

The Power of Social Networks: How the UNFCCC Secretariat Creates Momentum for Climate Education

*Nina Kolleck, Mareike Well, Severin Sperzel,
and Helge Jörgens**

Abstract

Despite the relevance of education-specific negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) and the influential role of the secretariat therein, research in this area is still scarce. We contribute to closing this research gap by exploring how the UNFCCC secretariat becomes involved in and has latent influence on the education-specific debates surrounding global climate conferences and the related information exchange on Twitter. Our analysis extends previous findings by combining theories and methods in novel ways. Specifically, we apply social-network theory and derive data from participant observations and Twitter, which enables us to analyze the role and influence of the UNFCCC treaty secretariat within education-specific negotiations. We find that the secretariat increases its influence by strategically establishing links to actors beyond the negotiating parties and show that it occupies a central and influential position within the education-specific communication networks in UNFCCC negotiations.

In recent years, scholars have increasingly turned their attention to the impact of international public administrations (IPAs)—that is, the bureaucratic bodies of international organizations (M. Bauer et al. 2016; S. Bauer 2006; Biermann and Siebenhüner 2009b; Johnson 2014). Within this research strand, a particular focus has been the secretariats of multilateral environmental conventions as potentially influential actors in world politics (Biermann and Siebenhüner 2009a; Jinnah 2014).

* This work was supported by the German Research Foundation (DFG) under Grants KO 4997/1-1, JO 1142/1-1, KO 4997/4-1, and JO 1142/2-1, as well as by the Center for Research Cooperation of the Freie Universität Berlin. We thank Barbara Saerbeck, Outi Ruuska, Christoph Knill, Arthur Benz, Michael Bauer, Ronny Patz, Klaus Goetz, Andrea Liese, Per-Olof Busch, and the members of the DFG Research Unit “International Public Administration” for valuable comments, and the two anonymous reviewers for their thoughtful and detailed comments and suggestions.

Studying the role and impact of international treaty secretariats is relevant because they constitute a least-likely case of IPA influence (Jörgens et al. 2016). Their formal mandates emphasize their logistical role within a multilateral treaty system while explicitly prohibiting them from taking an autonomous part in the negotiations under their treaty or convention. However, despite the increasing visibility of international treaty secretariats, and counter to a growing body of research on their role in global politics, their intentions to exert influence have scarcely been systematically studied over time, because of methodological problems in analyzing behavior that is not openly displayed. This article contributes to filling this research gap by combining theories and methods in novel ways: it proposes social-network theory (SNT) and social-network analysis (SNA) as an adequate theory and method, respectively, for assessing the latent influence of international treaty secretariats. Instead of relying on actors' openly expressed policy preferences, their self-assessments, or their reputation for being influential, SNT and SNA infer influence from their relative position in issue-specific communication networks (Kolleck 2009; Kolleck 2013). Focusing on the issue of climate change education (CCE), we use longitudinal Twitter data on the issue-specific communication flows during the yearly Conferences of the Parties (COPs) from 2009 (COP 15) to 2014 (COP 20). We complement SNT and SNA with participant observations as means to identify the UNFCCC secretariat's potential for autonomous action and the mechanisms through which this potential is exploited.

While CCE is one of the least prominent topics in academia, it has become a high-profile project of the UNFCCC secretariat and has steadily risen on the agenda. Education is considered to be an "essential element for mounting an adequate global response to climate change" (UNESCO 2015, 3). It can increase resilience by "helping populations understand and address the impacts of climate change, and [by] encouraging the changes in attitudes and behaviors needed to help them address the causes of climate change, adopt more sustainable lifestyles ... as well as to adapt to the impact of climate change" (UNESCO 2015, 3). The attention given to education as a tool for ensuring the overall success of the UNFCCC has broadened to reach not only a dedicated community but also a growing number of country representatives and stakeholders. At the same time, because of its low political saliency relative to other agenda items, CCE constitutes an issue area where a proactive and influence-seeking role for IPAs is most probable to materialize. In such a setting, we can expect government principals to relax control of the activities of international bureaucrats, thereby opening opportunities for autonomous action (Biermann and Siebenhüner 2009a, 335). Thus, analyzing the role of the climate secretariat in CCE can shed new light on the influence-seeking strategies of international bureaucracies in global environmental policy-making.

Despite the relevance of education in international affairs and the crucial role that IPAs play in this regard, studies on the role of international secretariats at the interface between education and environmental policy have so far been

missing. Specifically, studies that analyze the ways that education is set on the UNFCCC agenda and how different convention stakeholders push education as a topic in climate change have been lacking.

This article seeks to contribute to this research agenda by studying the role of the UNFCCC secretariat in the negotiations on CCE. Specifically, we seek to answer the following research question: *how does the UNFCCC secretariat become involved in and have latent influence on education-specific negotiations and debates within the UNFCCC?*

In analyzing this question, we aim not only to provide new empirical insights into the mechanisms through which international treaty secretariats exert influence on the processes and outputs of multilateral negotiations by creating momentum for specific issues, but also to contribute to a better understanding of how global educational innovations such as CCE are negotiated and taken forward at a global level. By presenting a methodological approach that uses Twitter data to analyze the role of the UNFCCC secretariat in negotiations on CCE, this article shows not only how scholars can study multilateral negotiations in the field of global educational policies, but also how influence on international policy outputs can be assessed and understood in other policy areas. Drawing on SNT as well as on SNA and techniques of participant observation, this approach explores a secretariat's role by analyzing its actions, behavior, and communication strategies, which are reflected in its positions in issue-specific communication networks (White 2008). Empirically, we extract information on the cooperation structures and behaviors of actors involved in the negotiations using data from participant observations at climate change negotiations from the period 2015–2016, as well as Twitter data covering the UNFCCC COPs from 2009 to 2014.

The article is divided into five sections. The next section gives a brief overview of the role of CCE in the UNFCCC, summarizes the state of the art regarding the role of IPAs in global environmental governance, and introduces SNT as our theoretical framework. The methodological approach based on participant observations and the analysis of Twitter data with SNA techniques is described in the section thereafter. Then we present and discuss the findings. The last section summarizes the major arguments and outlines prospects for future research.

Climate Change Education and the UNFCCC

Although CCE has not been a prominent topic in negotiations under the UNFCCC, in recent years it has in fact risen starkly on the agendas of formal sessions and other events, and it is increasingly recognized as being essential for successful climate governance (UNFCCC 2014a). Article 6 of the UNFCCC, which went into force in 1994, lays the foundation for education in the climate regime, highlighting the importance of educational and public awareness programs and the need to cooperate on these issues at the international level

(UNFCCC 1992, 17). The implementation of this article has subsequently been facilitated by a series of work programs: Parties adopted the New Delhi Work Programme on Article 6 in 2002, and the Doha Work Programme in 2012, thereby also instigating a Dialogue on Article 6, which is held annually and brings together parties and other stakeholders to exchange best practices on the implementation of Article 6, or “Action for Climate Empowerment.” In 2014, ministers adopted the Lima Declaration on Article 6 of the Convention. In 2015, Article 12 of the Paris Agreement was adopted, thereby firmly entrenching education, training, and public awareness as tools for achieving the goals of that agreement. Article 12 stipulates that “Parties shall cooperate in taking measures, as appropriate, to enhance CCE, training, public awareness, public participation and public access to information, recognizing the importance of these steps with respect to enhancing actions under this Agreement” (UNFCCC 2016b, 30).

State of the Art and Theoretical Approach

International Public Administrations in Multilateral Environmental Negotiations

In their seminal comparison of nine international environmental bureaucracies, Biermann, Siebenhüner, and colleagues (2009) laid out the groundwork for understanding the mechanisms of secretariat influence, by highlighting the importance of problem structure, polity, people, and procedures. In particular, they showed that besides an IPA’s “polity”—that is, the “legal, institutional, and financial framework that has been set ... by states as their principals” (Biermann et al. 2009, 51)—an IPA’s leadership and staff, their attitudes, and their strategic actions account for varying degrees of influence over time (Biermann and Siebenhüner 2009a). Building on Biermann et al.’s findings, Jinnah added relational variables that also condition secretariat influence, emphasizing the importance of the positioning of secretariats in the wider governance network (Jinnah 2014, 50–55).

A series of studies have substantiated these findings, suggesting that the role of environmental treaty secretariats may be shifting from rather passive servants of a treaty’s negotiating parties to active and influence-seeking actors in their own right (Jinnah 2010; Jinnah 2011; Michaelowa and Michaelowa 2016).

A case in point is the UNFCCC secretariat. In 2009, Busch found that the climate secretariat was caught in a “straitjacket” of “formal and informal rules” imposed by the UNFCCC parties that “ruled out any proactive role or autonomous initiatives” and led to an “organizational culture that bars staff ... from exercising any leadership vis-à-vis parties and from assuming a more independent role” (Busch 2009, 261). Today this characterization no longer seems accurate, since a number of scholars consider that the climate secretariat is

“breaking out of its straitjacket” (Hickmann 2016; see also Michaelowa and Michaelowa 2016). In response to the failure to reach a globally binding post-Kyoto agreement on climate change in 2009 at COP 15 in Copenhagen (Dimitrov 2010; Giddens 2011), and confronted with a negotiation stalemate in the following years, the UNFCCC secretariat abandoned its passive stance. Instead, it took on a more proactive role by bringing nonstate actors that are supportive of the secretariat’s policy preferences into the UNFCCC negotiations (Chan et al. 2015).

However, while indication is growing that international treaty secretariats deliberately seek to stretch their mandate as a means to feed their own policy interpretations into the negotiations (Jørgens et al. 2017), only limited systematic and comparative knowledge exists regarding treaty secretariats’ influence over time. Although the lack of longitudinal studies has been pointed out in the past (Biermann et al. 2009), systematic studies that assess the influence of secretariats over time using primary data are still scarce. So far, the most ambitious studies have relied on qualitative interviews and secondary data (Jinnah 2014) or on descriptive statistical analyses (Michaelowa and Michaelowa 2016).

Methodologically, studies of secretariat influence are mostly based on document analysis and interviews with secretariat staff and other stakeholders. This approach is problematic, because secretariats do not officially state their preferences or strategies for influence. To preserve a reputation for impartiality on which their authority, and thus their potential influence, depends, treaty secretariats can be expected to downplay their role in international negotiations, thereby potentially leading scholars to underestimate their actual impact. Furthermore, IPA research based on interviews and document analysis carries the risk of conflating the impact of environmental bureaucracies with that of the international organization or the international regime they are part of (Biermann et al. 2009, 45–46; Jinnah 2011, 25).

Social-Network Theory (SNT)

SNT distances itself from the assumptions of both methodological individualism and methodological structuralism by focusing on the interactions between structure and agency. Actors are not regarded as islands, but as being embedded in social structures—hence, the structure and properties of the environment must also be placed at the center of empirical analyses. SNT’s focus on the embeddedness of actors in policy-related networks enables us to better address the proactive and alliance-building role of secretariats that recent studies have identified and to overcome some of the aforementioned methodological challenges that have confronted previous research.

Synthesizing different theoretical constructs in traditional SNT, Borgatti and Lopez-Kidwell have developed an underlying generic theory: the network flow model (Borgatti and Lopez-Kidwell 2011, 40). This model assumes that many variants of network theorizing, such as the seminal works by Granovetter

(1973), Burt (1982), and Coleman (1998), are elaborations of the same underlying theory. Resting on this “conceptual universe” (Borgatti and Lopez-Kidwell 2011, 44), the authors point out two kinds of relational phenomena: the *backcloth* and the *traffic* of a network. The *backcloth* provides the underlying infrastructure that enables or constrains the *traffic*, which again refers to what flows through the network (e.g., information on CCE). The backcloth here is made up of similarities, social relations, or Twitter activities concerning CCE under the UNFCCC. As such, it serves as the conduit through which the traffic or new information flows (Borgatti and Lopez-Kidwell 2011, 44). For example, information exchange is possible on the basis of co-membership in a convention body, which in turn can facilitate certain relations, such as trusting a co-member, which may further increase the probability of information exchange.

For the theoretical framework used in this article, this network theoretical perspective is important because it allows us to neatly distinguish between the structural conditions (e.g., the network density), the actual flows (e.g., information exchange concerning CCE), and the resources that enable and foster issue-specific negotiations (e.g., in-session workshops or more institutionalized working groups and standing committees). In this article, we extend the existing literature by using the flow model to examine latent influence, assuming that influence and information flows are rarely apparent and cannot be analyzed with direct questionnaires (Borgatti and Lopez-Kidwell 2011, 45).

From this theoretical perspective, treaty secretariats have the ability to act as intermediaries (Kent 2014, 209). They are in a position to create momentum and thus to influence the course and outcome of international environmental negotiations. Creating momentum can be seen as a specific way to have latent influence, by setting essential impulses to influence the stream of information. Hence, our analysis also goes beyond the existing literature by conceptualizing influence in relational terms. Influence-seeking actors are, despite “different interests and perceptions of problem(s) and solution(s), ... interdependent of each other,” and thus need to interact with other actors to acquire resources (Verweij et al. 2013, 1036–1037). The network flow model can explain differences in an actor’s (i.e., an individual or collective actor’s) success regarding their performance or achieved rewards. In this understanding, an actor acquires resources, opportunities, or ideas through various relations that directly increase or decrease the actor’s success (Borgatti and Lopez-Kidwell 2011)—for instance, with respect to shaping debates on the implementation of CCE under the UNFCCC.

The advantage resulting from an actor’s embeddedness in a relational neighborhood has been conceptualized in different ways. Where Granovetter (1973) argues that the network structure or “context” in which an actor is embedded matters, others stress the importance of the actor’s position. Burt (1982) developed such a conceptualization of positional advantage as a source of social capital. In his study on structural holes, he finds that an actor increases his or her social capital by being in a unique position, allowing only this actor to

connect several clusters in the network. By exploiting structural holes and acting as a broker between clusters, this actor has an informational advantage and increased leeway for maneuver (Christopoulos and Ingold 2015; Sabatier and Jenkins-Smith 1993). In this article we seek to contribute to this literature by applying its theoretical fundamentals to the empirical analysis of the latent influence of international treaty secretariats in climate education policy.

Methodological Approach

Methodologically, we implement a sequential mixed design, in which qualitative and quantitative data are gathered and analyzed in consecutive steps (Creswell 2009, 208), to allow both sets of inferences to be combined in a consistent “meta-inference” (Borgatti and Ofem 2011, 18). Whereas quantitative SNA is used to analyze the information flows and specific roles of actors therein, through qualitative participant observations we seek to gain insights into the behavior of treaty secretariats.

In the following discussion, we demonstrate how Twitter data can be analyzed with quantitative SNA to trace and visualize a Twitter network’s structure. We then demonstrate how we conducted qualitative participant observations to gain insights into the ways in which the UNFCCC secretariat facilitates multilateral negotiations and pushes education as a crucial topic under the UNFCCC.

Analysis of Twitter Data and SNA

In recent years, Twitter has increasingly been used for communication by politically influential individuals (e.g., Conover et al. 2011; Dubois and Gaffney 2014; Williams et al. 2015), as well as for information distribution and calls for action by nonprofit advocacy organizations (Guo and Saxton 2014). While participating in negotiations, we observed that Twitter has become an important tool for convention stakeholders to exchange information. We suggest that analyzing Twitter data with SNA can provide us with a more comprehensive picture of the UNFCCC secretariat’s role during multilateral negotiations.

Although its main fields of application continue to be in the natural and computational sciences (Borgatti et al. 2009; Lazer et al. 2009), researchers increasingly use SNA in the social sciences to analyze information flows in online networks (e.g., Ingold and Leifeld 2014; Smith et al. 2014). Following Ingold and Leifeld, we assume that SNA is well suited to studying the role of public administrations. Most importantly, we argue that using SNA allows us to assess actors’ influence on the basis of communication networks (Jørgens et al. 2016; Kolleck 2014; Kolleck 2016; Uhl et al. 2017; Xu et al. 2014).

Through Twitter’s openly accessible application program interface, it is not possible to obtain data from the past. Thus, for the purpose of our case study, we purchased nonprotected tweets from “discovertext” for the period from



Figure 1

Left: One Example Tweet by the UNFCCC Secretariat During COP 20 Regarding Climate Education. Right: The Resulting “Graph” According to Our Approach.

2009 to 2014, covering the entire duration (2 weeks \pm 2 days) of six annual multilateral climate change conferences: UNFCCC COP 15, COP 16, COP 17, COP 18, COP 19, and COP 20.¹

On Twitter, information flows are represented by “tweets” (short messages). Twitter users can interact with each other in three basic ways: First, “retweets” (i.e., forwarding another user’s tweet without additional comments); second, “mentions” (a tweet that contains another user’s @username); or third, direct “replies” (a reaction to a specific tweet of another user). For SNA, we conceptualize Twitter users as nodes and their interactions as relations between the nodes. If Twitter user A retweets a tweet of user B, the direction of the arrow is from B to A; if user C mentions user D, the arrow points from C to D; and if user C is mentioned in a tweet that is retweeted by user A, then the arrow is directed from A to C (see Mejova et al. 2015). In the example tweet in Figure 1, @unfccc and @MarincKorolec are nodes in our network. Here, UNFCCC is “mentioning” Marcin Korolec, the Polish minister of environment.

To identify the actors with the greatest influence in Twitter communications, we applied the measure of eigenvector centrality. Eigenvector centrality is essential for detecting not only how an actor controls information flows, but also how an actor has access to the resources necessary for achieving an influential position (Ibarra 1993). It indicates how “prominent” an actor is in a network; that is, an actor is important if it is linked to other important actors. Hence, an actor who is connected to various other actors in the network does not automatically have a high eigenvector centrality. Instead, an actor’s eigenvector centrality is only high if the contacts also have a high eigenvector centrality. Such an actor may have only a few, but very important, relations (Leontief 1941; Seeley 1949). In contrast to betweenness centrality, which has frequently been used to study the centrality of actors through assessing the likelihood that

1. We acquired data according to filter criteria such as: #unfccc OR #article6 OR contains:unfccc OR article6 OR “article 6” OR “article six.” In total, we gathered a total of 1,599,162 tweets.

an actor will receive information (Smith et al. 2014, 163–164), eigenvector centrality is particularly suitable for larger networks, such as the social networks of online communities.

Participant Observations

Participant observations allowed us to substantiate the findings derived from Twitter data and review our assumptions on influence-seeking strategies. Data were collected through participation in negotiations and events between 2015 and 2016, as well as through the analysis of documents (official reports, declarations, and speeches). The essential advantages of this method are that researchers are able to record information in real time and to gain insights into how negotiations develop (see also Bogdan and Biklen 1992; Creswell 2009, 179; Merriam 1998).

We conducted participant observations during COP 21 in 2015 and at the Subsidiary Body of Implementation (SBI) sessions 42 and 44, in 2015 and 2016, respectively. A particular emphasis was placed on the events of “Education Day” (December 4, 2015, COP 21) and the Third and Fourth Dialogues on Article 6/Action for Climate Empowerment, which took place respectively during the 42nd and 44th SBI sessions (June 2–3, 2015, SBI 42; May 15–18, 2016, SBI 44; henceforth referred to as the “Third/Fourth Dialogues”). Observations were recorded using an observational protocol in which descriptive notes were separated from reflective ones. Coding of the data comprised four steps, following Creswell (2009, 181–186): First, a list of all topics that arose in the data was compiled. Second, similar topics were clustered together and abbreviated as a code. Third, the appropriate text segments were assembled according to the codes. And fourth, the list of codes was reduced and turned into larger categories. Finally, the data were assembled and compared.

Following this process, we analyzed the ways in which the identified categories and their interconnectedness addressed larger network-theoretical perspectives and how they related to our findings from the quantitative SNA. Through this mixing of methods, we aimed to cross-validate our data and gain a more encompassing and valid understanding of the role of the secretariat in the negotiations on Article 6.

Findings

Analysis of Twitter Data

In the course of preparing the data for this article, we isolated all education-specific tweets from our dataset, which encompassed a total of 1,599,162 tweets, by applying the keywords “education” and “article6” or “article 6,” plus the corresponding replies. In total, we found 3,232 mentions, 768 replies, 3,693 retweets, as well as 1,465 singular tweets that were neither retweets or replies,

Table 1

Total Number of Education-Specific Tweets Across the Yearly Conferences of the Parties (COPs)

| <i>Year</i> | <i>COP</i> | <i>Total</i> |
|--------------|------------|--------------|
| 2009 | COP 15 | 469 |
| 2010 | COP 16 | 610 |
| 2011 | COP 17 | 719 |
| 2012 | COP 18 | 1,632 |
| 2013 | COP 19 | 2,136 |
| 2014 | COP 20 | 3,592 |
| <i>Total</i> | | <i>9,158</i> |

nor contained a mention of another user. Table 1 shows the total number of tweets for each COP.²

The increase of Twitter data on education surrounding the UNFCCC over the years shows that CCE has been discussed increasingly on Twitter. This development is important because the growing number of tweets suggests the relevance of Twitter for scientific analyses. However, it is not an indicator that this topic has gained weight or of the influence of specific actors. Concurrent with the growing relevance of Twitter, the number of tweets on other topics has also increased.

To analyze the role of convention stakeholders with regard to education, we used the techniques of SNA. Table 2 presents the overall network analytical metrics of our dataset for each COP. *Centralization* refers to the average degree of centralization of all nodes. With a value close to 1, this measure already indicates that a small number of users with high centrality values dominate the flow of information in the Twitter network. At the same time, the networks show very low density values (*density* refers to the proportion of existing ties to the total number of possible ties) and high diameter values (i.e., the longest distance between two network participants). Both the density and the diameter assess the speed of information flows within social networks, and thus suggest that the nodes in the network are only loosely connected and that information exchange is rather slow.

To decide whether or not actors are influential, we used eigenvector centrality. A generally accepted numerical eigenvector centrality score does not exist. However, it can be assumed that an actor is central or influential if its

2. In our analysis, tweets, replies, mentions, and retweets were not weighted differently.

Table 2

Network Metrics of the Education-Specific Twitter Communication Across Different COPs

| | <i>COP 15</i> | <i>COP 16</i> | <i>COP 17</i> | <i>COP 18</i> | <i>COP 19</i> | <i>COP 20</i> |
|-------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Twitter users | 183 | 336 | 520 | 1,079 | 1,383 | 2,605 |
| Relations between users | 147 | 330 | 487 | 1,524 | 1,471 | 3,734 |
| Centralization | 0.97 | 0.99 | 0.98 | 1 | 1 | 1 |
| Density | 0.0044 | 0.0029 | 0.0018 | 0.0013 | 0.0008 | 0.0006 |
| Diameter | 3 | 8 | 3 | 6 | 3 | 10 |

eigenvector value is higher than those of other actors within a given network. Hence, we assume that the five actors with the highest eigenvector centrality scores have the highest potential to have latent influence. Another indicator for influence can be seen in high eigenvector centrality scores over time—that is, during nearly all of the conferences analyzed for this article.

Figure 2 visualizes the Twitter network in relation to selected COPs. Nodes represent Twitter users that post, reply, or retweet a tweet containing the term “education,” “article6,” or “article 6”; the links between the nodes depict their relations.

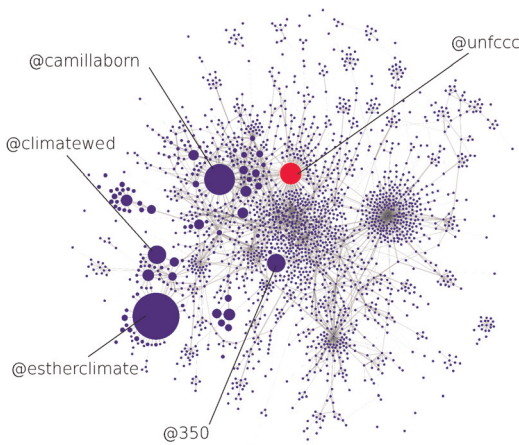


Figure 2
Education-Specific Twitter Network of All Selected COPs

Each node's size is proportional to its eigenvector centrality, visualized using the Force Atlas 2 algorithm in Gephi.

The data were visualized using Gephi's Force Atlas 2 algorithm. To determine the nodes' sizes, we calculated the eigenvector centrality for each Twitter account and COP using R and the *igraph* package. If a Twitter account was not present during a specific COP, we set an eigenvector centrality of 0. Next we weighted the mean value for each account by its appearance at each COP. In this way we could take account of the fact that some Twitter accounts appear very prominently during one COP, but do not participate in climate education discussions in any other COPs. In Figure 2 and Table 3, only the five most highly rated nodes are labeled. These results suggest that the UNFCCC is one of the most dominant actors within the Twitter network, along with other actors active in the debate on climate change education (such as international organizations, individuals, and youth associations). Esther Agbarakwe (@estherclimate), who is Special Adviser to the Nigerian minister of environment, and Camilla Born,

Table 3
Top Five Accounts in Terms of Their Eigenvector Centrality Values

| <i>Twitter Account</i> | <i>Self-Given "Account Description"</i> | <i>Eigenvector</i> | <i>Present at COPs</i> |
|-----------------------------------|---|--------------------|------------------------|
| @estherclimate | Founder & Director, Nigerian Youth Climate Coalition (NYCC), Social Climate Researcher, Climate Policy Expert and an Advocate for Sustainable Development. | 0.133205 | 4 |
| @camillaborn | @PowerShiftUK coordinator for the @ukycc. Particular interests include climate change, geography, theatre, politics and saving the world. | 0.084862 | 3 |
| @unfccc (former: un_climatetalks) | UN_ClimateTalks provides information and personal points of view on the latest developments in the climate change negotiations. | 0.057648 | 4 |
| @350 | Join a global movement that's inspiring the world to rise to the challenge of the climate crisis. 350=safe upper limit of CO2 in atmosphere. | 0.048233 | 3 |
| @climatewed | #ClimateWednesday is weekly tweet conversations by @NigYCC on climate change and related matters that aim at building a climate-smart generation in Africa. | 0.048098 | 2 |

Policy Advisor at E3G (NGO for sustainable development) are rated with higher eigenvector centralities than the UNFCCC. Both @estherclimate and @unfccc appeared at four of the six COPs.

Due to its relational position connecting different stakeholders, the UN climate secretariat was in an ideal position to make itself heard and affect the way in which other stakeholders related to each other in Twitter communications. This finding is also illustrated in Figure 3, which depicts the development of the education-specific negotiations over time. Not only do more and more actors engage in communication on education with the UNFCCC on Twitter, they are also increasingly well connected to each other. As noted, the UNFCCC account was present in the Twitter network during four of the six COPs.

Overall, our analyses demonstrate the high potential of the climate secretariat to influence the communication flows on Twitter over time. While these findings enable us to draw conclusions on a structural level, they do not provide any insights into how the secretariat has exploited its favorable relational position to influence the debates on education. Thus, in a second step, we used participant observations to gain a better understanding of how the climate secretariat used its central position in issue-specific information flows to shape climate education programs within the UNFCCC.

Participant Observations

We divided secretariat activities concerning CCE into three large categories: normative leadership, facilitation, and outreach. The following results of our

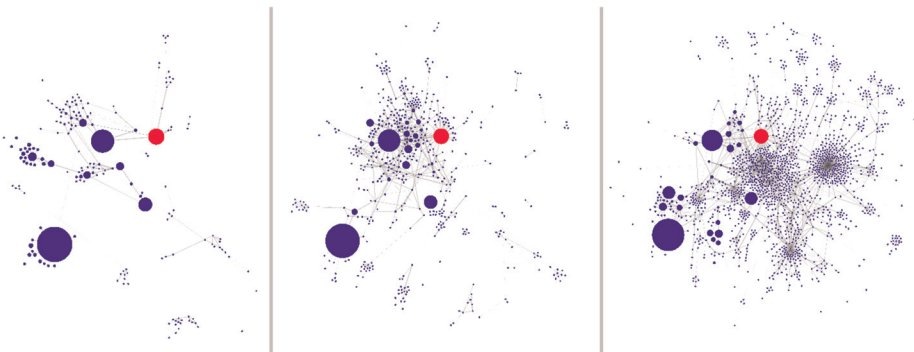


Figure 3
Development of the Education-Specific Twitter Networks over Time.

The Data from Figure 2 Are Separated into Parts. Left: COPs 15–16; Center: COPs 17–18; Right: COPs 19–20; Red dot: UNFCCC

Each node's size represents its eigenvector centrality for the whole time period.

observations demonstrate with which mechanisms the secretariat aims to exploit its favorable central position. First, its activities are aimed at providing *normative leadership*, which is substantiated by the following aspects (or codes):

- *Elevating the importance of Article 6 vis-à-vis other articles of the convention and linking education to the wider goals of the UNFCCC*

To elevate the importance of education as a tool for achieving the goals of the UNFCCC, the secretariat repeatedly stressed that Article 6 should be given a meaningful name that reflects its content and importance, not merely identified using the number of the article. In a speech delivered at the Third Dialogue (climateconference 2015a), former executive secretary Figueres stated that she had been “incredibly frustrated” that the term “Article 6” “doesn’t do justice to the importance of this article” (climateconference 2015a). She thus presented the participants of the Third Dialogue with the following challenge: “Can we commit that ... you will come up with something ... that is truly in accordance with what we are doing here?” (climateconference 2015a). The momentum created for the issue of education, training, and public awareness was well received among the participants of the dialogue, and pursuant to this strong impulse, the new term “Action for Climate Empowerment” was agreed upon (UNFCCC 2016c). Thus, by challenging a term that suggested a marginal role for CCE, the secretariat contributed to the equal linguistic treatment of educational issues vis-à-vis other issues under the Convention (climateconference 2015a; climateconference 2015b).

- *Setting goals for, and increasing ambitions regarding, the implementation of Article 6*

The secretariat aimed at increasing the ambition in relation to CCE by emphasizing that it should be mainstreamed into education at a general level. To this end, Figueres stressed that not only is improving the understanding of climate change in curricula critical, “but it needs to be embedded in the DNA of today’s very education concept” (UNFCCC n.d. [2015a]).

Second, the secretariat played an important role in *facilitating* and providing an enabling environment for discussing CCE activities, by

- *Defining the process of consultation and negotiations*
- *Providing UNFCCC-wide platforms for educational issues*

CCE was brought to the attention of all COP participants beyond the narrow “education community” through side events convened by the secretariat (UNFCCC n.d. [2015b]; UNFCCC 2016a).

- *Addressing challenges in the process, providing procedural support*

During the dialogues, stakeholders had the chance to voice their concerns and discuss the challenges that limit the implementation of Article 6. Among the challenges named were a lack of high-level political support for CCE, the need

for indicators of CCE, the insufficient cooperation between relevant actors, and the necessity to link CCE to the labor sector to improve capacity in adaptation and mitigation (UNFCCC 2015, 7–8). As a response to these concerns, the secretariat provided support by, for example, partnering with the UN Alliance on Climate Change Education, Training and Public Awareness in developing guidelines for national focal points for Article 6 (UNFCCC 2014b, 6); fostering high-level political support; and providing tools for the enhanced coordination of actors.

Third, an important conduit for secretariat influence was *outreach activities*, which comprised diverse aspects, including:

- *Joint initiatives with international organizations (IOs), thus connecting to wider governance frameworks*

At COP 18 in 2012, the secretariat launched the “UN Alliance” with six other IOs, among them FAO, UNEP, and UNESCO. By 2017 the membership of the UN Alliance had increased to thirteen IOs. The objectives of the UN Alliance were to build synergies between the IOs, support UNFCCC parties in their efforts regarding Article 6, and establish a link between the work of the member organizations and the UNFCCC (UNFCCC n.d. [2016d]). In this way, the UNFCCC secretariat fulfilled multiple functions:

It was at the center of the coordination of CCE in twelve other IOs. It also linked the activities under Article 6 to other governance frameworks, and thereby enhanced the visibility of CCE well beyond the climate change regime. Finally, it created incentives for UNFCCC parties to increase their actions with regard to Article 6, since these became relevant to their memberships in other IOs.

- *Focusing high-level attention on educational issues*

Rallying support from prominent actors, such as COP presidents or ministers of the environment, has been an important element in creating momentum for CCE. For example, Education Day was launched by the French ministers for environment and education, and COP 20 President Manuel Pulgar-Vidal gave a keynote speech at this event (UNFCCC n.d. [2015c]). This form of symbolic but high-level support has fostered awareness of activities under Article 6. Another illustration of the importance of high-level support is the Lima Ministerial Declaration on Education and Awareness Raising. It was initiated by Polish and Peruvian party representatives and promoted by former COP presidents.

- *Youth and subnational networks*

Just as the secretariat connected with the highest political level, it also garnered support for CCE at the grassroots level, which became manifest in its engagement with, for example, youth organizations and subnational networks. The secretariat created opportunities for young people to participate in COPs, in the forms of high-level youth briefings by the executive secretary or of

“Young and Future Generations Day” (UNFCCC n.d. [2015d]). Moreover, in an attempt to enhance the “public participation” component of Article 6, the secretariat used different means to address a transnational community of nonstate actors (United Nations n.d. [2015]; see also Hickmann 2016).

Discussion and Implications

In this article, we circumvented the problem of secretariats’ apparent impartiality by analyzing one secretariat’s behavior and strategies with SNT, SNA, and participant observations. We demonstrated that the UN climate secretariat possessed a potentially influential role and broker position, due to its relational position, connecting stakeholders from different subnetworks. The activities accompanying the ongoing negotiations and development of Article 6, which have steadily risen on the UNFCCC agenda, illustrate this influential role. Both participant observations and analyses of Twitter data confirmed that the UNFCCC secretariat strategically connected with other actors and seemed to be increasingly able and willing to transcend its formally restricted mandate, attempting to frame debates in line with its policy preferences. In the case of the education-specific negotiations, the secretariat showed an interest in extending and fostering educational aspects under the UNFCCC through the social media platform Twitter. In addition, the UNFCCC secretariat was successful in increasing the relevance of education in the UNFCCC negotiations. UNFCCC parties are now bound by the Paris Agreement to advance their actions on education.

The topic of CCE has provided the climate secretariat with opportunities to bring in its own values, problem perceptions, and policy preferences, thereby indirectly shaping the ways the fight against climate change is operationalized at global and national levels. More generally, focusing on a topic with relatively low political saliency has enabled the secretariat to gain autonomy from its principals, to actively seek a brokerage role in the CCE-related climate negotiations, and to increase its overall acceptance as a partially autonomous actor within the UNFCCC negotiations.

Information flows are rarely apparent and can often not be revealed with direct questionnaires. Hence, our study also extends the existing literature by using SNT and by conceptualizing influence in relational terms. Furthermore, we have contributed to the literature on SNT by applying it to a new empirical context and combining quantitative SNA of Twitter data with qualitative participant observations. Both the Twitter analysis and the participant observations lend further support to the argument that international treaty secretariats may be gradually moving from a rather technocratic and facilitative role to playing a proactive and influential part in international climate governance. In particular, we found evidence that with respect to CCE, the climate secretariat has increased its political influence by strategically establishing links to actors beyond the formal negotiation parties, and thereby gathering support for its preferred policy

outcomes. Together with normative leadership exerted directly vis-à-vis negotiators, the secretariat has played a key role in increasing momentum for education under the UNFCCC.

This brings us back to some of the mechanisms of influence laid out by Biermann and Siebenhüner (2009a) as well as by Jinnah (2014). We showed empirically that in the case of CCE, influence is likely due to the UNFCCC secretariat's social embeddedness and its unique position in global governance networks. In this way, we go beyond the existing literature in demonstrating empirically that the social embedding of secretariats plays a fundamental role—at least in the case of CCE. However, as our analysis shows, the relational conditions for secretariat influence can be further differentiated. In our case, the chances for influence were based, in particular, on four mechanisms employed by the UNFCCC secretariat: strategically connecting to other influential actors, enabling knowledge and communication flows, exploiting a unique position in global networks to diffuse the concept of education among many actors, and exerting normative leadership to accentuate concepts such as CCE and raise ambition for their implementation.

Although we showed that the UNFCCC secretariat plays a central role in shaping the educational agenda in the UNFCCC, our analysis was confined to the observations made during selected negotiations as well as the interpretation of Twitter data. Generalization of these conditions will require additional empirical evidence on the influence of treaty secretariats. Future research could extend these findings by collecting data on the information exchange and communication flows of convention stakeholders using network-analytical surveys at regular intervals, with the aim of capturing all relevant relations concerning the exchange of information over time. Although we have provided first empirical results regarding the role of the UNFCCC secretariat in education-specific negotiations, many questions still remain open. For example, it would be interesting to complement the results from SNA and participant observations by analyzing tweets and negotiation texts with qualitative methods such as qualitative content analysis or discourse analysis. What are the roles of the different convention stakeholders in advancing education as an agenda item?³ Have educational matters gained weight in these documents over time? To better understand how educational issues are used and shaped by the secretariats of multilateral conventions, further systematic empirical studies are urgently needed.

References

Bauer, Michael, Christoph Knill, and Steffen Eckhard. 2016. *International Bureaucracy: Challenges and Lessons for Public Administration Research*. Basingstoke, UK: Palgrave Macmillan.

3. We thank the anonymous referees for their advice in this regard.

- Bauer, Steffen. 2006. Does Bureaucracy Really Matter? The Authority of Intergovernmental Treaty Secretariats in Global Environmental Politics. *Global Environmental Politics* 6 (1): 23–49.
- Biermann, Frank, and Bernd Siebenhüner. 2009a. The Influence of International Bureaucracies in World Politics: Findings from the MANUS Research Programme. In *Managers of Global Change: The Influence of International Environmental Bureaucracies*, edited by Frank Biermann and Bernd Siebenhüner, 319–350. Cambridge: MIT Press.
- Biermann, Frank, and Bernd Siebenhüner. 2009b. *Managers of Global Change: The Influence of International Environmental Bureaucracies*. Cambridge, MA: MIT Press.
- Biermann, Frank, Bernd Siebenhüner, Steffen Bauer, Per-Olof Busch, Sabine Campe, Klaus Dingwerth, Torsten Grothmann, Robert Marschinski, and Mireia Tarradell. 2009. Studying the Influence of International Bureaucracies: A Conceptual Framework. In *Managers of Global Change: The Influence of International Environmental Bureaucracies*, edited by Frank Biermann and Bernd Siebenhüner, 37–74. Cambridge, MA: MIT Press.
- Bogdan, Robert, and Sari Knopp Biklen. 1992. *Qualitative Research for Education: An Introduction to Theory and Methods*, 2nd ed. Boston: Allyn and Bacon.
- Borgatti, Stephen, and Virginie Lopez-Kidwell. 2011. Network Theory. In *The SAGE Handbook of Social Network Analysis*, edited by John Scott and Peter Carrington, 40–54. London, UK: SAGE.
- Borgatti, Stephen, Ajay Mehra, Daniel Brass, and Giuseppe Labianca. 2009. Network Analysis in the Social Sciences. *Science* 323 (5916): 892–895.
- Borgatti, Stephen, and Brandon Ofem. 2011. Overview: Social Network Theory and Analysis. In *Social Network Theory and Educational Change*, edited by Alan Daly, 17–30. Cambridge, MA: Harvard Education Press.
- Burt, Ronald. 1982. *Toward a Structural Theory of Action: Network Models of Social Structure, Perception and Action*. New York: Academic Press.
- Busch, Per-Olof. 2009. The Climate Secretariat: Making a Living in a Straitjacket. In *Managers of Global Change: The Influence of International Environmental Bureaucracies*, edited by Frank Biermann and Bernd Siebenhüner, 245–264. Cambridge, MA: MIT Press.
- Chan, Sander, Harro van Asselt, Thomas Hale, Kenneth Abbott, Marianne Beisheim, Matthew Hoffmann, Brendan Guy, Niklas Höhne, Angel Hsu, Philipp Pattberg, Pieter Pauw, Céline Ramstein, and Oscar Widerberg. 2015. Reinvigorating International Climate Policy. A Comprehensive Framework for Effective Nonstate Action. *Global Policy* 6 (4): 466–473.
- Christopoulos, Dimitrios, and Karin Ingold. 2015. Exceptional or Just Well Connected? Political Entrepreneurs and Brokers in Policy Making. *European Political Science Review* 7 (3): 475–498.
- climateconference. 2015a. *Article 6 Becomes Action for Climate Empowerment—ACE*. Available at <https://www.youtube.com/watch?v=ZzuoiX4ygaM&feature=youtu.be>, accessed December 20, 2016.
- climateconference. 2015b. *Christiana Figueres Asking for a New for Article 6 of the Convention*. Available at <https://www.youtube.com/watch?v=XUobVu0Mky4&feature=youtu.be>, accessed December 20, 2016.
- Coleman, James. 1998. Social Capital in the Creation of Human Capital. *American Journal of Sociology* 94: 95–120.

- Conover, Michael, Jacob Ratkiewicz, Matthew Francisco, Bruno Gonçalves, Alessandro Flammini, and Filippo Menczer. 2011. Political Polarization on Twitter. In *Proceedings of the Fifth International Conference on Weblogs and Social Media*, 89–96. Menlo Park, CA: AAAI Press.
- Creswell, John. 2009. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 3rd ed. Thousand Oaks: SAGE.
- Dimitrov, Radoslav. 2010. Inside UN Climate Change Negotiations: The Copenhagen Conference. *Review of Policy Research* 27 (6): 795–821.
- Dubois, Elizabeth, and Devin Gaffney. 2014. The Multiple Facets of Influence. Identifying Political Influentials and Opinion Leaders on Twitter. *American Behavioral Scientist* 58 (10): 1260–1277.
- Giddens, Anthony. 2011. *The Politics of Climate Change*, 2nd ed. Cambridge, UK: Polity Press.
- Granovetter, Mark. 1973. The Strength of Weak Ties. *American Journal of Sociology* 78 (6): 1360–1380.
- Guo, Chao, and Gregory Saxton. 2014. Tweeting Social Change: How Social Media Are Changing Nonprofit Advocacy. *Nonprofit and Voluntary Sector Quarterly* 43 (1): 57–79.
- Hickmann, Thomas. 2016. The Evolution of the UNFCCC Secretariat: How the Climate Secretariat Is Breaking Out of Its Straitjacket. Unpublished paper presented at the 57th Annual Convention of the International Studies Association (ISA), Atlanta, GA, March 16–19.
- Ibarra, Herminia. 1993. Network Centrality, Power, and Innovation Involvement: Determinants of Technical and Administrative Roles. *Academy of Management Journal* 36 (3): 471–501.
- Ingold, Karin, and Philip Leifeld. 2014. Structural and Institutional Determinants of Influence Reputation: A Comparison of Collaborative and Adversarial Policy Networks in Decision Making and Implementation. *Journal of Public Administration Research and Theory* 26 (1): 1–18.
- Jinnah, Sikina. 2010. Overlap Management in the World Trade Organization: Secretariat Influence on Trade-Environment Politics. *Global Environmental Politics* 10 (2): 54–79.
- Jinnah, Sikina. 2011. Marketing Linkages. Secretariat Governance of the Climate-Biodiversity Interface. *Global Environmental Politics* 11 (3): 23–43.
- Jinnah, Sikina. 2014. *Post-Treaty Politics: Secretariat Influence in Global Environmental Governance*. Cambridge, MA: MIT Press.
- Johnson, Tana. 2014. *Organizational Progeny: Why Governments Are Losing Control over the Proliferating Structures of Global Governance*, 1st ed. Oxford: Oxford University Press.
- Jørgens, Helge, Nina Kolleck, and Barbara Saerbeck. 2016. Exploring the Hidden Influence of International Treaty Secretariats: Using Social Network Analysis to Analyse the Twitter Debate on the “Lima Work Programme on Gender.” *Journal of European Public Policy* 23 (7): 979–998.
- Jørgens, Helge, Nina Kolleck, Barbara Saerbeck, and Mareike Well. 2017. Orchestrating (Bio-)Diversity. The Secretariat of the Convention of Biological Diversity as an Attention-Seeking Bureaucracy. In *International Bureaucracy: Challenges and Lessons for Public Administration Research*, edited by Michael Bauer, Christoph Knill, and Steffen Eckhard, 73–95. Basingstoke, UK: Palgrave Macmillan.
- Kent, Avidan. 2014. Implementing the Principle of Policy Integration: Institutional Interplay and the Role of International Organizations. *International Environmental Agreements* 14 (3): 203–224.

- Kolleck, Nina. 2009. Business Power for Sustainable Development: The Role of Discourses. *RGSA Journal* 3 (2): 108–123.
- Kolleck, Nina. 2013. How Corporations Wield Their Power. In *Handbook of Global Companies*, edited by John Mikler, 143–152. Oxford: Wiley-Blackwell.
- Kolleck, Nina. 2014. Qualität, Netzwerke und Vertrauen: Der Einsatz von Netzwerkanalysen in Qualitätsentwicklungsprozessen. *Zeitschrift für Erziehungswissenschaft* 17 (6): 159–177.
- Kolleck, Nina. 2016. Uncovering Influence Through Social Network Analysis: The Role of Schools in Education for Sustainable Development. *Journal of Education Policy* 31 (3): 308–329.
- Lazer, David, Alex Pentland, Lada Adamic, Sinan Aral, Albert-László Barabási, Devon Brewer, Nicholas Christakis, Noshir Contractor, James Fowler, Myron Gutmann, Tony Jebara, Gary King, Michael Macy, Deb Roy, and Marshall Van Alstyne. 2009. Computational Social Science. *Science* 323 (5915): 721–723.
- Leontief, Wassily. 1941. *The Structure of American Economy, 1919–1929: An Empirical Application of Equilibrium Analysis*. Cambridge, MA: Harvard University Press.
- Mejova, Yelena, Ingmar Weber, and Michael Macy. 2015. *Twitter: A Digital Socioscope*. New York: Cambridge University Press.
- Merriam, Sharan. 1998. *Qualitative Research and Case Study Applications in Education*, 2nd ed. San Francisco: Jossey-Bass.
- Michaelowa, Katharina, and Axel Michaelowa. 2016. The Growing Influence of the UNFCCC Secretariat on the Clean Development Mechanism. *International Environmental Agreements: Politics, Law and Economics* 17 (2): 247–269.
- Sabatier, Paul, and Hank Jenkins-Smith. 1993. *Policy Change and Learning: An Advocacy Coalition Approach*. Boulder, CO: Westview Press.
- Seeley, John. 1949. The Net of Reciprocal Influence: A Problem in Treating Sociometric Data. *Canadian Journal of Psychology* 3 (4): 234–240.
- Smith, Jason, Daniel Halgin, Virginie Lopez-Kidwell, Giuseppe Labianca, Daniel Brass, and Stephen Borgatti. 2014. Power in Politically Charged Networks. *Social Networks* 36: 162–176.
- Uhl, André, Nina Kolleck, and Edgar Schiebel. 2017. Twitter Data Analysis as Contribution to Strategic Foresight—The Case of the EU Research Project “Foresight and Modelling for European Health Policy and Regulations” (FRESHER). *European Journal of Futures Research* 5 (1).
- UNESCO. 2015. *Not Just Hot Air: Putting Climate Change Education into Practice*. Available at www.uncclearn.org/sites/default/files/inventory/unesco01_0.pdf, accessed March 22, 2017.
- UNFCCC. 1992. United Nations Framework Convention on Climate Change. Report FCCC/INFORMAL/84. Available at <https://unfccc.int/resource/docs/convkp/conveng.pdf>, accessed March 22, 2017.
- UNFCCC. 2014a. Report of the Conference of the Parties on Its Twentieth Session. Part Two: Action Taken by the Conference of the Parties at Its Twentieth Session. Report FCCC/CP/2014/10/Add.3. Available at <http://unfccc.int/resource/docs/2014/cop20/eng/10a03.pdf>, accessed March 22, 2017.
- UNFCCC. 2014b. Summary Report on the 2nd Dialogue on Article 6 of the Convention: Note by the Secretariat. Report FCCC/SBI/2014/15. Available at <http://unfccc.int/resource/docs/2014/sbi/eng/15.pdf>, accessed March 22, 2017.

- UNFCCC. 2015. Summary Report on the 3rd Dialogue on Article 6 of the Convention. Report FCCC/SBI/2015/15. Available at <http://unfccc.int/resource/docs/2015/sbi/eng/15.pdf>, accessed March 22, 2017.
- UNFCCC. n.d. [2015a]. Climate Education and Training: Getting Equipped to Shape the Future. The Article 6 Dialogue. Available at <http://newsroom.unfccc.int/lima/article-6-climate-education-and-training/>, accessed March 22, 2017.
- UNFCCC. n.d. [2015b]. Education Day, 4 December 2015. Available at http://unfccc.int/cooperation_support/education_outreach/overview/items/9192.php, accessed March 22, 2017.
- UNFCCC. n.d. [2015c]. First Education Day to Reach Everyone at COP21. Available at <http://newsroom.unfccc.int/unfccc-newsroom/a-first-education-day-to-reach-everyone-at-cop21/>, accessed March 22, 2017.
- UNFCCC. n.d. [2015d]. Youth for Climate Action. Conference of Youth. Available at http://unfccc.int/cooperation_and_support/education_and_outreach/youth/items/8966.php, accessed March 22, 2017.
- UNFCCC. 2016a. Action for Climate Empowerment. Available at http://unfccc.int/files/cooperation_and_support/education_and_outreach/application/pdf/unfccc_adriana_valenzuela.pdf, accessed March 22, 2017.
- UNFCCC. 2016b. Report of the Conference of the Parties on its Twenty-First Session, held in Paris from 30 November to 13 December 2015. Report FCCC/CP/2015/10/Add.1. Available at <http://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf>, accessed March 22, 2017.
- UNFCCC. 2016c. Review of the Doha Work Programme on Article 6 of the Convention. Draft Conclusions Proposed by the Chair. Report FCCC/SBI/2016/L.15/Add.1. Available at <http://unfccc.int/resource/docs/2016/sbi/eng/l15a01.pdf>, accessed March 22, 2017.
- UNFCCC. n.d. [2016d]. *United Nations Alliance on Climate Change: Education, Training and Public Awareness*. Available at http://unfccc.int/cooperation_and_support/education_and_outreach/education_and_training/items/8958.php, accessed March 22, 2017.
- United Nations. n.d. [2015]. *Lima-Paris Action Agenda Matures into Major Force Driving Climate Action*. Blog Post, Sustainable Development Goals blog, December 9, 2015. Available at www.un.org/sustainabledevelopment/blog/2015/12/lima-paris-action-agenda-matures-into-major-force-driving-climate-action/, last accessed March 22, 2017.
- Verweij, Stefan, Erik-Hans Klijn, Jurian Edelenbos, and Arwin van Buuren. 2013. What Makes Governance Networks Work? A Fuzzy Set Qualitative Comparative Analysis of 14 Dutch Spatial Planning Projects. *Public Administration* 91 (4): 1035–1055.
- White, Harrison. 2008. *Identity and Control: How Social Formations Emerge*, 2nd ed. Princeton, NJ: Princeton University Press.
- Williams, Hywel, James McMurray, Tim Kurz, and Hugo Lambert. 2015. Network Analysis Reveals Open Forums and Echo Chambers in Social Media Discussions of Climate Change. *Global Environmental Change* 32: 126–138.
- Xu, Weiai, Yoonmo Sang, Stacy Blasiola, and Han Park. 2014. Predicting Opinion Leaders in Twitter Activism Networks: The Case of the Wisconsin Recall Election. *American Behavioral Scientist* 58 (10): 1278–1293.