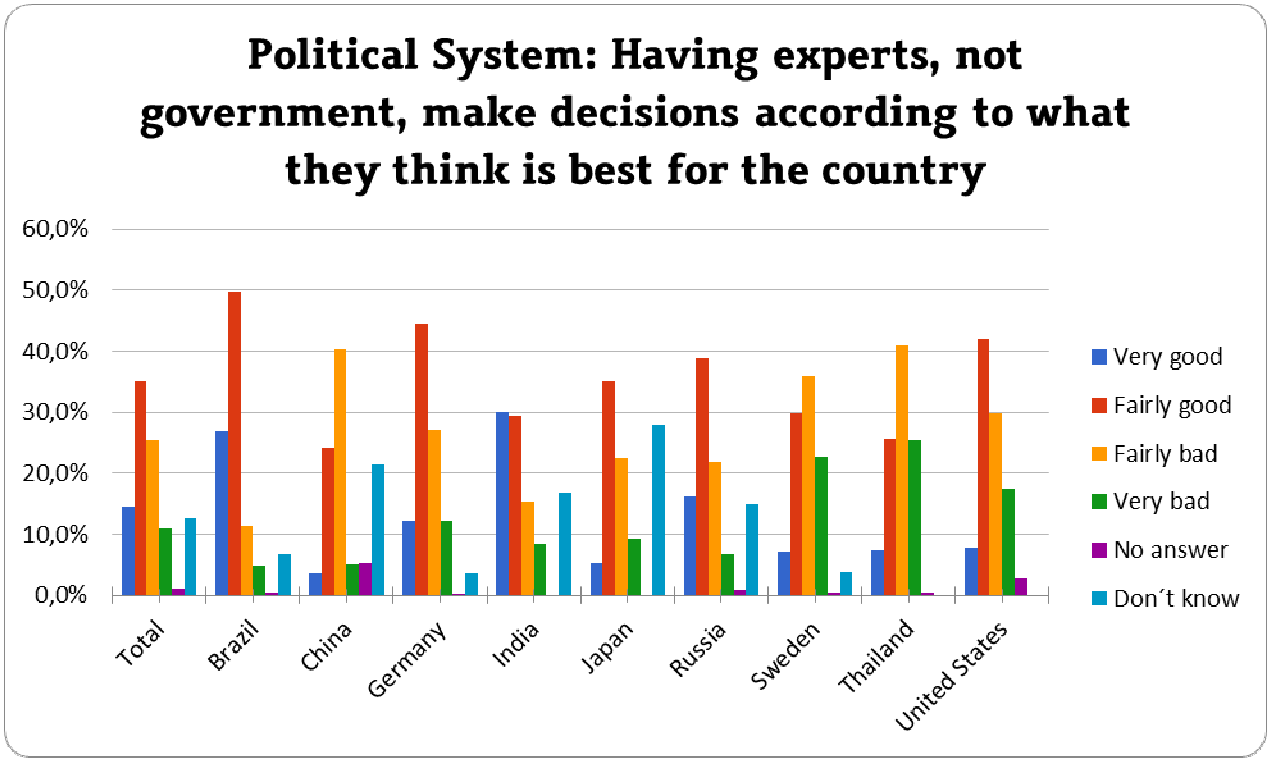
Input 3: Social Norms, Values and Principles

Science's affinity with broader social norms, values and principles are likely to enhance its legitimacy to the extent that it explicitly articulates universal goals, or helps member states achieve those goals (Reus-Smit 1997, 568-570; Aggarwal 1998). A number of broad principles have been identified in the IR literature, including multilateralism (Keohane 1990; Cox 1992; Ruggie 1993); embedded liberalism (Ruggie 1983; Bernstein 2001); state sovereignty (Biersteker and Weber 1996); liberal multilateralism (Deudney and Ikenberry 1999; Ikenberry 2011) and possibly as an emergent norm, sustainable development.

Mike Hulme, borrowing from the STS literature, argues that science is inherently political and normative - because of its distributional consequences and the ways that it is used in practice by decision makers to advance their prior goals – so that the best science is that which is explicitly linked to shared norms (Hulme 2012). The legitimacy of science thus hinges on its application to socially shared ends (Turnhout, Dewulf et al. 2016). In a complementary manner scientific institutions must resonate with domestic norms and goals as well (Cortell and Davis 1996). Diagram 1 indicated how national faith in expertise varied by country. The Pew Research Center suggests that 76% of Americans express a great deal (21%) or a fair amount (55% of confidence in scientists. Medical scientists claimed slightly more confidence (24% a great deal, 60% a fair amount) (Pew Research Center 2016, 14-15). Scientists – medical and non-medical – were second in social institutions trusted by Americans, with the military at the top and elected officials at the bottom.

The World Values Survey reveals significant heterogeneity between countries in terms of public confidence in expertise from 2010-2014. While the questionnaire did not ask directly about legitimacy or confidence in science, expertise provides a good proxy for scientific legitimacy.

Diagram 1: Confidence in Expertise by Country



Source: World Values Survey: http://worldvaluessurvey.org

The results should be taken with a grain of salt. It is unclear what the survey is truly measuring. Faith in expertise could merely reflect diminished faith in the state rather than a positive endorsement of the legitimacy of scientific expertise.

The World Values Survey findings are confirmed by the International Social Survey Program, which indicates that less than 50% of respondents worldwide believe the modern science will solve our environmental problems with little change to our way of life (Pammett 2015, 557) with fairly consistent responses occurring from 1993-2010, although 70-80% of respondents believe that science does more good than harm (Pammett 2015, 554). In the USA, highly differentiated responses to science and its claims to legitimacy are based on political orientation (Leiserowitz, Maibach et al. 2013).

Citizens vary with regard to their confidence in institutions, and in different scientific institutions as well. According to Gallup polls, Americans express a great deal or quite a lot confidence in the military, well above that of the medical system, and other social institutions (Gallup 2016, http://www.gallup.com/poll/1597/confidence-institutions.aspx). Confidence in scientific research as a foundation for public policy varies widely by country, although most countries believe that they are better off from the use of science and technology (National Science Board 2016, figures 7-12 and 17-13).

Input 4: Consensus

One of the major foundations for scientific legitimacy is its ability to project consensus about understanding technical problems. A common front underscores the authority of scientific knowledge and expertise, as well as providing a rhetorical firewall against challenges.

Process:

A number of arguments have been presented about social processes which confer legitimacy on institutions and actors.

Process 1: Fairness – Respecting alternative viewpoints

Robert Keohane (Keohane 2001; Buchanan and Keohane 2006), Thomas Franck (Franck 1990), and Oran Young (Young 1991) speak of the need for fairness as a criterion of the legitimacy of international institutions in the eyes of states, and also presumably civil society. Fairness often has two senses. One is the common usage applied to outcomes that everyone gets something.

For science, the focus must be applied to the deliberative process by which confident formulations are generated. For states the process itself must be regarded as legitimate, often by providing for voicing alternative viewpoints, as well as not being biased towards privileged actors. For science panels to enjoy legitimacy they must express consensus and provide for the expression of a variety of viewpoints.

Process 2: Transparency of Expert selection and Expert Consensus

A transparent process by which observers may understand how decisions were reached, and how experts were selected will enhance the legitimacy of a scientific institution. Inclusiveness and participation are particularly valued legitimizing criteria for groups with little ability to promote input based legitimacy, and with limited ability to appraise political processes, such as developing countries, as well as non-state actors including NGOs and the private sector (Kahler 2005; Scholte 2005). Geographic distribution of experts is a widely invoked form of procedural legitimacy.

Process 3: Transparency of the Deliberative Process

The transparency of deliberation and contestation are valued processes for science in international affairs (Stevenson and Dryzek 2014, 25, 28-29). Such public revelations confirm the ways in which expertise is performed and conclusive findings are warranted. Beyond immediate transparency, such arrangements also contribute to reflexivity, and thus more effective policy and politically relevant knowledge as second order objectives, which states value (Stevenson 2016; Dryzek and Pickering 2017).

Process 4: Discursive Practices

Agreement on discursive practices may also serve as a key source of legitimacy for scientific expertise (Risse 2003; Steffek 2003; Adler and Bernstein 2005; Borzel and Risse 2005; Risse 2006; Adler and Pouliot 2011; Helgadottir 2016). Discursive practice delimits the parameters of permissible deliberations and the legitimate forms of communication by establishing competent performance. The vocabulary which is used confers legitimacy, such as legality democracy, social justice, progress (Stephen 2015, 778) and even sustainability. Thus in UN venues scientific experts must speak the arcane language of UN precedents as well as that of science.

Outputs and Outcomes:

Institutions may enjoy legitimacy if they provide valuable outcomes for their constituencies, particularly the provision of global public goods (Hurd 1999). While one could consider the variety of indirect second order and possibly sinister outcomes which states may desire, such as delaying decisions, creating or breaking up coalition, and simply moving the goal-posts of policy deliberations, such choices are beyond the simpler first order outputs and outcomes valued by states. Under such circumstances, such as with central banks, illegitimate processes may be overlooked if the effects of the institutions are believed to work (Vibert 2007). Functional bodies such as science panels are likely to be valued for their direct contributions more than their indirect political functions (Steffek 2015).

Tensions between Legitimacy Criteria

Not all criteria may be obtained simultaneously. For instance, there are tensions and even contradictions between satisfying input criteria for disciplinary expertise and inclusive process criteria favoring multiple stakeholders, when some civil society stakeholders enjoy less legitimacy than scientists in the eyes of most states. Similarly, equity concerns with inclusive geographic distribution may run up against notions of competence and expertise unless great care is taken in the selection process. Deliberative transparency may contradict expert authority. By being honest about the degree of consensus and contestation within the scientific community, they may run the risk of undermining their reputation for authoritative understanding. Scientific independence may be at odds with states' desires for maintaining sovereignty and a range of political control over domestic policy.

IV. Conclusion: Challenges to Scientific Legitimacy

Thirteen criteria for legitimacy are cited in the legitimacy literature in IR, associated with input, process and output/outcome measures. The following table summarizes the legitimacy criteria and their application to IPCC reforms.

Table 1 Legitimacy Criteria for Organized Science in World Politics

Category	Criteria for legitimacy
Input	Reputation/prestige/competence
	Impartiality/independence of scientists
	Ameliorate risk/uncertainty
	Promote wealth accumulation
	Analysis resonates with broader social norms/values/principles
	Consensus
	Legitimacy must be held by domestic populations as well as states
Process	Respect for multiple viewpoints
	Transparent selection
	Transparent deliberation
	Egalitarian inclusiveness
	Discursive practices
Outcome/output	Associated with effective governance of global public goods

Targeted assaults on truth and reason in the USA and UK on the legitimacy of science have challenged the legitimacy and authority of scientific institutions (Mooney 2005; Oreskes and Conway 2010; Gauchat 2012). Such threats arise from two sources. Deliberate attacks on its legitimacy come from the fossil fuel industry and from conservative republicans who wish to discredit the justifications for environmental regulation. A populist epistemology valuing

individual experience over professional expertise is a deeper force (Mead 2011; Drezner 2017; Nichols 2017).

Such challenges run the risk of blurring the social domains of science and thus undermining its presumptive authority. Science critics try to supplant hybrid facts which are the domain of expertise and scientific communities with social facts, which are subject to normative and interest based arguments by a wider array of actors. By moving political debate to the realm of social facts, critics seek to undermine science's privileged position.

In a post-truth era where expertise is under siege, what are the prospects for the future of science diplomacy and of deference to international science panels? Science's role in world politics is challenged, but not irreversibly. Critics focus only on the input criteria of accuracy and reputation. The extent to which these challenges may fully undermine science and science panels' legitimacy may be exaggerated, given the much wider number of legitimacy criteria which science panels continue to reflect than the narrow ones on which they are attacked.

Bibliography

Adler, Emanuel; and V. Pouliot, Eds. (2011). International Practices. Cambridge, Cambridge University Press.

Adler, E. and S. Bernstein (2005). Knowledge in Power. Power in Global Governance. M. Barnett and R. Duvall. Cambridge, Cambridge Univeristy Press.

Adler, E. and V. Pouliot (2011). "International Practices." International Theory 3(1): 1-36.

Aggarwal, V. K., Ed. (1998). Institutional Designs for a Complex World. Ithaca, Cornell University Press.

Allan, B. B. (2017). "Producing the Climate: States, Scientists, and the Constitution of Global Governance Objects." IO 71(1): 131-162.

Anderegg, W. R. L., J. W. Prall, et al. (2010). "Expert Credibility in Climate Change." Proceedings of the National Academy of Sciences 107(27): 12107-12109.

Avant, D. D., M. Finnemore, et al., Eds. (2010). Who Governs the Globe? Cambridge, Cambridge University Press.

Avant, D. D., M. Finnemore, et al. (2010). Who Governs the Globe? Who Governs the Globe? D. D. Avant, M. Finnemore and S. K. Sell. Cambridge, Cambridge University Press.

Barnes, B., D. Bloor, et al. (1996). Scientific Knowledge: A Sociological Analysis. Chicago, University of Chicago Press.

Barnett, M. and R. Duvall (2005). Power in Global Governance. Power in Global Governance. M. Barnett and R. Duvall. Cambridge, Cambridge University Press: 1-32.

Bernstein, S. (2001). The Compromise of Liberal Environmentalism. New York, Columbia University Press.

Bernstein, S. (2011). "Legitimacy in Intergovernmental and Non-state Global Governance
" Review of International Political Economy 18(1): 17-51.

Bernstein, S. (2011). "Legitimacy in intergovernmental and non-state global governance." Review of International Political Economy 18(1): 17-51.

Biermann, F. (2002). "Institutions for Scientific Advice." Global Governance 8(2): 195-219.

Biermann, F. (2006). Whose experts? The role of geographic representation in global environ¬mental assessments. Global Environmental Assessments. R. B. Mitchell, W. C. Clark, D. W. Cash and N. M. Dickson. Cambridge, MIT: 87-112.

Biersteker, T. J. and C. Weber, Eds. (1996). State Sovereignty as Social Construct. Cambridge, Cambridge University Press.

Bodansky, D. (1999). "The Legitimacy of International Governance." American Journal of International Law 93(3): 596-624.

Bolin, B. (2007). A History of the Science and Politics of Climate Change. Cambridge, Cambridge University Press.

Borzel, T. A. and T. Risse (2005). Public-Private Partnerships: Effective and Legitimate Tools of International Governance? Complex Sovereignty. E. Grande and L. W. Pauly. Toronto, Toronto University Press.

Buchanan, A. and R. O. Keohane (2006). "The Legitimacy of Global Governance Institutions." Ethics and International Affairs 20(4): 405-437.

Cash, D. W., W. C. Clark, et al. (2003). "Knowledge Systems for Sustainable Development." PNAS 100(14): 8086-8091.

Committee on the Science of Science Communication (2016). Communicating Science Effectively: A Researach Agenda. Washington, DC, The National Academies Press.

Cortell, A. P. and J. W. J. Davis (1996). "How do International Institutions Matter? The Domestic Impact of International Rules and Norms." International Studies Quarterly 40(4): 451-478.

Cox, R. W. (1992). "Multilateralism and World Order." Review of International Studies 18: 161-180.

De Solla Price, D. J. (1975). Science Since Babylon. New Haven, Yale University Press.

Deudney, D. and G. J. Ikenberry (1999). "The Nature and Sources of Liberal International Order." Review of International Studies 25(2): 179-196.

Drezner, D. W. (2017). The Ideas Industry. Oxford, Oxford University Press.

Drori, G. and R. Meyer (2006). Global Scientization: An Environment for Expanded Organization. Globalization and Organization: World Society and Organization G. S. Drori, J. W. Meyer and H. Hwang. Stanford, CA, Stanford University Press.

Drori, G. S., J. W. Meyer, et al., Eds. (2003). Science in the Modern World Polity: Institutionalization and Globalization. Stanford, Stanford University Press.

Drori, G. S. M., John W.; Ramirez, Francisco, O.; Schofer, Evan (2003). Science in the Modern World Polity: Institutionalization and Globalization. Stanford, Stanford University Press.

Dryzek, J. S. and J. Pickering (2017). "Deliberation as a Catalyst for reflexive environmental governance." Ecological Economics 131: 353-360.

Dunlop, C. (2000). "Epistemic Communities: A Reply to Toke." Politics 20(3): 137-144.

Earth Negotiations Bulletin (2016) "IPBES-4 Highlights." 31.

Edwards, P. N. and S. H. Schneider (2001). Self-Governance and Peer Review in Science-for-Policy: The Case of the IPCC Second Assessment Report. Changing the Atmosphere. C. A. Miller and P. N. Edwards. Cambridge, MA, MIT Press.

Esguerra, A., S. Beck, et al. (2017). "Stakeholder Engagement in the Making: IPBES Legitimizaton Politics." Global Environmental Politics 17(1): 59-76.

Ezrahi, Y. (1990). The Descent of Icarus. Cambridge, Harvard University Press.

Flathman, R. E. (1980). The Practice of Political Authority. Chicago, University of Chicago Press.

Foucault, M. (1972). Power/Knowledge. New York, Pantheon Books.

Franck, T. M. (1990). the Power of Legitimacy Among Nations. New York, Oxford University Press.

Fung, A. (2006). "Varieties of Participation in Complex Governance." Public Administration Review 66: 66-76.

Gallup. (2016). "Confience in Institutions."

Gauchat, G. (2012). "Politicization of Science in the Public Sphere." American Sociological Review 77(2): 167-187.

Gieryn, T. (1999). Cultural Boundaries of Science. Chicago, University of Chicago Press.

Gleditch, N. P. and R. Nordas (2014). "Conflicting Messages." Political Geography 43: 82-90.

Golden, W. T., Ed. (1991). Worldwide Science and Technology Advice. New York, Pergamon Press.

Gore, A. (1996). The Technology Challenge: What is the Role of Science in American Society. American Association for the Advancement of Science, Baltimore, Md.

Guzzini, S. (2016). "Power and Cause." Journal of International Relations and Development.

Haas, E. B. (1990). When Knowledge is Power: Three Models of Change in International Organizations. Berkeley, University of California Press.

Haas, P. (2004). "When Does Power Listen to Truth? A Constructivist Approach to the Policy Process." Journal of European Public Policy 11(4): 569-592.

Haas, P. M. (2015). Epistemic Communities, Constructivism and International Environmental Politics. London, Routledge.

Haas, P. M. (2017). Coupling science to governance: Straddling the science-policy interface. The Politics of Expertise in International Organizations. A. Littoz-Monnet. London, Routledge.

Haas, P. M. and C. Stevens (2011). Organized Science, Usable Knowledge and Multilateral Environmental Governance. Governing the Air. R. Lidskog and G. Sundqvist. Cambridge, MIT Press: 125-161.

Hacking, I. (1990). The Taming of Chance. Cambridge, Cambridge University Press.

Held, D. and M. Koenig-Archibugi, Eds. (2005). Global Governance and Public Accountability. Oxford, Blackwell.

Helgadottir, O. (2016). "The Bocconi Boys go to Brussels." Journal of European Public Policy 23(3): 392-409.

Hirschman, A. O. (1977). The Passions and the Interests: Political Arguments for Capitalism before Its Triumph. Princeton, Princeton University Press.

Holdgate, M. W. (1982). "The Environmental Information Needs of the Decision-Maker." Nature and Resources 18(1): 5-10.

Hulme, M. (2012). What Sorts of Kowledge for What Sort of Politics? Science, Climate Change and the Challenge of Democracy. 3S Science, Society & Sustainability. Norwich, University of East Anglia.

Hurd, I. (1999). "Legitimacy and Authority in International Politics." IO 53.

Hurd, I. (2007). After Anarchy. Princeton, Princeton University Press.

Hurrell, A. (2005). "Legitimacy and the Use of Force: Can the Circle be Squared." Review of International Studies 31(Special Issue on Force and Legitimacy in World Politics): 15-32.

Ikenberry, G. J. (2011). Liberal Leviathan, Princeton.

InterAcademy Council (2010). Climate Change Assessments: Review of the Process and Procedures of the IPCC.

Intergovernmental Panel on Climate Change (2010). Guidance Note for Lead Authors of the IPCC Fifth Assessement Report on Consistent Treatment of Uncertainties.

Jabbour, J. and C. Flachsland (2017). "40 Years of Global Environmental Assesssments." Environmental Science & Policy 77: 193-202.

Jasanoff, S. (2004). States of Knowledge: The Co-production of Science and Social Order. New York, Routledge.

Jasanoff, S. (2011). Quality Control and peer review in advisory science. The Politics of Scientific Advice. J. Lentsch and P. Wiengart. Cambridge, Cambridge University Press: 19-35.

Jasanoff, S. and M. B. Martello, Eds. (2004). Localizing and Globalizing: Knowledge Cultures of Environment and Development. Cambridge, MA, MIT Press.

Johnson, C., T. J. Dowd, et al. (2006). "Legitimacy as a Social Process." Annual Review of Sociology 32(1): 53-78.

Kahler, M. (2005). Definining Accountability Up. Global Governance and Public Accountability. D. Held and M. Koenig-Archibugi. Oxford, Blackwell

Kahler, M., Ed. (2009). Networked Governance. Ithaca, Cornell University Press.

Kanie, N., P. M. Haas, et al., Eds. (2014). Improving Global Environmental Governance: Best Practices for Architecture and Agency. New York, Routledge.

Karlsson-Vinkhuyzen, S. (2013). "Legitimacy in an Era of Fragmentation." Global Environmental Politics 13(3): 56-78.

Kennedy, D. (2016). A World of Struggle. Princeton, NJ, Princeton University Press.

Keohane, R. O. (1990). "Multilateralism: An Agenda for Research." International Journal 45(4): 731-764.

Keohane, R. O. (2001). "Governance in a Partially Globalized World." American Political Science Review 95(1): 1-13.

Knorr-Cetina, K. (1999). Epistemic Cultures: How the Sciences Make Knowledge. Cambridge, MA, Harvard University Press.

Kowarsch, M., J. Garard, et al. (2016). "Scientific Assessments to Facilitate Deliberative Policy Learning." Palgrave Communications.

Kullenberg, G. (1995). "Reflections on marine science contributions to sustainable development." Ocean & Coastal Management 29(1-3): 35-49.

Lasswell, H. D. (1965). The World Revolution of Our Time. World Revolutionary Elites. H. D. Lasswell and D. Lerner. Cambridge, MIT Press: 29-96.

Le Prestre, P. (2016). Global Ecopolitics Revisited. London, Routledge/Earthscan.

Leemans, R. (2008). "Personal Experiences with the governance of the policy-relevant IPCC and Millennium Ecosystem Assessments." Global Environmental Change 18: 12-17.

Leiserowitz, A., E. W. Maibach, et al. (2013). "Climate Change in the American Mind: Americans' Global Warming Beliefs and Attitudes in April 2013."

Lentsch, J. and P. Weingart, Eds. (2011). The Politics of Scientific Advice. Cambridge, Cambridge University Press.

Lindblom, C. E. and D. K. Cohen (1979). Usable Knowledge. New Haven, Yale.

Lukes, S. (1974). Power. Houndmills, MacMillan.

McCarthy, D. R. and M. Fluck (2017). "The Concept of Transparency in International Relations." European Journal of International Relations 23(2): 416-440.

McNamara, K. (2010). Constructing Authority in the European Union. Governing the Globe. D. D. Avant, M. Finnemore and S. K. Sell. Cambridge, Cambridge University Press.

Mead, W. R. (2011). "The Tea Party and American Foreign Policy What Populism Means for Globalism." Foreign Affairs 90(2): 28-47.

Meyer, J. W. (1997). "The Structuring of a World Environmental Regime." IO 51(4): 623-651.

Miller, C. A. and P. N. Edwards (2001). Changing the Atmosphere. Cambridge, MIT Press.

Mitchell, R. B., W. C. Clark, et al., Eds. (2006). Global Environmental Assessments: Information and Influence. Cambridge, MA., MIT Press.

Mokyr, J. (2016). A Culture of Growth. Princeton, Princeton University Press.

Mooney, C. (2005). The Republican War on Science. New York, Basic Books.

Morin, F. and A. Orsini (2015). Politique Internationale de l'Environnment. Paris, SciencePo LES Presses.

Mowery, D. C. and N. Rosenberg (1989). Technology and the Pursuit of Economic Growth. Cambridge, Cambridge University Press

Nasiritousi, N., M. Hjerpe, et al. (2016). "Normative Arguments for non-state actor participation in international policymaking processes." European Journal of International Relations 22(4): 920-943.

National Science Board (2016). National Science and Technology Indicators 2016. Washington, DC, National Science Foundation.

Nichols, T. (2017). The Death of Expertise. Oxford, Oxford University Press.

North, D. C. (2005). Understanding the Process of Economic Change. Princeton, Princeton University Press.

Nowotny, H. (2016). The Cunning of Uncertainty. London, Polity.

OECD (2015). Scientific Advice for Policy Making: The Role and Responsibility of Expert Bodies and Individual Scientists. OECD Science, Technology and Industry Policy Papers. Paris, OECD.

Oreskes, N. and E. M. Conway (2010). Merchants of Doubt. New York, Bloomsbury Press.

Pammett, J. H. (2015). "Faith that science will solve environmental problems: does it hurt or help?" Environmental Politics 24(4): 553-574.

Pew Research Center (2016). The Politics of Climate, Pew Research Center.

Porter, T. M. (1986). The Rise of Statistical Thinking 1820-1900. Princeton, Princeton University Press.

Reid, W. V. and H. A. Mooney (2016). "The Millennium Ecosystem Assessment: testing the limits of interdisciplinary and multi-scale science." Current Opinion in Environmental Sustainability 19: 40-46.

Reus-Smit, C. (1997). "The Constitutional Structure of International Society and the Nature of Fundamental Institutions." IO 51(4): 555-589.

Risse, T. (2003). "Let's Argue." International Organization 54(1): 1-39.

Risse, T. (2006). Transnational Governance and Legitimacy. Governance and Democracy. A. Benz and Y. Papadopoulos. London, Routledge.

Rittberger, B. and P. Schoeer (2016). The Legitimacy of Regional Institutions. The Oxford Handbook of Comparative Regionalism. T. A. Borzel and T. Risse. Oxford, Oxford University Press.

Ruggie, J. G. (1983). "Intenraitonal Regimes, Transactions, and Change." IO 36(2): 379-416.

Ruggie, J. G. (1983). International Regimes, Transactions and Change: Embedded Liberalism in the postwar economic order. International Regimes. S. D. Krasner. Ithaca, Cornell University: 195-232.

Ruggie, J. G., Ed. (1993). Multilateralism Matters. New York, Columbia University Press.

Sagan, C. and A. Druyan (1995). The Demon Haunted World: Science as a Candle in the Dark. New York, Random House.

Scharpf, F. W. (1999). Governing In Europe. Oxford, Oxford University Press.

Scharpf, F. W. (2009). "Legitimacy in the Multilevel European Polity." European Political Science Review 1(2): 173-204.

Scholte, J. A. (2005). Civil Society and Democratically Accountable Global Governance. Global Governance and Public Accountability. D. Held and M. Koenig-Archibugi. Oxford, Blackwell.

Scientific Advisory Board (2016). The Future of Scientific Advice to the United Nations. Paris, UNESCO.

Sebek, V. (1983). "Bridging the Gap Between Environmental Science and Policy-Making." Ambio 12(2): 118-120.

Sending, O. J. (2015). The Politics of Expertise. Ann Arbor, MI, University of Michigan Press.

Shackley, S. and B. Wynne (1996). "Representing Uncertainty in Global Climate Change Science and Policy." Science, Technology and Human Values 21(3): 275-302.

Skolnikoff, E. B. (1994). The Elusive Transformation. Princeton, Princeton University Press.

Smith, B. L. R. (1990). American Science Policy Since World War II. Washington D.C., The Brookings Institution Press.

Smith, B. L. R. (1992). The Advisers. Washington D.C., The Brookings Institution Press.

Steffek, J. (2003). "The Legitimation of Interational Governance: A Discourse Approach." European Journal of International Relations 9(2): 249-275.

Steffek, J. (2015). "The Output Legitimacy of International Organizations and the Global Public Interest." International Theory 7(2): 263-293.

Stephen, M. D. (2015). "'Can you pass the salt?' The legitimacy of international institutions and indirect speech." European Journal of International Relations: 1-25.

Stevenson, H. (2016). "The Wisdom of the Many in Global Governance." International Studies Quarterly 60(4): 400-412.

Stevenson, H. and J. Dryzek (2014). Democratizing Global Climate Governance. Cambridge, Cambridge University Press.

Stokes, D. E. (1997). Pasteur's Quadrant. Washington DC, Brookings.

Tuinstra, W., L. Hordijk, et al. (2006). "Moving Boundaries in Tranboundary Air Pollution Co-Producton of Scienc eand Policy Under the Convention on Long Range Transboundary Air Pollution." Global Environmental Change 16: 349-363.

Turnhout, E., A. Dewulf, et al. (2016). "What does policy-relevant global environmental knowledge do?" Current Opinion in Environmental Sustainability 18: 66-72.

United Nations (2015). Global Sustainable Development Report. New York, United Nations.

Vibert, F. (2007). The Rise of the Unelected. Cambridge, Cambridge University Press.

Watson, R. T. (2005). "Turning Science into Policy: Challenges and Experiences from the Science-Policy Interface." Philosophical Transactions of the Royal Society(360): 471-477.

Weber, M. (1958). Bureaucracy. From Max Weber: Essays in Sociology. H. H. Gerth and C. W. Mills. New York, Oxford University Press: 196-244.

Young, O. R. (1991). "Political Leadership and Regime Formation." IO 45(3): 281-308.

Zaum, D. (2013). International Organizations, Legitimacy, and Legitimation. Legitimating Intenational Organizations. D. Zaum. Oxford, Oxford University Press.

Zaum, D. (2016). Legitimacy. The Oxford Handbook of International Organizations. J. K. Cogan, I. Hurd and I. Johnstone. Oxford, Oxford University Press.

Ziman, J. (2000). Real Science. Cambridge, Cambridge Univeristy Press.

Zurn, M. (2005). Global Governance and Legitimacy Problems. Global Governance and Public Accountability. D. Held and M. Koenig-Archibugi. Malden, MA, Blackwell: 136-163.

Zurn, M. (2018). A Theory of Global Governance. Oxford, Oxford University Press.

Zurn, M., M. Binder, et al. (2012). "International Authority and its Politicization." International Theory 4(1): 69-106.

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