When Green Became Blue: Epistemic Rift and the Corralling of Climate Science

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Abstract

The emergence of climate science denialism in the U.S. provides a challenge to STS theories of the relationship between scientific expertise and public policy because a situation of epistemic rift occurs: the capacity of scientific consensus to establish the grounds of political debate is broken, and the standard circulation of expertise from the scientists and funding from the state is interrupted. Three mechanisms for the containment of scientific expertise are studied: direct intellectual suppression of climate scientists, industry support of contrarian scientists and policymakers, and cutbacks on government research programs that support climate change. This situation politicizes climate scientists, who are drawn into the public sphere as a counterpublic to the effort to contain the circulation of their knowledge in the political field. Although the strategy of contained expertise has been effective in blocking climate legislation at the federal government level in the U.S., it may be losing effectiveness, and an emergent alternative strategy based on adaptation may be coming to replace it. Factors that affect the reduction in the capacity to contain the circulation of scientific expertise are also analyzed.

In the U.S. a well-orchestrated public relations machinery has emerged to contain the policy implications of scientific research that has identified threats posed by anthropogenic climate change and the need for a policy response (Dunlap and McCright 2011; Jacques et al. 2008; Oreskes and Conway 2010). The machinery subjects legitimate climate scientists to personal attacks by industry-funded scientists and conservative media, and it enables elected politicians to voice climate denialism and skepticism without danger of an immediate collapse of credibility among voters.[1] For example, during the 2012 presidential campaign, candidates for the Republican nomination for president expressed anti-science views with respect to climate change, often in contrast to views that they had formerly professed to hold.

The emergence of climate science denialism among political leaders presents a puzzle for theories of scientific expertise and the policy process, because there has been a partial breakdown in the circulation of expertise from the research community to the political field and in the funding of the research community by the government. This study uses the case of the partial breakdown in credibility of an expert community as a basis for building field theory on political power and the relations between the scientific field and other social fields, such as the state, industry, and civil society. Although Bourdieu (2001) produced an important set of theoretical concepts for understanding change within the scientific field, he did not develop a general theory of the relations between the scientific and other social fields (Camic 2011). Several approaches have emerged and are discussed in this volume. One approach, which draws directly on Bourdieu's work, is to focus on the changing relationship between the basic and applied poles of research fields (Albert and McGuire, this volume; Lave 2012) that in turn is an outcome of broader societal and political changes. Another approach is to examine how changes in other social fields alter the political opportunity structure to permit challengers to contest the positions of incumbents, an approach that might include the effects of political funding structures on strategies of conservation and subversion in the scientific field (Fligstein and McAdam 2012). Yet another approach is

to examine how policy changes affect the relative position of different institutional logics, logics of action, or patterns of governmentality in the scientific field (Berman and Schweber, this volume).

This study builds on the conversation in the political sociology of science on interfield relations by moving in a somewhat different direction based on the problem posed by climate denialism, that is, the problem of how and why an established interfield relationship breaks down. Thus, the goal is not to explain changes within the scientific field by reference to an external change, such as the shift of policymakers toward a greater concern with innovation and with neoliberal policy instruments. Rather, the goal is to begin with an established relationship between the scientific and political fields and to explain how the relationship has broken down.

The relationship between the scientific field and other social fields can be viewed as a kind of metabolism or exchange relationship. The scientific field produces knowledge for the other social fields, and in turn it receives both support and a degree of autonomy to pursue the manufacture of knowledge. Support can include direct, financial support in the form of contracts and grants, and it can also include broader support from the private sector and civil society for government funding of the research and educational enterprises. However, the exchange relationships can break down, and the term “epistemic rift” is introduced here based on the similar concept of “ecological rift” in environmental sociology, which was developed from the study of the relationship between agriculture and human waste that breaks down with the urbanization process. Whereas in traditional agrarian societies agricultural and animal waste is returned to the soil, in urban societies the metabolism breaks down, and the human waste is disposed in landfills and water resources (Foster 2000). In a similar way, an “epistemic rift” can occur when significant segments of the state (or other social fields) reject the credibility of scientific research and withdraw their support for it.

This study will develop some of the theoretical implications of the epistemic rift based on a case study of climate denialism in the United States. The first section will outline in more detail a conceptual

toolkit for understanding epistemic rift, the second section will discuss the historical background of climate denialism in the U.S., the third section will delineate the mechanisms of epistemic rift, and the fourth section will discuss the emergence of a possible resolution to the crisis and the causes for the shift. The study is largely theoretical and in the Weberian tradition of social theory. In other words, it aims at developing typological mechanisms of the dynamics of epistemic rift that can elucidate empirical research. In the process, the project draws on the research base of two long-term ethnographic projects on the green economy in the U.S., with two teams of student researchers who conducted semi-structured interviews with state and local leaders in the government, business, and nonprofit sectors.

Conceptual Background

This research projects draws on and contributes to one theoretical current within the political sociology of science and technology, field theory, by focusing on the issue of inter-field relationships. The term "field" is used here to describe a space of social contestation where the actors have a common stake in outcomes, such as a policy field in which there are relations of cooperation and conflict over policymaking and implementation (Bourdieu 2005; Fligstein and McAdam 2012). In contrast with the focus on norms, processes, and rules found in traditional functionalist analyses of institutions, the field concept is preferred here because of its greater emphasis on power, strategies of conflict and cooperation, and the diversity of agency. The approach to field theory adopted here also pays attention to the role of systems of meaning, but utilizing the concept of field-based cultural systems rather than the more individualized concept of habitus. Specifically, the analysis will focus on the role of clashing political ideologies such as neoliberalism, social liberalism, and developmentalism in the political field. In the case to be discussed below, longstanding ideological conflicts between neoliberalism and social liberalism over the regulatory and redistributive role of the state are central.

Power and State Theory

The political sociology of the modern, parliamentary state has generally found a poor empirical match between observed political processes and two, opposing ideal types of the state: an instrument of the interests of a dominant economic class and/or a political elite, and an independent arbiter among relatively coeval interest groups mobilized for specific issues. Instead, there is broad recognition of the variation across policy issues, in which some issue networks show domination by economic and political elites and others are closer to a pluralist model (Hicks and Lechner 2005, McFarland 2010). Although actors with high levels of financial resources can strongly influence both public opinion and policy outcomes for issues that they deem important, both economic elites and political leaders are often divided. Consequently, policy outcomes are often best explained by a focus on coalitions of actors that emerge and dissolve around specific issues. Rather than reject theories of the state based on class, political elites, or pluralist interest groups, a coalition-politics approach to a conflict theory of the state brings those approaches together in one framework (van den Berg and Janoski 2005).

Power is understood here as the capacity of an agent to influence the course of events in a field. As Lukes (1974) has argued, there are various faces or dimensions of power, including more covert forms such as the capacity to influence the agendas and the goals of other agents. As Foucault (2007, 2008) and Rose (1999) have also argued, the more covert forms of power can be embedded in organizational routines and everyday habits. But even power in these more covert forms is connected to questions of cui bono; thus, from a conflict theory perspective, a full analysis of power must be anchored in conflict among agents, even if the agents are collective ones such as races, classes, and genders. The capacity of an actor to influence the outcome of political conflict depends on control over different types of capital, which can be imported from other social fields. Among the most important types of capital in the political field are financial (the resources needed to support lobbying and campaign activity), social and cultural (coalition partners and their knowledge of the political system),

general symbolic (media credibility and public legitimacy), and epistemic (knowledge about an issue, including scientific knowledge). Because the political field has some autonomy from other social fields, the exercise of power in the political field must translate extrafield resources into the currency of the political field, which in electoral democracies means the capacity to influence votes in legislatures and implementation decisions in the executive branch (Bourdieu 2005).

Science and Interfield Relations

Like the political field, other social fields have their own way of assessing field position and a common understanding of what is at stake. In the industrial field, the stakes are about preserving and growing an economic position, which can include a firm's position as well as an industry's position (e.g., fossil fuels) within a broader industrial sector (e.g., energy). Thus, "market position" is the common understanding of what is at stake. In the scientific field (which is divided into thousands of research fields), there is conflict and cooperation over creating knowledge that one or more research fields deems important. What is "at stake" is the capacity to produce knowledge that the field recognizes as important and rewards with citations, prizes, and other forms of recognition (Bourdieu 2001).

In a standard relationship of metabolism between the scientific field and other social fields, the scientific field exerts a high level of influence over the other fields because of its capacity to establish "doxa," that is, the underlying area of the uncontested that is created through the engagement of orthodoxies and heterodoxies. In the political field, when both parties accept a body of scientific expertise, there is a doxa of what *is* the case upon which political contestation is grounded. Of course, other types of knowledge may be included in policy deliberations, such as industrial and occupational expertise and the perspectives of lay people (e.g., Irwin 2006). However, the scientific field has paramount legitimacy as the site where competing truth claims can be vetted and evaluated. This truth-determining capacity limits but does not determine the myriad battles over what *should be* the case,

that is, the normative debates about how to respond to what is the case. In the standard model by which the scientific field and the political field are connected, policymakers draw on scientific experts to provide advice on technical issues, and scientists engage in various strategies to create boundaries between their technical expertise and the normative claims at play in the policy field (e.g., Guston 2001; Jasanoff 1994). By creating a boundary between scientific expertise and policy contestation, scientists protect their doxological power at the expense of having effective political power over policy outcomes.

This standard model is also normative in the sense that it represents an ideal of the relationship between the scientific and political field that rests on a division of labor between "is" and "ought." Scientists provide knowledge about what is the case, what problems need to be addressed, and what would likely happen in a particular policy scenario, but political actors negotiate social and value conflicts to determine a policy outcome. Certainly, scientists can and do make normative statements, but the normative statements tend to be limited in scope (e.g., there is a problem that needs to be addressed). Scientists tend to separate their political positions from institutionalized advising mechanisms, which rests on a precarious defense of a perception of political neutrality.

This standard relationship may appear to be innocent of power differentials, especially to those in the main circuits of the flows of capital and knowledge. In other words, there are power differentials within the political field, but scientists have a process of reaching a high enough level of consensus on an issue to allow them to address the epistemic needs of policymakers. However, there are often networks located in the subordinate positions of the scientific field that do not agree with the dominant research agendas and the associated definitions of public good and policy direction. In general, those in dominant positions in the scientific field reject the epistemic challenges that emerge within the field. The dominant networks of the scientific field can then mobilize various types of capital to result in the marginalization of challengers, loss of funding for them, and social exclusion.

When these conflicts remain internal to the scientific field, there is simply a situation of scientific controversy. However, in some cases those in the heterodox position in the scientific field also believe that their alternative research agenda has broad policy implications and represents a better formulation of public benefit that existing research agendas. Examples have been studied in detail in the health field, but there are also examples of "scientific and intellectual movements" more generally (e.g., Brown 2007; Frickel and Gross 2005; Hess 2007, 2014). In addition to mounting an epistemic challenge within the research field, scientists can become associated with broader social movements that advocate for alternative technologies and an end to some aspects of an existing industrial regime. When scientists adopt a public position by arguing that an alternative research program would be of broad public benefit, in contrast with the existing dominant paradigm, and when they become connected with broader agendas for policy change, they form a scientific counterpublic (Hess 2011). They also point to a condition of undone science, that is, the systematic underfunding of research programs that they argue are potentially of broad public benefit (Frickel et al. 2010; Hess 2007). They may lose funding for their research programs and access to prestigious journal venues, but in some cases scientists can find support from large civil society organizations and firms in a countervailing industry (such as nutritional supplements companies that can counterbalance a lack of interest in complementary medicine from the pharmaceutical industry; Hess 2009). The long-term outcome may be the incorporation and transformation of the alternative technologies into existing industrial regimes and the development of funding and recognition for the alternative research agendas within the scientific field.

In the mobilizations of subordinate networks as scientific counterpublics, there is not necessarily an epistemic rift in the general sense of a breakdown of metabolism between the scientific and political fields. The circulation of research and funding in the dominant networks of both the scientific and political fields can continue to flow, and the dominant networks of both fields can engage in various strategies to handle the challengers: ignore them, marginalize them, or incorporate and transform them.

Indeed, industry often prefers to have a scientized or technocratic policy field, because the production of scientific knowledge is resource intensive, and social movements and interest groups that mount challenges to industry in the policy arena generally lack the ability to produce countervailing knowledge (Kinchy 2012). However, when there are enough scientists who challenge the dominant paradigms of the research field, they can throw the research field into a high level of controversy. In response to the threat of a breakdown in credibility of the dominant paradigms, the dominant networks of the research and policy fields may respond by creating new flows of funding that address the undone science. In the U.S. a good example is the creation of the National Center for Complementary and Alternative Medicine, which responded to the challenge of complementary and alternative researchers, doctors, and patient advocacy groups by creating (and controlling) funding for the alternative research field (Hess 2014). Thus, the funding for the mainstream programs of cancer research and their credibility in the political field were not disrupted, but new avenues of credibility and funding were opened up for the alternative programs.

The emergence of climate denialism is different because there is a breakdown of general credibility for a research field that is in a state of relatively high consensus with respect to empirical questions such as the role of anthropogenic greenhouse gases in climate change. Although there are controversies within the field, on the policy-relevant scientific issues (e.g., do anthropogenic greenhouse gases cause global warming?) there is a high level of consensus. The focus of conflict is less within the scientific field between those who support a dominant paradigm and those who oppose it than it is between industries that are producing a technology that would be harmed by the new policy direction (e.g., the fossil-fuel industries) and the networks of scientists and public-interest advocates who have identified a policy problem and solution (e.g., reduce greenhouse gas emissions). In this situation the scientific research field provides knowledge about a policy problem that is in conflict with an industry that is responsible for creating the problem, and the research field plays the role of a countervailing

power to industrial power in the policy field. Industry responds to the challenge by funding contrarian science, that is, expertise that attacks the countervailing science and/or creates new empirical research (Oreskes and Conway 2010). The goal of contrarian science is to create a false perception in the political field that the research field is in a state of high controversy and therefore to break down the doxological capacity of the scientific field to define the epistemic grounds of policy action. In the case of climate science in the U.S., the contrarian science strategy is not effective at creating high levels of controversy within the research field, because most of the contrarian scientists lack standing (symbolic capital and sometimes cultural capital) *within* in the scientific field. However, the contrarian strategy is effective at causing epistemic rift because funding from a network of industry and conservative donors provides a platform for disseminating disinformation about the level of scientific controversy in the media and for funding political candidates who deny the scientific research and seek to defund it.

The epistemic rift is not general in the political field. In the U.S. after 2009, it became widespread among many Republicans leaders but less so for Democrats. However, its effect is to allow political leaders who are aligned with the fossil-fuel industry to portray climate scientists as politically motivated. Thus, their doxological capacity is delegitimated, and to the extent that they have an effect in the political field, they become portrayed as part of the countervailing counterpublic of environmentalists and progressives who seek broader policy reforms. See Table 1.

Table 1. Three Configurations of Interfield Relations for the Scientific Field

Type of Interfield Relationship	Scientific Field	Policy Field	Industrial Field	Civil Society Field
Standard Expertise	Dissensus in the research field is managed through boundary organizations	Balances advice from scientists, industry, and civil society organizations	Affects the policy process through lobbying, election participation, etc.	Affects the policy process through lobbying, election participation, etc.
Alternative Scientific Counterpublic	Scientists in subordinate positions openly question the dominant networks of the research field; identify undone science	Ignores calls for funding undone science unless there is a strong public mobilization and/or countervailing industry support	Ignores calls for funding, but advocates may find a nearby industry (countervailing) that supports the research	Identifies areas of undone science, recruits allies in the political and industrial fields
Countervailing Scientific Counterpublic	Problems identified by scientists but denied by industry; relatively low controversy among scientists not funded by industry	A battleground between countervailing science and an industry	Sunset industry funds contrarian scientists & corrals scientists; countervailing industry may emerge	Divided between industry-funded groups and grassroots mobilizations

In summary, for the case of climate science in the U.S. after the 2010 elections, when denialist political leaders gained power in the U.S. House of Representatives and some state governments, there is a need to extend theory on the relationships among the scientific, political, and industrial fields by exploring the transformation of a research community from a standard model of advice giving into a countervailing counterpublic. In this situation climate scientists have lost enough credibility among enough leaders in the political field that their expertise can no longer define the grounds of political debate.

The Historical and Political Context of Epistemic Rift

From a field sociological perspective, the development of the epistemic rift for climate science was enabled by the slow transformation of the organizational field that Barley (2010) has described as "corralling." His focus and mine is on the U.S., but to some extent a similar change has occurred in other areas of the world, such as the European Union (Greenwood 2002, Mahoney 2008). The "corralling" of a government occurs when large corporations build an institutional field around a government to limit the redistributive and regulatory policies associated with the ideology of social liberalism. The transformation of political ideology in the U.S. was based on corporate spending on political action committees, public relations firms, media with a free-market bias, conservative think tanks, lobbying firms, trade associations, and public affairs offices. This general transformation of the organizational field of the American federal government made it possible for neoliberal ideology to flourish even when Democrats were in power, because the center of political debate shifted to the right. I extend this approach by showing how the corralling of a government has taken on a new phase that involves the corralling of climate science. The emergence of the strategy of corralling climate science may be a unique historical development that is associated with the emergence of a risk society and broad awareness of the environmental implications of industrial society (Beck 1999). The global threat identified by scientists requires a series of interlocking technological transitions from electricity, buildings, and transportation based on fossil fuels to ones based on low-carbon energy alternatives. However, the dynamic of reflexive modernization engenders counter-movements of anti-reflexivity, which are funded by industries that face sunsetting due to the transition (Dunlap and McCright 2011).

In the United States, the transition to a low-carbon energy infrastructure is a long-term, variegated political process that has been occurring since the 1970s, and there are various points of intersection with the trend toward market-oriented regulation that has also occurred during the period. During the 1970s, government-supported energy research and industrial development diversified from nuclear and fossil fuels to include renewable energy and energy conservation in response to the growing

environmental movement, broad public concerns with air quality, and the oil crisis of 1973 (Hess 2012). Although President Reagan slashed the budgets for renewable energy and energy conservation, they were never eliminated after the 1970s. The 1978 Public Utilities Regulatory Policies Act represented an early step toward a market-oriented restructuring of the electricity industry, because the law opened up electricity generation to small generators by requiring utilities to purchase electricity from them if their price was below the avoided cost (Hirsh 1999). More comprehensive liberalization of electricity markets occurred during the 1990s, when electricity restructuring enabled competition among both electricity generation companies and retail distributors (ibid.).

During the 1990s, state governments also began to develop policies that encouraged the transition of electricity generation (Hess 2012). In the process, the renewable energy industry shifted from a small niche oriented toward home power enthusiasts and off-grid generation to utility-scale solar and wind farms and to the sometimes larger niche of distributed (roof-top) generation. The technological system underwent a process of incorporation into grid-based energy production, and the technologies also underwent design transformations to accommodate their integration (on the "incorporation and transformation"process more generally, see Hess 2007). Various market-oriented policies emerged from the restructuring of the electricity industry: competitive grants for renewable energy projects, capital assistance for start-up companies, renewable portfolio standards that created markets for renewable electricity, and regional carbon trading programs.

The corralling of climate science crystallized after another set of reform efforts during the late 1990s. In 1997 the Clinton administration agreed to join the Kyoto Protocol, which would have required the U.S. to reduce its greenhouse gas emissions to approximately 5% below 1990 levels by the year 2012. However, under the Byrd-Hagel Resolution of 1997, the Senate failed to ratify the treaty agreement. The oil industry had worked to stop climate-related policy reforms since at least 1989, when Exxon-Mobil and the American Petroleum Institute formed the Global Climate Coalition, which

promoted climate science denialism (Rahm 2010). After the Kyoto Protocol, several large companies accepted the scientific consensus and withdrew from the Global Climate Coalition, but Exxon-Mobil then formed the Global Climate Science Team to promote denialism (ibid.). When George W. Bush became president in 2000, he confirmed that the U.S. would not join the Kyoto Protocol and stated that there was not enough evidence in support of climate mitigation policy.

Although the Energy Policy Act of 2005 and the Energy Security and Independence Act of 2007 included some support for renewable energy and energy efficiency, the administration of President George W. Bush favored fossil-fuel development. Consequently, policies in support of the green-energy transition continued to be developed largely at the state-government level. During the 2000-2008 period of the Bush presidency, states with Democratic Party majorities developed multiple policies that facilitated both the development of green innovation clusters and demand for energy efficiency and renewable energy (Hess 2012). Republican governors such as Arnold Schwarzenegger, Tim Palwenty, George Pataki, and even Rick Perry also facilitated the growth of renewable energy, albeit at different levels of enthusiasm. Bipartisan initiatives among governors supported regional climate change policy development in the Northeast, Midwest, and West. Likewise, during the 2008 presidential election both Republican and Democratic presidential candidates supported federal climate change legislation.

The political situation changed with the election of President Obama, who embraced a transition in the energy basis of the economy as a central part of his presidency. Obama's promise to create five million "green jobs" enabled him to build support among the party's base of progressives, environmentalists, the urban poor, and labor unions and to reach out to other voters who were concerned with employment and job security. Once elected, climate science and green energy research went from a highly marginal position, in which government scientists faced censorship, to the centerpiece of a green industrial policy initiative. Secretary of Energy Steven Chu embraced the science of climate change and the need for a technological transition to renewable energy and energy efficiency,

and the Department of Energy became the site for the administration's new green industrial policy (Hess 2012). The American Recovery and Reinvestment Act provided funding for green-energy business development, consumer demand for renewable energy and energy efficiency, and training programs for green jobs. The House of Representative's American Clean Energy and Security Act (HR 2545) addressed the demand side of green industrial policy by supporting carbon regulation and a national renewable energy and energy efficiency standard (20 percent by 2020). In the Senate, John Kerry and Joseph Lieberman supported their version of the house cap-and-trade bill, the Clean Energy Jobs and America Power Act (S. 1733), with a diverse coalition that included retired military officers, leaders of some large corporations, the renewable energy industry, unions, and some environmentalists.

However, by the summer of 2010 it was clear that demand-side policy (carbon regulation and a national renewable electricity standard) of green industrial policy would not survive a vote in the Senate. The Kerry-Lieberman bill was defeated due largely to a coalition of political conservatives and the fossil-fuel industry. The lobbying strength of the oil and gas industry ($146 million in 2012), the utility industry ($141 million), and mining ($32 million, much of it from the coal industry) far outpaced the capacity of the countervailing renewable energy organizations, such as the American Wind Energy Association ($2.4 million) and the Solar Energies Industry Association ($1 million; Center for Responsive Politics 2013). The billionaires David and Charles Koch developed a network of conservative and fossil-fuel donors who helped to provide support for the anti-green Republican backlash that became apparent in the midterm election results of November 2010 (Eilperin 2012, Fang 2010). They also joined with other fossil-fuel donors to support and publicize climate change denialism and skepticism (Greenpeace 2010).

The transformation of the policy field was evident in the 2010 elections. Ninety-four of the 100-person entering class of Congress explicitly denied the science of climate change, signed the "No Climate Tax Pledge" of Americans for Prosperity (a group funded by the fossil-fuel billionaires Charles and David

Koch), and/or signed the "FreedomWorks Tea Party Contract with America," which opposes cap-and-trade legislation (Johnson 2010). About half of all Republican members of both houses had made statements indicating that they questioned the science or scientific consensus about climate change (ibid.).

Many of the Republican governors and state legislators who were newly elected in 2010 made dramatic reversals on climate-related policy in cases where they replaced Democratic governors. For example, Governor Chris Christie of New Jersey withdrew the state from the Regional Greenhouse Gas Initiative, and Maine's governor proposed a long series of environmental roll-back initiatives that led to a battle with the state's legislature. In Wisconsin, Governor Scott Walker worked to roll back the state's wind energy development program, and in Colorado, Michigan, Montana, Ohio, Washington, and West Virginia legislators attempted to end the state's renewable portfolio standard laws, which dedicated a portion of the state's electricity from renewable energy sources (Hess 2012).

However, in states with a strong clean-tech industry, such as Iowa and Nevada, Republican governors adopted more moderate positions. Likewise, in states with Democrats as governors, new legislation in support of green energy continued to win legislative approval. In California a coalition of unions, environmentalists, civil rights, renewable energy industry, and green venture capital leaders provided the organizational strength and financial support to turn back a ballot assault on the state's AB 32 law, which had set in motion the mechanism for carbon regulation (Hess 2012). Likewise, in that year then Attorney General Jerry Brown won the governor's office, and he openly support green-energy transition policies within the context of limited budgets.

Climate Denialism and Party Conflict

One of the central political actors that supported climate denialism was the Tea Party movement. Climate change denialism and skepticism has both a longer history than the existence of the

Tea Party movement and a broader range of political support, but the Tea Party movement became a major vector that brought climate change denialism and skepticism into state legislatures, governors' offices, and the U.S. Congress. Although the central frame of the movement was government overspending, Tea Party candidates who came into office in 2010 also had strong anti-environmental stands that were consistent with the network of fossil-fuel and conservative donors that supported their candidacies. For example, a survey of self-identified Tea Party adherents showed that they generally did not believe in global warming and did not support a twenty-percent renewable energy standard or a global carbon trading agreement, whereas the majority of Democrats, Republicans, and independents held the opposite views (Leiserowitz et al. 2011). The backlash continued in 2011 and 2012 during the Republican Party nomination for the presidency, when candidates who had formerly supported green transition policies in their states reversed their positions in order to win the nomination.

Although there was a close relationship between climate change denialism and conservative political candidates, there was also a general a decision among Republican Party leaders in Congress to undercut President Obama's policies by denying him legislative victories and branding him as a big-spending social liberal or, in the case of health-care reform, a socialist. Even moderate Republicans who accepted the scientific consensus on global warming faced primary battles and attacks from the anti-environmental right wing of their own party. In general, relatively moderate Republicans who had formerly supported climate change policy, such as Senator John McCain, quieted their views and came in line with the party position, and Republican Party support for climate change became increasingly limited to retired leaders. Former Senator John Warner, former Representative Sherwood Boehlert, former Representative John Inglis, and former Secretary of State George Schultz are examples of Republican retirees from elected office who defended the need for climate change action (Davenport 2011).

By 2011, Republicans had targeted the failed investments in solar energy companies such as Solyndra to launch a general attack on the green developmentalism of the Obama administration and to defend a neoliberal alternative that left investment decisions to private markets (Hess 2012). In response to the attacks on his green transition policies, the president backed away from the strong green jobs rhetoric that had characterized his 2008 election. His initial presidential campaign speeches in late 2011 focused on jobs but carefully deleted references to green jobs, and a study of his speeches showed that in general he had backed away from green energy rhetoric (Roberts and Kincaid 2012). Nevertheless, he moved ahead with green-energy policies in non-legislative arenas, such as by supporting changes in fuel efficiency in the automotive industry and by facilitating the transition to renewable energy in the military (Hess 2012). He also backed increases in green-energy research and development in his budget proposals, and in January, 2011, the Environmental Protection Agency also began to require that big polluters would have to obtain permits for greenhouse gas emissions. The rules were focused on electricity generation plants and oil refineries, but they were scheduled to be extended to other types of industrial polluters.

Republicans in the House responded by grilling the EPA administrator Lisa Jackson, by arguing that carbon regulation went beyond the agency's legislative mandate, and by proposing budget cuts that would reduce the agency by one-third. Some Republican presidential candidates even promised to abolish the agency. The fossil-fuel industry also launched lawsuits against the EPA, and in concert with conservative think tanks the industry also developed plans for a coordinated national attack on wind energy (Goldenberg 2012). The plan included attempts to roll back state-government legislation, support for NIMBY struggles against wind farms, and a $6 million purchase of advertising against President Obama's green energy plans. In the various attacks on green energy policy, neoliberal ideology was often a point of reference and a way of distinguishing Republican Party conservativism from the Obama administration's developmentalism.

Mechanisms of Corralled Science

As opposition to green energy reforms grew, the efforts to corral climate science also increased. The corralling of climate science in the U.S. during this period involved three main mechanisms, the first of which is intellectual suppression. Widely recognized in the sociology of science literature, intellectual suppression is especially common for individual scientists who raise questions about public health or environmental risks associated with exposure to industrial chemicals and other products (e.g., Delborne 2008, Martin et al. 1986, Martin 2010). The most visible scientist leaders of the climate science counterpublic have suffered from personal attacks on Internet web sites and in the media, attacks on their research by contrarian scientists, and intimidation such as an envelope with suspicious white power (Clynes 2012). The scientists have also been subjected to hostile lawsuits, Freedom of Information Act requests, and investigations by Congress and universities (ibid.). Although some climate scientists have chosen to provide public rebuttals to climate science deniers and skeptics, knowledge about the intimidation has encouraged others to stay out of the public spotlight. Thus, the prospect of exposing oneself to intellectual suppression motivates some climate scientists to maintain a low profile, stay out of the public limelight, and avoid becoming involving with politics and policy.

However, the strategy of suppression can create a secondary dynamic of backfire (Martin 2007). In other words, attacks on scientists can generate media coverage (e.g., Clynes 2012), and the public limelight can turn climate scientists under attack into public figures. They can become portrayed as heroic figures who are defending the light of knowledge and public interest against bullying figures who represent special interests. When the media coverage increases, scientists are given a platform to showcase their rebuttals to the unfounded arguments of critics. Once they are in the public eye, they may become more willing to expand their role from that of making scientific statements (what is the case) to that of giving opinions on policy options, such as James Hansen has done in his support for the

carbon tax (Hansen 2009). Furthermore, the suppression of individual scientists has helped to motivate the broader climate science community to respond to attacks (e.g., Trenberth 2012). Their messages imply the need for policy action and the weakness of a neoliberal approach to the problem, which would leave the green transition to long-term market forces.

The second mechanism of the corralling of science involves journalists and policymakers who produce disinformation about the state of scientific controversy among experts. In the case of climate science denialism, there were two phases to this mechanism. Climate change denialists in right-wing think tanks have been funded for some time, and they have produced a perception in the media of a higher level of controversy among scientific experts than actually took place (Dunlap and McCright 2011, Fang 2010, Oreskes and Conway 2010). Furthermore, the elimination of moderate Republican candidates in primary elections in 2010 and 2012, and the general shift in the Republican Party's energy policy toward a pro-fossil-fuel stance, magnified the public dissemination of the denialist message by providing spokespersons in the political field.

Again, this mechanism produces a countervailing dynamic that tends to undermine climate denialism in the media and political field. There is growing recognition that the media standard of achieving a "balanced" story has led to the magnification of the perspective of contrarian scientists who may have some general credentials but lack standing in the climate science field (Boykoff 2013). In turn, the recognition has led some journalists and advocates to call into question the air space given to contrarian scientists as itself a form of misinformation. For example, the television network CNBC has been criticized for its willingness to air climate denialist perspectives at a rate of over 50% of stories during 2012-2013 (Strupp 2013). The fact-checking web site Media Matters has highlighted how the continued misuse of the tradition of the balanced story has led to divisions among journalists, such as a panel of senior business journalists who criticized the coverage of CNBC (ibid.).

A second countervailing dynamic also results from the success of climate denialism in the political field. Although it has been possible to purge Republican moderates in primary campaigns, the the extreme position of Tea Party and other highly conservative candidates on climate and environmental issues can put them at a disadvantage in some general elections. The election of a climate-supporting governor over a climate-denying candidate in Virginia in 2012 has sometimes been cited as an example of how climate denialism does not play well across a wide range of voters in a general election. In support of this proposition, Krosnick and colleagues (2011) compared voting preferences for a hypothetical senate candidate who held one of the following three positions: pro-green, not green (that is, denies climate science and the need to respond to it), or no position on climate change. For Democrats, the preferences were 74% in favor of the pro-green candidate, 37% in favor of the not green candidate, and 53% in favor of the candidate with no position. Independents had a pattern similar to that of Democrats. For Republicans, the differences in preferences were not statistically significant and all in the 76 to 83% range. For all affiliations together, the preferences were 77% pro-green, 48% anti-green, and 65% no position. The results suggest that taking a pro-green position will help both Democrat and Republican candidates in general elections. Consistent with those data, a poll conducted for the League of Conservation Voters in 2013 showed that voters for senate candidates in swing states prefer candidates who support environmental and clean-energy issues (Hart Research Associates 2013).

The third mechanism of the corralling of science is the systematic reduction of government funding for agencies that sponsor the countervailing research. On October 14, 2011, Ralph Hal—the chair of House Science, Space, and Technology—and Republican colleagues issued a statement of intent to cut funding for programs related to climate science and green energy. The cuts were proposed to take place across agencies and represented a broad attempt to end the federal government's support of

climate-change research (U.S. House of Representatives 2011, Morello et al. 2011). The cuts included the following:

- Reduce by one third the Department of Energy's Energy Efficiency and Renewable Energy portfolio
- End ARPA-E funding because of its "venture capital" investments and consider funding only for very early stage projects
- Cut the Atmospheric System Research and the Climate and Modeling Program of the Office of Research of the Department of Energy
- Shift the DOE's fossil-fuel research from carbon sequestration to oil and gas exploration
- Cancel NASA's Orbiting Carbon Observatory satellite
- Reduce by 20% the program within NASA's Earth System's Mission account, which includes research related to climate change
- Cut the National Science Foundation contributions to the Climate Change Technology Program and U.S. Global Research Program, and eliminate the Climate Education Program.
- Cut the funding for the Air, Climate, and Energy programs and for the Integrated Risk Information System Program of the the Environmental Protection Agency.

Although many of the proposed cuts were not approved by the Senate, which was controlled by Democrats, some proposals were successful. For example, NASA's climate-related science budget was cut, and it was forced to cancel grants (Clynes 2012, Vastag 2011). In 2012, the House of Representatives also voted to end the budget for the Political Science Program of the National Science Foundation. Among the grants mentioned was an agent-based model of climate change (Jones 2012).

We do not yet know the general effects on research proposals and funding patterns, but there are some cases of undone science that have already been produced by the cuts. For example, the National Oceanic and Atmospheric Administration froze the "Twentieth Century Reanalysis" project,

which provides hour-by-hour changes in the atmosphere during the twentieth century (Morello 2012). Furthermore, scientists and programs across the government were attempting to avoid mentioning climate change in their proposals (Clynes 2012).

For this mechanism there are two primary countervailing dynamics. Within the government, attempts to cut climate science funding produce mobilizations by Congressional Democrats, who can restore the cuts in final budget negotiations, and by the Democratic president (Semeniuk et al. 2011). The affected executive branch agencies are also generally unhappy with the interference, and they may devise work-arounds to the cuts. But the cuts also produce a secondary dynamic outside Congress because scientists and universities that mobilize to preserve research funding. For example, professional associations in the social sciences mobilized to resist the attack on political science and to head off future attacks on other social sciences, and climate scientists lobbied Congress in their annual Climate Science Day event. Likewise, university presidents have responded to threats posed by the general budget by lobbying Congress for continued funding especially in light of the budget sequester that occurred in 2013 (Anderson 2013). The ongoing mobilization by scientific associations and universities is not likely to have the same lobbying capacity of the fossil-fuel industry, but it only needs to be strong enough to block further cuts by recruiting sufficient allies in Congress and the executive branch.

In summary, epistemic rift—the breakdown of the exchange of government support for scientific expertise—occurs through three mechanisms: the suppression of scientists, the propagation of denialism in the media and among elected officials, and the cutting and sequestering of government funding. A segment of the political leadership that is significant enough to have policy effects rejects the consensus knowledge of the scientific research community and targets scientists and research programs that are aligned with the rejected knowledge. These mechanisms of epistemic rift in turn generate countervailing dynamics, such as backfire for the suppressed scientists, credibility gaps for journalists and elected officials who broadcast the views of contrarian scientists, and mobilizations by professional

associations and universities to restore funding. The counter-dynamics help to equilibrate the levels of funding invested by the coalitions that support contrarian science and its propagation through think tanks, the media, and political advertising, because the counter-dynamics generate unpaid media attention that can showcase the misleading information that is circulating. Although the system could reach an equilibrium in which all government-supported climate science is defunded and the mainstream media coverage of contrarian science approaches 100%, this outcome seems unlikely. Although the Catholic Church could refuse to look through the new telescopes and could opt to suppress Galileo, in the long run it was not able to stop the emerging astronomical knowledge of the scientific field. In a similar way, the more likely outcome of the interaction of the corralling mechanisms and the countervailing dynamics is the re-education of the public through the media coverage of information manipulation and the eventual collapse of the situation of epistemic rift. However, in the case of climate science this outcome may take years, and each passing year of delay generates new long-term risks and the prospects of more expensive and painful adaptation.

Cracks in the Corral

Is there evidence that the corralling of climate science is losing its effectiveness? Public opinion polls indicate that the effects of climate denialism and skepticism on public opinion peaked in 2010 and began to reverse. For example, Republicans who said that they believed there was scientific evidence of global warming declined from 59% in 2006 to 35% in 2009 but then increased in 2011 to 43%, and there was a similar bottoming out and uptick for Independents. Among moderate and liberal Republicans (who represent about a third of all Republicans), those who stated that there was solid evidence for global warming grew from 41% in 2009 to 63% in 2011, whereas among conservative Republicans opinion remained constant at 31% during the period (Pew Research Center 2011). In the survey of persons of all political persuasions, belief in the reality of global warming continued to grow between

2011 and 2013, from approximately 50% to 69%, and belief in the anthropogenic cause of global warming also grew, albeit at a lower level that reached 42% in 2013 (DeSilver 2013).

Why did public opinion on climate denialism and skepticism bottom out and start to recover its previously higher levels? Specific events have some effect on public opinion. For example, the "Climategate" stories in November, 2009, which were released to undermine the credibility of climate scientists at the time of United Nations Copenhagen summit, had some effect on public opinion, although the effect was limited by awareness of the story. In a survey conducted in December, 2009, and January, 2010, Anthony Leiserowitz and colleagues (2010) found that only 29% of respondents had heard of the Climategate news story, and in a survey in June, 2010, Jon Krosnick (2010) found that only 9% of Americans knew about it. However, Leiserowitz and colleagues also found that among the respondents who had followed the story, about 47% said the stories made them somewhat or more certain that global warming was not happening. Krosnick and colleagues also showed that including a skeptic in a news story negatively affected belief in global warming (Malka et al. 2009).

If media portrayal of climate denialism and skepticism and stories sympathetic to that viewpoint negatively affects public opinion, one would expect that similar stories in the other direction would positively affect public opinion and might explain the uptick in public belief after 2009. For example, one explanation of the up-tick in public belief may be a reaction to weather. High outdoor temperatures have been shown to increase belief in global warming (Joireman et al. 2010), and there were many stories after 2009 about record-breaking heat waves and other unusual weather events. Another explanation is the possible effect of media stories favorable to climate science that appeared in 2011 and 2012, but there are no studies at this point that confirm the effects of those stories on general public opinion. Four of the most significant events are as follows:

- In October, 2011, physicist Richard Muller (2011) of the University of California at Berkeley released the results of a study that had been partly funded by the Charles G. Koch

Foundation and was expected to be another media event in support of climate change denialism and skepticism. After reviewing 1.5 billion temperature readings, the team concluded that global temperature had increased by about .7˚ C since 1957, a finding that confirmed consensus science on climate change.

- In February, 2012, climate scientists released a widely cited reply to an op-ed editorial in the *Wall Street Journal* in which they argued that the so-called climate scientists who signed a previous denialist editorial were mostly outside their area of expertise, a phenomenon that they likened to "dentists practicing cardiology" (Trenberth 2012).
- In February, 2012, Peter Gleick, a scientist who had been awarded a MacArthur Fellowship for work on water issues, used an assumed name and obtained documents from the conservative Heartland Institute, which had sponsored conferences of global warming skeptics and deniers. The documents revealed information about the organization's donor connections, financial support for climate change deniers, and other activities. Although the organization claimed that at least one of the documents was forged, and the event backfired on Gleick, it did provide a great deal of media coverage of the funding of denialism.
- In May, 2012, the same organization became embroiled in another media controversy over an advertising campaign that likened supporters of climate science to terrorists. The backfire from the campaign led many corporate donors to withdraw support, including State Farm and General Motors. At the annual conference of climate denialism, the institute announced that it lacked funds to hold another annual conference (Lacey 2012).

In 2012, the re-election of President Obama and the continued control of the U.S. Senate by Democrats, as well as extreme weather events such as the Midwestern drought and coastal storm Sandy, may have taken some of the winds out of the sails of climate denialism. It is possible that the Republican Party and fossil-fuel industry will conclude that that support for climate change denialism

and skepticism is a waning phenomenon and politically damaging in elections in districts outside deeply conservative regions. Climate change denialism may become one part of a group of conservative, "white male" issues that are losing political ground in the country due to broader demographic changes. The 2012 Republican candidate Mitt Romney may have served as a bellwether of the shift. He stated on several occasions that he believed global warming was real and that it was at least partially caused by humans. Although there were some occasions when he waivered or even expressed denialism and skepticism, in general his position was to sidestep the science issues and ground an anti-green energy position on economic arguments. On his presidential campaign web site, the page on "energy" voiced strong opposition to Obama's "green jobs" programs and supported continued development of fossil fuels (Romney 2012); however, the web site also showed support for ARPA-E as an example of bipartisan, basic research, a view that was at odds with that of the House Republicans discussed above. In his campaign speeches, Romney also opposed cap-and-trade legislation unless other countries, such as China, also agreed to it (Jacobson 2012). Thus, although he remained within the party mainstream on the policy issues, he was not a vociferous exponent of climate denialism.

It is possible that the epistemic rift that occurred in the political field will be undermined by the failure to maintain a similar epistemic rift in general public opinion, and as a result political candidates in closely contested races will moderate their views in order to appeal to a wide range of voters. If the trend continues in favor of the regrowth of public confidence in climate science, and if denialist candidates find that their political future is harmed in general elections, then we might see the collapse of climate denialism as a political force. In such a situation, we might see the closing of the epistemic rift and the re-emergence of the doxological function of the climate science research field.

However, this change would not necessarily mean that the political opportunity structure for green transition policies would automatically reopen. A possible harbinger of the next phase was a speech in June, 2012, by the CEO of ExxonMobil, Rex Tillerson, who stated that global warming was real

and that fossil fuels were contributing to it, but he added that fears were overblown and society that would adapt (Tillerson 2012). Tillerson's use of the word "adapt" points to another development in the policy field and a possible reconfiguration of the epistemic rift. Across the world and across the U.S., the policy responses to climate change have diversified from mitigation strategies to adaptation strategies. According to a study by the PEW Center on Global Climate Change (Cruce 2009), by 2009 18 states had launched or begun adaptation plans, and our review in 2013 indicated that more plans had emerged since then. Likewise, the U.S. federal government and associated organizations have been developing climate adaptation plans. For example, the U.S. Department of Transportation (2012) published studies on the potential effects on climate change on transportation infrastructure, from buckled rails to flooding, and the National Academies of Sciences published a review of adaptation issues for airports (Airport Cooperative Research Program 2012). Most of the policy initiatives in this area address concerns with water, such as droughts, flooding, and sea water rise. In effect, water is to climate adaptation as energy is to climate mitigation.

Water concerns have a different epistemic weight than do those for energy. In the case of climate mitigation, energy technologies must be transitioned to low-carbon forms, and a powerful industrial sector is threatened by declining opportunities. In the case of water, the relationship to climate change is much less direct, because water-related resilience is complicated by a variety of human-caused factors, such as decisions regarding flood plain development, agricultural land use, deforestation, suburban sprawl, general population growth, groundwater use, and the capacity of infrastructure to absorb rain water. As a result, political leaders can support adaptation policies without necessarily taking a stand on the relative importance of climate change in posing general risk. Furthermore, the technical difficulties of downcasting climate models to an urban or even state-government scale also make climate scientists hesitant to apply their research at a local level except in the most general terms. Finally, if adaptation policies are not combined with climate mitigation, they

can end up supporting the continued use of fossil fuels under the presumption that societies will adapt to the changes.

Thus, adaptation can serve as a boundary object across various constituencies. For the environmentalists, it can be an unfortunate outcome of failed mitigation policies, an opportunity to design systems that are both adaptive and sustainable, and an occasion to reveal the importance of a double strategy of mitigation and adaptation. For the opponents of mitigation strategies, adaptation can simply mean, "Live with it," as the Exxon-Mobil CEO was suggesting. Although it is far from certain what role adaptation will play as part of the continued strategy of the fossil-fuel industry to slow the green-energy transition, it represents one possible outcome in which there is a return to something approximating the standard model of science-policy relations. In other words, the fact of global warming can become widely accepted as the doxa of the political field, but the policy implications—the relative balance of mitigation versus adaptation investments—would remain highly contested politically. This outcome of the interaction of corralling mechanisms and countervailing dynamics appears likely even if it may not be ideal.

Conclusion

The epistemic rift for climate science in the U.S. is not only of grave political and environmental importance, but it is also an occasion to develop theory in the political sociology of science and technology. In previous research, I focused on the alternative counterpublic relationship, in which scientists are marginalized institutionally and/or epistemically because of their advocacy of research programs that are outside the mainstream of their research fields. The paradigm case here was the networks of scientists, clinicians, patients, and nutraceutical companies that advocated the development of non-toxic, nutrition-based therapies for chronic disease. In the full-blown scientific counterpublic, scientists also have a relationship with actors in the subordinate positions in the political

and industrial fields, such as grassroots social movement organizations and entrepreneurs who develop alternative technologies (Hess 2011). Together, scientists and activists draw attention to the pattern of undone science, or the systematic underfunding of research that would address the knowledge questions of the counterpublic and the need for alternative technologies and products. Thus, they question the agendas of the dominant research fields and the consensus among regulators, industry, and mainstream scientists. This type of relationship is common in the complementary and alternative medicine fields as well as for many environmental health issues in which a counterpublic draws attention to risk and uncertainty, often in opposition to assurances of safety from industry.

In the case of climate science, the scientists who attack the consensus on the anthropogenic forcing of climate change are themselves in marginal positions at least with respect to the specific field of climate science. Some of the climate science deniers lack credentials as natural scientists, and even the natural scientists generally lack credentials as climate scientists and are not active producers of research; hence, they lack standing within the relevant research field. Some of them have also been documented to have ties to industry-funded contrarian science campaigns (e.g., Oreskes and Conway 2010). Although there are controversies in the climate science research field, the controversies occur within a shared set of assumptions that contemporary global warming is established and that anthropogenic greenhouse gases play a very significant role in global warming. Thus, a scientist like James Hansen is within the mainstream of the research field, even if he suffers suppression in the political field and arrests at demonstrations (Hansen 2009). Conversely, whereas scientists who express climate skepticism and denialism lack symbolic, temporal, and other forms of capital in the scientific field, they have standing with powerful corporations, which in turn work to restructure the scientific field (by suppressing scientists and cutting funding) and the political field (by purging the Republican Party of leaders who are soft on climate change and by pouring money into think tanks and media advertising).

The study of the politics of climate science in the U.S. suggests that countervailing dynamics will emerge from the attempt to corral a research field that has achieved a high level of consensus and has made important recommendations to policymakers. As the public becomes aware that so-called climate "skeptics" are not credentialed climate scientists and that most of the scientists in the research field share a consensus about the role of anthropogenic forcing of global warming, then the denial machine begins to lose its effectiveness at corralling the science, and the epistemic rift may begin to close up. It is possible that the sharp rise in climate denialism witnessed after the 2010 elections began to decline by 2012, when the controversies over the Heartland Institute garnered media attention, the admission by the CEO of Exxon-Mobil that global warming is real undermined denialism, and extreme weather events led to greater awareness of the possibility of climate change.

As the negative publicity on the harassment of climate scientists increases, weather records continue to be broken, and public opinion in support of the reality of global warming and greenhouse gas causation increases, then Republican Party leaders may shift the strategy from denialism and skepticism about the science to a different kind of pro-fossil fuel politics. This situation would be a return to the standard model for the science-policy relationship, in the sense that the consensus knowledge of the research community would form the epistemic ground on which political debate would take place. However, as argued above, the return of the doxological function of climate science in the political field would not necessarily imply that policy action on climate mitigation would be imminent. Instead, the debate could turn more on what, if anything, should be done about the "fact" that has now recovered its credibility in the political field. As the CEO of Exxon-Mobil suggested, the response from the fossil-fuel industry is to urge adaptation rather than mitigation. Indeed, adaptation appears to be the dominant direction of policy reform for the twenty-first century. Unfortunately, the prospect of adapting to climate change is likely to be especially brutal for the world's most vulnerable human populations, not to mention other species.

Endnote

1. The terms “denialism” and “skepticism” are used together to indicate a spectrum of opinion from self-conscious denial of established scientific research to questions about some aspects of climate science that are based on lack of knowledge.

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