MAPPING THE "ENVIRO-SECURITY" FIELD. RIVALRY AND COOPERATION IN THE CONSTRUCTION OF KNOWLEDGE.

Abstract: This article maps out the network of researchers on environmental security from the end of the 1980s to 2014, providing a systematic analysis of how the research is organized in this interdisciplinary field. First, we use the Web of Science database to generate a co-citation analysis that exhibits the cognitive structure of the field. Second, to understand the structure of academic debates inside the field over time, we conduct 20 interviews that uncover relationships of cooperation, rivalry and conflict. We find that central authors have had a long-lasting influence on the field despite the evolution of their productivity. The field is composed of six fairly structured groups as well as a few peripheral authors. These groups can be distinguished by their epistemological and methodological choices, as well as geographical centre of gravity. Although researchers work for the advancement of knowledge, they are also part of a competitive space in which they struggle to be recognized as authoritative scientific actors.

Keywords: scientific field; sociology of knowledge; environmental security; co-citation analysis;

Since the 1980s, the topic of environmental security has grown in popularity. Climate change is now regarded as a security threat by the United Nations Security Council (UNSC):

> We must make no mistake. The facts are clear. Climate change is real, and it is accelerating in a dangerous manner. It not only exacerbates threats to international peace and security, it is (itself) a threat to international peace and security.[1]

Policymakers and researchers have put the argument forward that the drought in Syria (due to climate change) was a causal factor in the outbreak of the conflict.[2] In its Fifth Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) devotes a chapter to the links between climate change and security (IPCC 2014). In June 2015, the G7 summit has focused on the threat posed by climate-fragility risks and has intended to tackle the issue in preparation of the Conference of the Parties to the United Nations Framework Convention on Climate Change in Paris in December the same year (COP21).

In the scientific community, however, the consensus about the relationship between the environment and violent conflict is weaker.[3] Scholars have been studying the impact of environmental factors on international peace and security for decades (Homer-Dixon, 1994; Lee, 2009). After the end of the Cold War, scholars opened the debate on whether the environment should integrate security studies as a new variable (Brown, 1977; Ullman, 1983). This debate led them to consider two kinds of questions: Is climate change a new cause of war? How will climate change affect security issues? As scientists wrote more about this topic during the 1990s, the environment became an important concern in International Relations as well as in other disciplines in the humanities. Research has also been conducted in political science, geography, and economics, as well as in sociology.

As three recent special issues show, academic contributions on the links between the environment and security are still hotly debated.[4] In 2013, a comprehensive study was published in the journal *Science*. It was widely reported in international press as it came out just before the release of the IPCC report (Hsiang et al. 2013).[5] This study compiles quantitative data already available to demonstrate that there exists strong causal evidence linking climatic events to human conflict. It perpetuates a longstanding dispute with the Peace Research Institute of Oslo (PRIO) through its research director H. Buhaug even though authors from other institutions have joined his side. S. Hsiang, M. Burke and E. Miguel have established patterns of human conflicts caused by climate change on a global scale. H. Buhaug and its colleagues from PRIO find the same kind of empirical evidence only in certain contexts. First, they disagree on the nature of the relationship between climate and conflict. While Hsiang et al. have been on the front stage stating that climate is a cause of conflict, Buhaug et al. have developed a cautious tale about the linkages between the environment and security. Second, on the methodological side, the main contention between the authors is about the variable to use in meta-analysis to test the relationship between climate and conflict. Furthermore, the dispute focuses on how the empirical evidence should be interpreted. It has reached the point where a "call for peace" between researchers has been made (Solow, 2013). [6]

This suggests that environmental security can be described as a scientific field where controversies, debates and collaboration take place among researchers who are socially situated. We call it the “enviro-security” (ES) field because it is mainly concerned with the links between the environment and security. How did this field come about? How is it structured today? To analyse the structure of academic debates over time, this article

examines the production of knowledge on the environment and security. By defining ES as a scientific field (Bourdieu, 1975) we want to stress the fact that it is a competitive space wherein struggles take place for the monopoly of scientific authority. Social scientists, Bourdieu argues, experience duality in their practices as academics:

> Every scientific choice - the choice of the area of research, the choice of methods, the choice of the place of publication, the choice between rapid publication of partly checked results and later publication of fully checked results - is in one respect - the least avowed, and naturally the least avowable - a political investment strategy, directed, objectively at least, towards maximisation of strictly scientific profit, i.e. of potential recognition by the agent's competitor-peers. (Bourdieu 1975: 22)

In line with this view, Collins (1998) shows that an intellectual network is a constrained market where symbolic struggles take place in order to gain eminence and recognition. Bourdieu (1975) and Collins (1998) describe the competitive nature of the scientific field. In scientific fields, we expect to observe "coalitions of the mind", i.e., competing groups.[7] By forming arguments and lineages, groups struggle for eminence within the field. From Collins' view, groups can be metaphorically represented as rival camps. The production of knowledge does not only stem from a pure interest in science. It is a socially situated activity through which its actors look for recognition as legitimate speakers. Thus, we expect to encounter rivalries, conflict and disagreements. In the ES field, researchers disagree on three main issues: the securitization of the environment and climate change,[8] the measure of climate change's impacts on society and the interpretation of empirical evidences.[9] Conflicts arise not only from those disagreements but also from intrinsic rivalries of the scientific field. We conceive rivalry as the social state of the scientific field in which actors are engaged in a competition to claim their legitimacy. They are "competitor-peers": statistical studies published in highly recognized journals (*Journal of Peace Research, Science* or *International Security*) get a lot of attention contrary to

qualitative case studies, area oriented, published in specialized journals. As researchers form lineages, coalitions and cooperation are other defining aspects of the scientific field. Researchers cooperate when they offer explicit support to each other, sustain relationships formally or informally, [10] or when they train new researchers to continue their work.

The idea that the ES field is made up of well-structured groups is more often assumed than empirically demonstrated. By looking at the content of scientific contributions, authors have reached the conclusion that the field is fragmented (Deligiannis, 2012; Floyd and Matthew, 2013). Indeed, they have shown that this is not a homogeneous field but a "polysemous category" with different approaches and methodologies (Floyd and Matthew, 2013). As Ronnfeldt has shown, research on the environment and security is a three-generation field (Ronnfeldt, 1997). In the early 1980s, a first generation focused on the integration of environment factors into the concept of security (Brown, 1977; Ullman, 1983). The second generation used case studies to identify empirically the pathways from environmental stress to conflicts (Homer-Dixon 1994). Finally in the late 1990s, the third generation offered renewed methodological means to investigate the links between environmental degradation and international security (Hauge and Ellingsen, 1998; Gleditsch, 1997). Dalby et al. described three phases of environmental security, differentiating them according to their institutional affiliations (Dalby and Brauch and Oswald Spring, 2009).

Our paper draws from previous understandings of the field the idea that it is divided. But we conceive this heterogeneity as a marker of its competitive nature. We thus adopt a sociological look on the evolving ES field. To find out how the field has been structured, we first ask the following questions: Who are the leading researchers? What are their

relevant publications? What are their institutional affiliations? (Reid and Chen, 2007). Is there evidence of substantial sub-networks according to geography and research programs objectives? We analyse co-citations relationships at the early stages of the empirical research (1990-1999).[11] Then, we focus on the 2000-2007 period. Finally, we analyse the field from 2008 until 2014. As the field is a "constrained market" we expect that its organization and its actors' positions in it change over time. In fact, scholars believed to be "prime movers" in the 1990s don't necessarily take part to the debates any more.

The analysis picks up authors belonging to six different groups as well as peripheral authors. Although no single author dominates, we point out to a core couple of researchers who seem to remain essential through time (T. Homer-Dixon and N.P. Gleditsch). The cognitive base of the field is composed of scientific publications from the early 1990s. We refer to it as the original group. It stills plays a significant part in 2014. Overall, we show that the research is mostly led by North American and North European groups (Canada, US and Scandinavian countries).

Co-citation analysis offers an incomplete map of the field as the social content of citations relationships is ignored. To understand how the field came about, we need to look for the meaning of those relationships. Semi-structured interviews with 20 researchers are used to triangulate the systematic evidence on their scientific publications by bringing the narratives behind relations of intellectual proximity, uncovering patterns of cooperation, rivalry, and sometimes conflict. Interviews corroborate the existence of "rival camps" or groups while they help to nuance the mainstream view of the field as being only contentious.

The paper is organized as follows. First, we present our methodological design. Then we present the results of our analysis. Finally, we discuss the social network of people working on the environment and security.

METHODOLOGY

Our analysis relies on a combination of methodological tools. We first use bibliometrics to perform a co-citation analysis. This helps unveiling intellectual relationships between scientists. The data offers a formal look at those relationships. Then we conduct 20 semi-structured interviews to balance the results from the co-citation analysis. Using interviews, we analyse the structure of the field from another standpoint.

TOOLS AND DATA SOURCE

While bibliometrics has been, in recent years, increasingly used for the evaluation of researchers and institutions, one of its historical uses has been to provide empirical data on the structure of the scientific community (Cole and Cole 1973; Merton, 1973). Among bibliometric methods that allow for such measurements, author co-citation analysis, which is based on the frequency at which authors appear together in the bibliography of scientific documents (Small and Griffith, 1974), is probably the most well-known. According to McCain, author co-citation analysis "can be used to produce empirical maps of prominent authors in various areas of scholarship" (McCain, 1990: 433).

We aim to measure and visualize the size and the composition of the network of researchers working on environmental security. Compiling the data, we look systematically at the

structure of interpersonal relations, and thus, analyse linkages among pairs of researchers. To identify core researchers we borrow tools from social network theory. First, we measure the centrality of actors in the network, which can be defined as the sum of the links one entity has (Freeman, 1979). This measure is used as an indicator of influence, popularity and prestige (Carrington and Scott, 2011) and, thus, can quantify actors' prominence in the network (Knoke and Yang, 2008). Centrality deals with actors' involvement in many relations whereas prestige is "the extent to which a social actor in a network "receives" or "serves as the object" of relations sent by others in the network" (Knoke and Yang, 2008). It allows us to understand the positions of the actors within the structure. Second, we capture the relationships between actors' positions. Are there ties among actors? Do some actors have fewer ties than others? Are there sub-groups (clusters)? (Hanneman and Riddle, 2011). Following these guidelines, we are not only able to locate the main actors in the network, but we can also reveal intellectual ties between them.

A co-citation occurs when two papers appear in the same bibliography (Small and Griffith 1974). Two different names referenced together in several articles suggest a connection or proximity (social or cognitive) between the two persons. We want to know who is linked to whom and how closely because that can reveal both social and intellectual structures within a field of inquiry (White, 2011).

In order to conduct a co-citation analysis, one needs to compile bibliometric data using a citation index. The database we use in this paper is the *Web of Science* (*WoS*) which is the most used database for bibliometric analyses. [12]

KEYWORDS AND CORPUS

Bibliometrics allows us to create a corpus from which we can analyse authors' relationships. We constituted a list of keywords. In order to be systematic, we listed the words and expressions likely to articulate the environment and security. The query on the *WoS* has been made following those keywords listed in Table 1 (see the appendix). We applied keywords to titles only, given that the abstracts of the papers were not indexed in the database before 1996.[13]We also focus on a list of scientific journals. In exploratory trials, we indiscriminately searched disciplines and journals which led to thousands of occurrences. However, the majority of the results were either false positives (articles that should not have been retrieved) or false negatives (titles that should appear but do not). The fact that social sciences are at a disadvantage in terms of indexation led us to narrow our query further. To select the list of journals, we use the results of previous queries and search for the most recurrent journals, whose indexed articles titles match the keywords. We also use the compiled data derived from Buzan & Hansen (Buzan and Hansen, 2009). Their work investigated the history and evolution of international security studies. They identified major journals in the discipline. We assume that the link between the environment and security has been well covered by those journals. Finally, we also look at secondary sources like existing literature reviews to include the most relevant journals. Table 2 lists the journals selected (see the appendix). On the whole, we isolate 492 titles that form our corpus from which the co-citation analysis is produced.

INTERVIEWS

We performed 20 semi-structured interviews to enrich the formal aspect of the mapping. To conduct our interviews, we selected individuals that show up on the map from the core to the periphery. We assume the central nodes represent the most important people, so we

chose to begin with them. We refined our list of interviewees based on the knowledge gathered in exploratory interviews. A few researchers who did not appear on the map were nonetheless interviewed, as they were considered as important by their colleagues. We carried out interviews up to one and a half hour, with the aim of obtaining three main information. First, what do they think is the current organization of the field? Second, how do they think the field has evolved? Finally, we triangulated the results of the co-citation analysis with their perceptions of who was/is involved in the field. Who is important? We proceeded in two steps. First, interviewees were invited to give their own interpretation of the relationships laid out by bibliometrics. What did they see? Second, we asked them to define their position, status and affiliation. Who did they feel closest to? On the one hand, we are able to validate the existence of groups or "camps". On the other hand, we can nuance this vision of conflictuality by taking into account actors' interpretation of their positions.[14]

EMPIRICAL ANALYSIS

In this section we present the findings of the co-citation analysis, as well as elements of corroboration from the interviews. We analyse its organization and shape between 1990 and 2015. Generating a systematic map of the ES field, we highlight six visible groups of research that we present chronologically. The co-citation analysis shows the "Toronto group" understood as the group of people that have worked under the supervision of T.

Homer-Dixon in the early 1990s. After 1999, only Homer-Dixon appears in the data. We prefer to focus on the original group that published seminal theoretical and empirical work on the links between environmental degradation and violence, rather than maintaining a blurred idea about the "Toronto group" (the "prime movers"). This original group is not homogeneous as the first debates occurred within it (Homer-Dixon and Levy, 1996). We also find that scholars from Scandinavian countries form a specific group either called the "PRIO group" or the "Oslo group". This group is quite homogeneous and it revolves around NP Gleditsch. It is the most represented group. It is indeed much institutionalized and it is the only one to "own" two academic journals (Journal of Peace Research and Security Dialogue). There is a group of scholars working together through the Robert Strauss Centre at the University of Texas, Austin. They participate in the "*Climate Change and African Political Stability Program* (CCAPS). We call them schematically the "CCAPS group". We find the "Berkeley group" as being a prominent group especially after 2009. This is a small group as only three scholars are part of it. This group is more oriented toward econometrics compared to the others that belong to social sciences. We mention two other European groups that seem to be less important. Data single out two scholars (T. Bernauer and V. Koubi) from a Swiss based group that we call the "ETH Zurich" group. T. Bernauer is the research leader of the group "international political economy" based at the Centre for Comparative and International Studies. This group focuses on the conditions under which international environmental and economic problems can be solved. Climate change is conceived as one of the many variables that can impact society and induce political violence (Koubi et al. 2014). Data also show one researcher (J. Scheffran) from the University of Hamburg, who leads the Research Group on Climate Change and

Security, the "CLISEC group". We expect people's importance in the network to vary with their productivity: those who contributed to the research in the early 1990s don't necessarily work on those issues anymore and, consequently, we expect that actors' positions might change through time. In fact, the analysis shows the constant presence of the original group that opened the way for the empirical investigation of the linkages between the environment and security. We also highlight a core couple of researchers that survives across time but we do not single out one researcher as dominant.

THE FIELD BETWEEN 1990 AND 2015

a- 1990-99: the pioneers

Figure 1: The early research 1990-1999

Figure 1 represents the cognitive base of research on environmental security. It is a small and loose network with a diffuse core.[15] During that time, the research is led by a few political scientists. It originates mainly from North America with a few exceptions. Thomas Homer-Dixon is at the core of the early empirical research as it is the biggest node in the network. He led the first empirical and systematic projects on environmental stress and violence after he published a seminal article in *International Security* in 1991 ("On the Threshold: Environmental Changes as Causes of Acute Conflict").[16] Scholars from the field we interviewed confirm his status as a pioneer because he paved the way for a new way to think about environmental stress. Nevertheless, the figure shows that he is not the only dominant actor. In fact, the network is also composed of scholars who initiated a conversation on whether it was relevant or not to broaden the concept of security after the

end of the Cold war. That is the case with L. Brown (1977), J. Tuchman Mathews (1989), A. Westing (1989) and B. Buzan (1991) with whom T. Homer-Dixon is co-cited. Those authors are part of the network as they all stress the importance of including environmental factors as security concerns. Furthermore, the network is characterized by the closeness between T. Homer-Dixon and N. Myers as well as R. D. Kaplan who appear on the map. Myers wrote a seminal article in 1989 pointing to the emerging risks of climate change (Myers 1989). Kaplan published a famous article, "The Coming Anarchy", in 1994. This article intended to link scarcity, overpopulation and violence (Kaplan 1994). Kaplan explicitly cites T. Homer-Dixon. P. Gleick (1991) and M. Renner (1996) are also two early contributors of the academic movement that has aimed to connect the environment and security.[17] The co-citation analysis doesn't give much importance to G. Baechler although he has been Homer-Dixon's European counterpart in the early 1990s (he is not visible on the map).[18] They were both working on the same issues at the same time using similar methodologies (case studies). Baechler led the Environment and Conflicts Project in Zurich, Switzerland, which has investigated the causal relationship between environmental damage and degradation and actual or possible conflicts. Although scholars mention Baechler's influence (they know he has published work on the subject), he does not show up as an essential contributor. The reason why he does not appear in the map lies in the fact he was less cited in the first place. Therein, the US centric nature of the early ES research can explain that.[19]

Figure 1 illustrates the first disagreements too. After Homer-Dixon's first publications from 1991 to 1998, scholars like M. Levy (1995), D. Deudney (1990, 1991) N. P. Gleditsch

(1998) and S. Dalby (1992) started publishing pieces questioning the soundness and risks of linking environmental issues to security. In particular, D. Deudney refuted this idea that resource scarcity would lead to war. From the mid-1990s, those scholars were engaged in debates. Sometimes these are referred to as a "dispute" between the Toronto group and the Oslo group led by N.P. Gleditsch.[20] What is meant by the Toronto group is mainly T. Homer-Dixon and his co-authors, i.e., research assistants and students.[21] This emerging debate concerns mainly Homer-Dixon and Gleditsch. Indeed, data show that Homer-Dixon has been co-cited with Hauge (1998) who co-authored an article with empirical interests and conclusions similar to Homer-Dixon's. W. Hauge is a member of the Peace Research Institute of Oslo, like N. P. Gleditsch. We will see later that it is more complex than that but it is worth noting that from 1998 onward, as Gleditsch publishes a critique on "Armed conflict and the Environment", he represents the other "camp".

b- 2000-07: a denser field

Figure 2: A growing field of research 2000-2007

Figure 2 is a simplified picture of the field as it becomes more complex. More researchers are involved.[22]We notice the intellectual base of the research located at the periphery of the network (early authors circle the network). T. Homer-Dixon is still highlighted as a central actor and he is situated at the crossroad between original research and new research. Being a pioneer, he acts as a bridge and he is a reference as he keeps showing up in the network although his last published empirical work on the subject goes back to 1998 (his work is published in two major books in 1998 and 1999). Figure 2 shows how strong the intellectual base of ES is as we find the same scholars with the highest number of co-

citation relationships (Gleick, Levy, Hauge, Myers, Mathews, Deudney ect…). During that time, the field is divided between the original research led by Homer-Dixon's case studies and deductive approaches, and PRIO research led by N.P. Gleditsch. The debate between Homer-Dixon and Gleditsch is primarily a methodological debate. How can one best solve the empirical question of whether environmental stress induces conflict? The disagreements between Gleditsch and Homer-Dixon thus constitute the second intellectual base of the research on environmental security. They are often co-cited because they represent the driving forces of the research.

c- ***2008-2014: the ES field today***

Figure 3: Recent research 2008-2014

Figure 3 is again, a simplified map of the field. In fact, the network becomes so dense that it is hard to pick up authors' names.[23] At the core, we find three contemporary groups of research often referred as the "Oslo group", the "Berkeley group" and the "CCAPS group".[24] The "CCAPS group" is notably composed of Joshua Busby, Clionadh Raleigh, Idean Salehyan and Cullen Hendrix. Quantitative methodology is at the heart of the project.[25] One of the main objectives of this group is to know where and how climate change poses threats to stability in Africa (Salehyan and Hendrix, 2012). On the one hand, the data shows the dominance of Gleditsch, Buhaug and Theisen (Buhaug's PhD student) from PRIO. On the other hand, it shows a close relationship between Hsiang, Burke and Miguel from the University of California-Berkeley. [26]In fact, the co-citation analysis highlights the ongoing quarrel identified in interviews between these two groups. Hsiang et al. start publishing on climate and conflict in 2010.[27] Since then, they have been engaged

in methodological debates with Buhaug et al. Hsiang and al. are not war and peace researchers contrary to PRIO researchers. They tend to be closer to econometrics and use mathematical models to test the influence of environmental events on conflict (Hsiang et al. 2013). In fact, they are trained in climate physics and economics.

The analysis catches the intense exchanges occurring between these two rival groups from 2010 until the 2014 *Climatic Change* commentary "One effect to rule them all? A comment on climate and conflict". 26 authors co-signed a comment directed against the work of the "Berkeley group".[28] Several authors of this comment appear on the map: Buhaug, Bernauer, Koubi, Brzoska, Busby, Fjelde, Gartzke, Gleditsch, Hegre, O'Loughlin[29], Raleigh, Scheffran, Theisen, Urdal. These scholars belong to four different groups that formed a coalition against the "Berkeley group". There is the "Oslo group" (Buhaug, Fjelde, Gleditsch, Hegre, Theisen, Urdal), the Swiss Federal Institute of Technology – the "ETH Zurich group" – (Bernauer and Koubi), the "CCAPS group" (Busby, Raleigh), the "CLISEC group" from Hamburg, Germany (Brzoska, Scheffran). We notice that the research has developed outside North America and Norway; there is a growing field in Europe especially in Germany (CLISEC, Max Planck Institute). CLISEC has been launched in 2009 as a multi-disciplinary group of research, working with the Institute of geography of Hamburg University. CLISEC members use a vast array of methods including qualitative methods as well as data and modeling tools (Scheffran et al. 2012). Scheffran is often co-cited with Gleditsch and Buhaug as CLISEC research program is quite similar to PRIO's. CLISEC emphasizes the need to answer why there is a relationship between climate and conflict if data say so. CLISEC members also conduct fieldwork to take local complexities as a major variable in the relationship (Scheffran et al. 2014).

Furthermore, on the right side of the map we see the original group with Homer-Dixon who is still an essential reference in the field even though he is not an active member in terms of publications. At the periphery, we find critical voices like Dalby and Barnett, Adger and Peluso. Barnett and Adger are geographers, as well as Peluso. Dalby is more oriented towards critical geopolitics. The network represents the empirical research on climate and conflict and as such, the data we compiled does not give a lot of weight to publications about human security, peacebuilding or adaptation.[30] This can explain why we find these authors at the periphery. It seems like the research on environmental security in the climate conflict aspect is mainly a methodological discussion between two quantitative groups, i.e., the "Berkeley group" and the "Oslo group". In the meantime, the field seems to continue a typical configuration with Homer-Dixon and Gleditsch as two unshakeable pillars.

d- 1990-2014: a general depiction of the ES field.

Figure 4: The ES field 1990-2014

Figure 4 is a general snapshot of the co-citation network of authors cited by papers on environmental security. It sums up figures 1, 2 and 3. It is more comprehensive. It is interesting to see that the network is centralized around two authors although, again, no single researcher is dominant. Homer-Dixon and Gleditsch maintain a central position through time, as leaders of two distinct research agendas. On the left side of the network, we find the original group (Ullman, Brown, Mathews, Myers), empirical validations of Homer-Dixon's work (Renner, Gleick, Kahl, Brauch), and early critics of his work (Deudney, Levy). On the right side, we look at the mid-90s research first led by Gleditsch

through PRIO and perpetuated by his pupils (Buhaug, Urdal, Hauge…) through the 2000s. Figure 4 also picks up the actual methodological debate between Buhaug and the "Berkeley group" composed by Hsiang, Burke and Miguel. As we will discuss this later, we find CCAPS people (Hendrix, Raleigh, Salehyan, Busby) "navigating" between PRIO people as they sustain strong collaborations with them. The same remark applies to other European scholars like Bernaeur (ETH Zurich), Scheffran (CLISEC Hamburg) and Adono (Max Planck Institute, Munich). The left side of the network is more case study oriented whereas the right side is more oriented towards statistical methods to assess the relationship between the environment and conflicts. Both of them use deductive and positivist approaches. The divide is foremost an epistemological divide. What counts as knowledge? At the periphery, we find scholars who use different frameworks. For most of them, political science and war theories are not satisfying to think about the ways the environment impacts social behaviours. Dalby, Hartmann, Peluso, and Adger share roots in political geography and geopolitics. They contribute to the research as critical voices.

DISCUSSION: BETWEEN COLLABORATION, RIVALRY AND CONFLICT

Our analysis unveiled some of the core researchers of the ES field. Some of them are not active any more (Homer-Dixon, Myers, Kahl), and a new generation of scholars is emerging (PRIO). Focusing on the temporal dimensions of the field, we expected to witness the changing configuration of the research, i.e., that new actors would have replaced the "founding fathers" in terms of centrality. It is not the case. Instead, we find a relatively static field in terms of co-citations. In the next two paragraphs, we discuss the

organization of the field using qualitative information. It has emerged and evolved through patterns of conflict but also through collaboration.

THE "ENVIRO-SECURITY" FIELD: A CLIMATE OF WAR?

Co-citations patterns do not say anything about what is really happening between groups or individuals. We go beyond the formal analysis to bring out the social dimensions of the research network. To do that, we conduct interviews with academics. We face a contested field of research in which, as Collins and Bourdieu put it, struggles take place to acquire scientific authority. Conflict is part of the everyday practice in a scientific field. Personal animosity is not something new, and it is not unique to this field. Notwithstanding, we argue that struggles within the ES field are not only about empirical and methodological questions. Scholars' disputes also illustrate a struggle for the recognition of their legitimacy as scientific actors. It is not only about the objects of knowledge. Sharing his experience as a PhD candidate in the early 1990s, one professor says:

> "It was a blood sport, and I got to tell you people were mean to shit" [31]

Interviews unveil knowledge about scholars' assessments of their peers "seriousness" or their "lack of discipline". The implicit question is thus: who is legitimate to speak in the field? Most of our interviewees take a critical eye on their peers' practices. We ask them about the state of the field to understand how contentious it could be.

> "There has been a lack of discipline I think in its field with people making statements (laughs) making claims, using data claiming that the data was supporting their statements"[32]

> "People have not been careful about broad sweeping claims that their studies weren't designed to address"[33]
>
> "He has veered off in a direction that is insane. I mean his attempt to dismiss the recent work that is trying to elucidate the evidence of causal connection between climate stress and political violence which for me is exactly the kind of work that is important to do"[34]
>
> "I think it (the empirical research) is pretty much sterile. Part of the problem there is that people are trying to generate something that looks different and then hiking up the claims because they try to justify the work"[35]

The ES field has been polarized around three questions: does environmental degradation (due to climate change) lead to conflicts? What is the best way to answer this question? Who does it best? Researchers have engaged in, sometimes, very heated debates. Since the 1990s there have been different stakes. First, there was the question of redefining the concept of security after the Cold war as the containment philosophy became obsolete. There were, then, opportunities to be grasped by scientists. "People didn't have a clue about how to change security". Researchers tell us about how early works (referring notably to Thomas Homer-Dixon's work) had been "under siege" from the beginning; not only from people who were questioning the research but also from people who had difficulties with others' successes. Several interviewees insist on the fact that large amount of money have had engendered professional jealousy. The early 1990s have been described as really intense. One of our interviewees has started his career in the think tank community. Consequently, he has witnessed the emulation around the theme of environmental security both in the policy community and in academia. He remembers about what made the field a contested one. He tells us about the consequences of handing new research to policymakers without participating in the discussions and thus risking to be instrumentalized. At the same time, the publicity that comes with new research in the security realm also begets jealousy. As our interviewee puts it:

> "There is a combination of that and "we don't like people who succeed, I'm jealous and I'm too big for your purchase" right? So a lot of this is personal"[36]

Second, the research has progressed and has become more and more sophisticated in order to explain the relationships between the environment and security. The debates have focused more on methodological aspects of the research. This situation maintains two kinds of tensions within the field. The first one deals with some scholars' frustrations to see the research going "out of steam". Some express their impatience to see the research move on:

> "Ok! We got the message "we need to pay attention"[37]

This frustration is often discredited as coming from the "critical theorists (who) have an epistemological bone to pick with the whole literature". It reinforces the idea that scholars who keep discussing methodological aspects of the research render the debate sterile. As such, they seem less legitimate.

The second tension lies in the "big fight" between those who continue to search for generalizations thanks to more and more technical mathematical tools and those who think they are missing the point. Interviews uncover a conflict about the scope of the research. A young academic defines his research as doing "the best job possible" referring to the idea of good science. He says:

> "In reality policymakers are interested in good science. Every day I try to teach my student to do good science, not to talk about ideology. My interest is in producing good science to design good policy"[38]

While other respondents don't deny the possibilities that there exist important linkages between environmental factors and conflicts, their reaction relates to the design of the research. Its sophistication is not uncontroversial, as one researcher expresses it:

> "Our reaction is primarily a reaction to those few studies we see as overstating relationships or grim results that are made for publications that receive a lot of attention"[39]

When we address those issues with researchers that are not part of the immediate debate, we face discontent verbalized with humour and irony. One interviewee puts it in a provocative way:

> "They like to go back and forth (Laughs) About quantitative people, honest to God, they just love to blow each other up" [40]

We identify the recurring use of the lexical field of battle. Exchanges between scholars have been defined as "attacks" between "camps", and conversations have been called "disputes", "shoutings" or "yellings". Critics have looked like personal attacks or "snipping". This is how actors define some of the exchanges they have with each other:

> "Dispute is a word that also often comes up when people describe the conversation. Conversation is more to talk about a formal communication. It has been somewhat nastier than that unfortunately"[41]

> "Contentious? (*Laughs*). I stay out of the personal fights (*pause*) he is a nice guy (*pause*) he had published in blogs (*sigh*) hum you know maybe it was done on a spirit of academic debate but it seemed more like pointed (*pause*) snipping"[42]

Scholars tend to accuse each other for being "aggressive" or "nasty". "Those people are not particularly my buddies" said one of them.

> "You know there have been a lot of controversies. People have had troubles moving on"[43]

> "The particular flavour of the debate. It has become unusual. The subject area is something fascinating to the public, so I think a lot of folks in the press have covered this. That got people excited. It is good for people to be engaged. On the other hand, if people become upset and angry in part because of the number of people watching the discussion, it does not make for the most productive discussions"[44]

One interviewee has shared his vision on the way "people do their research". According to him, they often "mischaracterize", "downplay" other people research to "catapult" and

"emphasize" their own research. Again these excerpts point out to the struggle that aims to distinguish competent actors from others. This is also visible through scholars' assessment of the maps. Do the maps mirror the state of the field? We find that scholars react to their own position in the field either by being surprised, flattered or satisfied. In fact, their reaction is twofold. First, they say our analysis "overemphasizes" one's importance in the network, or "underestimates" someone's contribution. Second, they also try to justify their position and identify themselves in relation to other by labelling their work. We ask them to define their position in the field by showing the results of the co-citation analysis:

> "I am a little island to myself. That fits my intuition. If you look at the publications, they came to a halt a pretty long time ago. Broker role is definitely the role that I've taken"[45]

> "There is no one person that has figured stuff out. Everybody is highly limited or flawed"[46]

When challenged about their prominence, researchers say:

> "I am a generous soul. I'm not doing this for any kind of gratification. People can say whatever they want"[47]

> "I notice there is a big node around me (chuckles)"[48]

> "Since our paper, a dozen of papers have come out where people use our statistical framework and obtain results that are almost consistent with what we published. So there has been lots of validation of that result"[49]

The use of labels to identify groups of research is another marker of the field's heterogeneity. They are geographically constrained. We use them to map the field, but they are used by people from the field as a way to define either collaborators or rival camps as the "Berkeley gang" label shows. We ask whether talking about the "Oslo group" is meaningful for PRIO researchers. N.P. and H. Buhaug responded negatively. They see it

as an exaggeration, a label put on by others. As Gleditsch thinks, there is a "bunch of individuals" working together from different countries. The "Berkeley group" seems also to be misleading as the work by Hsiang et al. has been produced at Columbia and Princeton, before he moved to Berkeley. Nevertheless, the "Berkeley group" was the target of the commentary we mentioned in this paper, signed off by 26 authors of the field. While they see this comment as a needed statement to denounce controversial research, their counterparts see it as a real "petition" (Buhaug et al. 2014). We see it as the culmination of a "climate of war".

A COLLABORATIVE FIELD

Using co-citations we looked at the cognitive relations within groups of researchers. In the midst of what seems to be a conflictual space, we find that the view of the field as being composed of antagonistic groups is only one part of the story.Setting formal considerations aside, we present a few examples of collaborative ties expressed mainly through the ideas of "friendship", and "support". [50]

Interviews unveil the existence of informal collaborative groups and relationships in the early 1990s. For instance, Marc Levy remembers about the time he was a graduate and a research fellow as the "Cambridge days". He would meet with scholars from Harvard and the MIT. Thomas Homer-Dixon was one of them. Homer-Dixon had an informal interdisciplinary groups of peers with whom he shared his first thoughts on environmental conflicts. There was also a growing community with the American Association for the Advancement of Science (AAAS) with whom Homer-Dixon became associated; He was also associated with the American Academy of Art and Science at Cambridge as well as

the Mc Arthur Foundation where he would meet Peter Gleick. In the Washington area, the Council on Foreign Relations (J. T. Mathews and G. Dabelko), Georgetown University (R. Matthew), and the University of Maryland (G. Dabelko, Ken Conca) have gathered important contributors. All of them have worked closely together and were supportive of Homer-Dixon's preliminary results. Although the debate that has occurred between Homer-Dixon and Gleditsch has made history, it overshadows the interest PRIO had in Homer-Dixon's findings. Dan Smith directed PRIO from 1993 to 2001 and he has maintained intellectual ties with Homer-Dixon. He explains how things happened:

> "There was an interesting set of questions, areas to be explored. If you take this at a different angle, if you take the field of development studies, there was nobody who was writing about development and violent conflicts, "no! it's for peace and security studies". It was the same for the environment. And in the early 90's TAD (Homer-Dixon) said "well there is something to say about the environment, development and conflict, we need to start talking about these issues in a serious way". And you look at PRIO from an academic standpoint and you see PRIO equals Gleditsch equals critique of TAD but no! PRIO also equals Smith also working with TAD but not in a "I agree with everything you say""[51]

Thomas Homer-Dixon remembers the "intellectual differences" with PRIO and Gleditsch but he sees them as a "genuine stimulation". Homer-Dixon and Val Percival went to PRIO to share their thoughts on the linkages between the environment, development and conflict. Asking PRIO researchers' opinion on Homer-Dixon's work, we find that there is very much sympathy for the perspectives he has presented. However, choosing different angles of research they haven't been able to find empirical support for them.

On the same note, co-citation patterns do not show that Homer-Dixon maintains intellectual relationships with most of its critics.

> "Dan Deudney is often cited as a critic of my early work. Over the years, especially in the early days, we had really valuable intellectual exchanges about environmental security issues. As it turns out, Dan and I see almost eye to eye on most environmental security issues. That's not at all apparent in the public documentation"[52]

Although the mainstream story opposes Homer-Dixon and Deudney, they both insist that they have been "long-time friends". D Deudney recalls that he reviewed Homer-Dixon's *Environment, Scarcity and Violence* book for Princeton University Press and he recommended its publication. Moreover, Deudney adds that Homer-Dixon drew on his 1990 Millenium paper, which was highly critical of the securitization of the environment:

> "In my article, I focus on five scenarios. He only focuses on one. He conceives the others as not likely to conduct to conflict. And the one he focuses on, it's the one that I conceive the most likely (*chuckles*)"[53]

Scholars spend time abroad and this transcends traditional institutional frontiers. PRIO has been the academic hub for many scientists in the field, as the example above shows. Idean Salehyan (University of Texas at Dallas, CCAPS group) has been a guest researcher at PRIO in 2005. He talks about "personal connections" and "friendships". Those relationships are not visible through the co-citation analysis. Also not visible is the informal relationship between S. Hsiang and M. Levy. Levy has been one of Hsiang's supporters during his years as a PhD candidate and later as a post-doctoral research fellow at Columbia University and Princeton University.[54] In line with this, S. Hsiang remembers receiving an email from T. Homer-Dixon after the publication of his Nature article (2011) about how "Civil conflicts are associated with global climate". It came as a recognition from an early pioneer although Hsiang had little knowledge about the field in itself. This shows how intellectual proximity and collaboration work from a very informal standpoint. Although the story tells that Levy and Homer-Dixon were at odds on environmental security during the 1990s, they seem to share common grounds on the linkages between the environment and security. In fact, M. Levy has recently launched Columbia University's Environment, Peace, and Security Certification of Professional Achievement, aiming at practitioners to

develop skills to better understand the connections between the environment and security. This implies, along the fact he supports Hsiang's view on climate conflicts, that he also shares Homer-Dixon's view on environmental conflicts.

To sum up, we have described the organization of the field looking at co-citation relationships. This formal analysis helps to identify the main actors of the "enviro-security" field research. It highlights groups of research systematically. We argued that the map of the field is incomplete if we don't give meaning to the social content of those relationships. This widens our understanding of the competitive nature of the field. We also nuance this view, as the story told by scholars is also made of informal and collaborative exchanges.

CONCLUSION: AN IMPERFECT IMAGE AND AVENUES FOR RESEARCH

That climate change is a security threat seems to be evident in the general discourse. In this paper, we perform a structural analysis of the enviro-security field as we face a multiplicity of scientific arguments and evidences that challenge this evidence. We choose two standpoints to understand how the field is organized. First, we trace the contours of the research by identifying core researchers. Second, we focus on the social dimensions of knowledge production to show how the field came about. Relying on co-citation analysis and researchers' narratives, we argue that behind formal relationships lie patterns of conflict, rivalry and collaboration. Those patterns relate to an essential feature of academic practice, that is, its competitiveness. The ES field is composed of six visible groups and peripheral authors that partake in the advancement of knowledge at the same time that they

struggle for their recognition as competent scientific actors. Our analysis contributes to the empirical work on academics as "competitor-peers".

Other standpoints are needed to understand fully how the research on the environment and security has evolved. A lot of what is produced on this subject comes from the grey literature. Scholars have personal blogs where they continue having interposed conversations. They also write on institutional blogs, as it is the case for *New Security Beat, The blog of the Environmental Change and Security Program (ECSP).* They encapsulate their arguments in brief forms such as videos. They participate to other activities like writing reports and policy briefs. The world of NGOs and think tanks does have an important role in the way we talk about the environment as a security threat. For instance, the four maps show how a certain number of non-academic reports pervade the ES field. It is the case for the World Bank, the IPCC, the Center for Naval Analysis Cooporation, the UNEP ect… This draws attention to the circulation of knowledge. It would be interesting to analyse how researchers carry their ideas and expertise in other fields thus contributing to make the environment a major concern.

End Notes

[1] In early July 2011, the 6587th meeting of the SC was devoted to the maintenance of international security and peace and the impacts of climate change. Available at http://www.securitycouncilreport.org/monthly-forecast/2011/07/lookup_c_glKWLeMTIsG_b_7535735.php

[2] Henry Fountain, "Researchers Link Syrian Conflict to a Drought Made Worse by Climate Change", *New York Times*, March 2nd 2015.

[3] The 2014 IPCC report reflects that. The chapter on climate change and security takes a careful position reflecting the ongoing controversies within the academic sphere.

[4] There have been three special issues in 2014 about the environment-conflict nexus research, published by *Climatic Change*, *Political Geography* and *Geopolitics*.

[5] S. Hsiang participated as a contributing author of the IPCC Work Group II AR5 (Chapter 19).

[6] *Climatic Change* released a special issue in 2014, in which the debate reaches its peak. Buhaug et al. (2014) criticize notably the quality of the sample used by Hsiang et al. (2013) and Hsiang and Burke (2014) in their meta-analysis. Hsiang et al. blame Buhaug et al. for altering data and misrepresenting Hsiang et al. coding work.

[7] We refer to groups of research as a) groups of researchers working on the same question using similar methods ("CCAPS group"), b) interdisciplinary groups working under the general theme of environmental security using different frameworks but located at one institution ("CLISEC group"), c) research group in which the environment is only one factor among others ("Oslo group").

[8] Securitization is a concept developed by the Copenhagen School that intends to explain how general issues are transformed in security problems. See Waever (1995).

[9] We refer to evidences that either link the environment to the occurrence of conflict or empirical data that infirm the relationship.

[10] Co-authorship is one way to assess cooperation. We do not engage in this analysis here.

[11] The co-citation analysis capture works published before 1990.

[12] The *WoS* indexes articles, research notes and review articles published in peer-reviewed scientific journals. Despite the fact that books or book chapters are not indexed as source items, the citations they receive in articles are included and, hence, it is possible to assess the role of their authors in the co-citation network. Although the *WoS* is the most comprehensive and systematic database, we face some limitations. Notably, the indexation is unbalanced across disciplines (Archambault et al. 2006, Larivière et al. 2006), with a lower coverage for social sciences and, especially, humanities.

[13] As figure 1 shows, the WoS has been indexing articles on the topic since 1954.

[14] Facing the impossibility of distinguishing ourselves from our object of study, we choose to protect respondents' identity. We tell the story using actors' narratives anonymously as much as possible. This way we hope not to recreate tensions within the field. Respondents have been contacted by email and we have

exposed our guidelines to them. They have been informed by a follow-up email that their names will not appear with a few exceptions.

[15] This allows to visualize more co-citation relationships (3 or more are represented)

[16] There was the *project for the Environment, Population and Scarcity* (1994-1996) and the *project on Environmental Scarcities, State Capacity and Civil Violence* (1994-1998)

[17] Michael Renner is not an academic. Working at the WorldWatch Institute, he has published a book untitled *Fighting for Survival: Environmental Decline, Social Conflict, and the New Age of Insecurity* meant for general audiences. He has also published work through WorldWatch papers. The WoS shows that his book has been cited in scientific articles.

[18] Most of Baechler's work has been published as monographs or as parts of edited volumes. But, citations received by such volumes in papers that form the corpus are counted. He may has been co-cited a couple of time though but the map shows only relationships of 3 co-citations.

[19] It can also be explained by the "Atlantic divide" that often comes up during interviews. Scholars refer to the tendency to cite less European literature.

[20] We will discuss these labels later in the paper.

[21] Kelly K., Howard P., Percival V.

[22] Here we propose to look only at relationships of 4 co-citations or more.

[23] The map shows relationships of 8 co-citations or more.

[24] It is funded by the U.S. Department of Defense's Minerva Initiative, a university-based, social science research program focused on areas of strategic importance to national security policy.

[25] Raleigh also leads the Armed Conflict Location and Event Data Project supported by Minerva project through CCAPS. It collects data on political violence in developing countries.

[26] M. Burke now holds a position at Stanford University but completed his PhD at Berkeley.

[27] Hsiang alone or as a lead authors starts publishing in 2010. Burke actually published an article in 2009 in PNAS but the keywords we use could not match the title "Warming increases the risk of civil war in Africa" as they tend to narrow the possibility of false positives results. So this paper is not in our corpus, and we can't count co-citations in its bibliography.

[28] This example can be interpreted as an case of rivalry in the field: 26 authors form a "coalition" against 3 other authors' practices of research. This commentary denounces the failure to comply with basic research rules thus looking for its authors' credibility as opposed to their competitors-peers (the political strategy of scientific choices)

[29] J. O'loughlin does not belong to any of these groups. But he shares the same methodologies. We can say that he is close to Raleigh as two geographers using quantitative methods.

[30] However, as we use different combination of keywords to build our corpus, it is logical to find these authors in the network.

[31] Author interview, 12 March 2015

[32] Author interview, 12 Mai 2015

[33] Author interview, 17 February 2015

[34] Author interview, 21 January 2015

[35] Author interview, 23 February 2015

[36] Author interview, 12 March 2015

[37] Author interview, 23 February 2015

[38] Author interview, 12 Mai 2015

[39] Author interview, 4 Mai 2015

[40] Author interview, 12 March 2015

[41] Author interview, 3 December 2014

[42] Author interview, 17 February 2015

[43] Author interview, 12 May 2015

[44] Author interview, 12 May 2015

[45] Author interview, 21 January 2015

[46] Author interview, 28 November 2014

[47] Author interview, 15 December 2014

[48] Author interview, 7 November 2014

[49] Author interview, 12 May 2015

[50] These examples are not representative of the wide collaborative network of research that only a co-authorship network analysis could systematically capture.

[51] Author interview, 6 March 2015

[52] Author interview, 4 October 2013

[53] Author interview, 16 June 2015

[54] M. Levy is deputy director of the Center for International Earth Science Information Network (CIESIN) at the Earth Institute within Columbia University

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Figure 1 : 1990-1999. Only relationships of 3 co-citations or more are shown

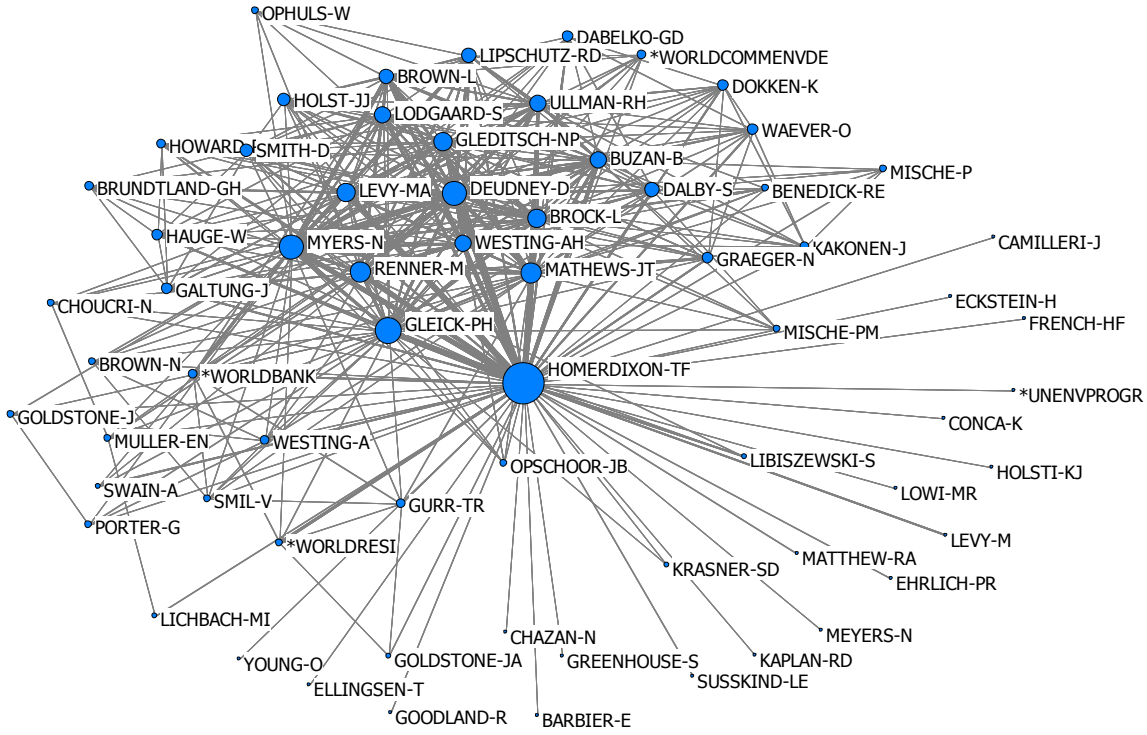


Figure 2 : 2000-2007. Only relationships of 4 co-citations or more are shown.

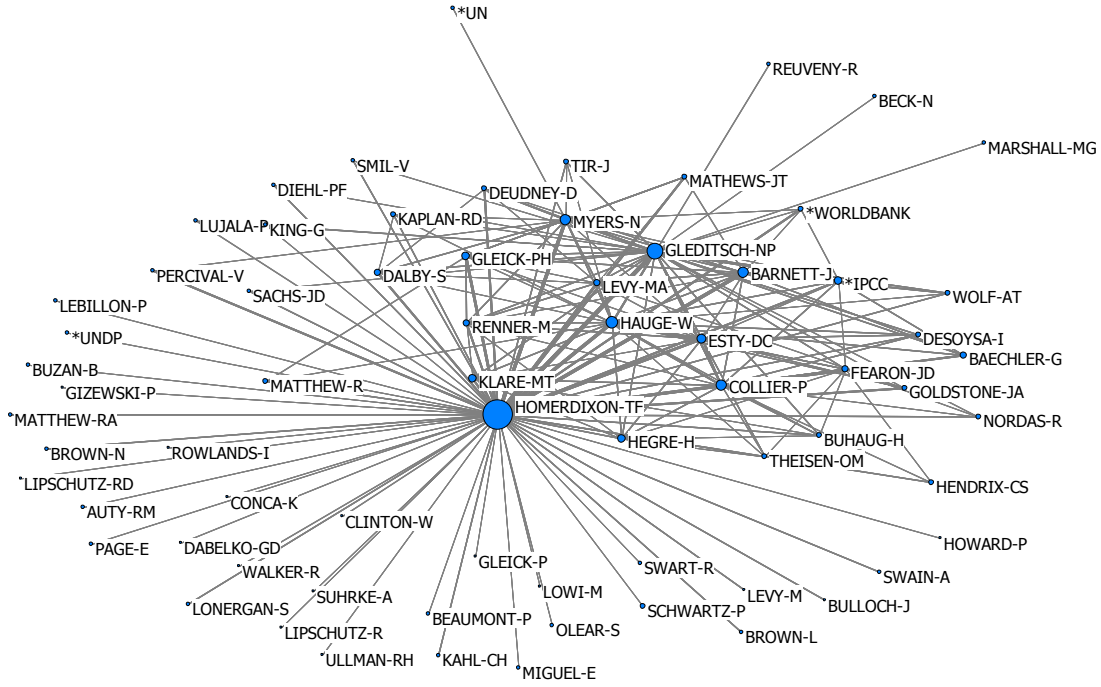


Figure 3 : 2008-2014. Only relationships of 8 co-citations or more are shown.

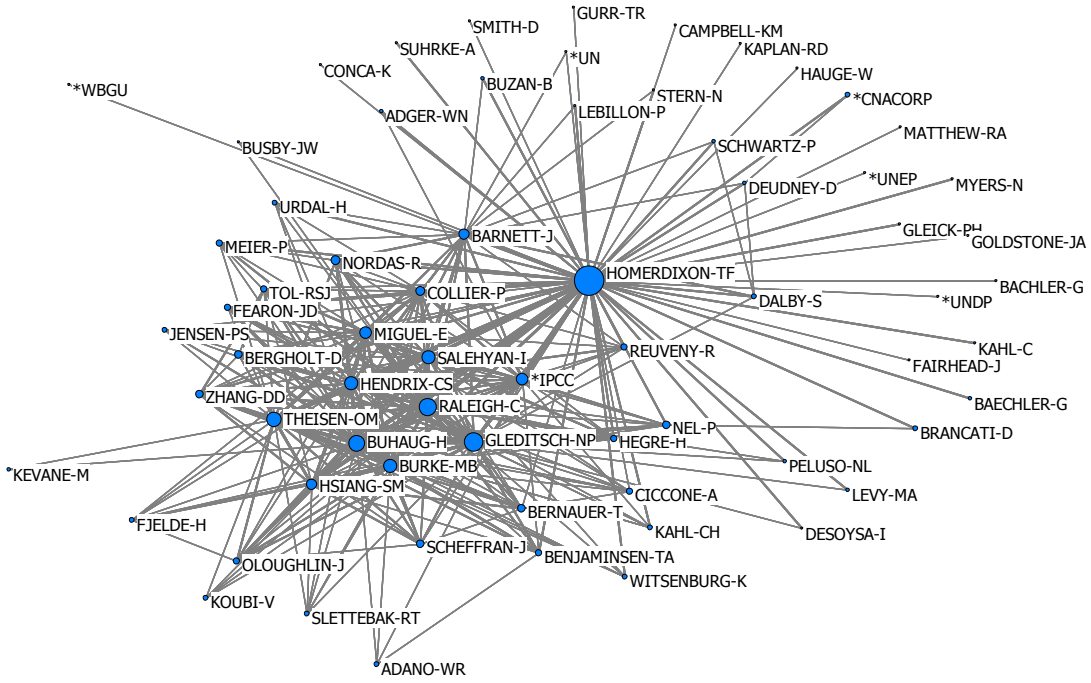
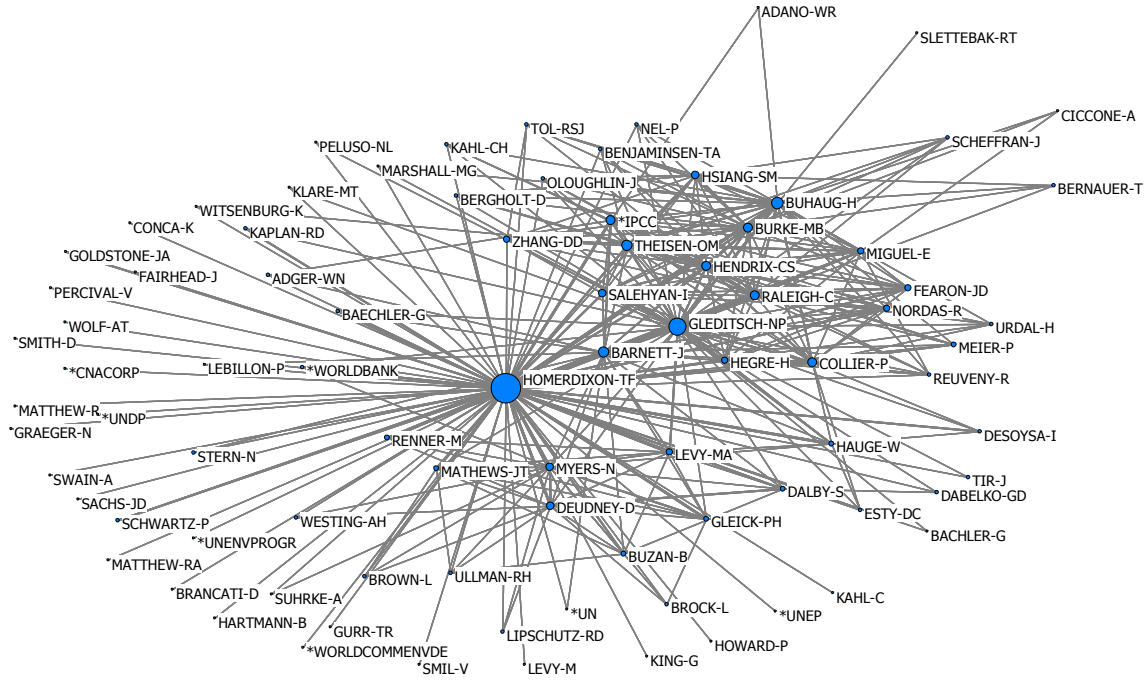


Figure 4: 1990-2014. Only relationships of 10 co-citations or more are shown.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POLOUGHLIN-J
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BUHAUG-H
WITSENBURG-K
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CONCA-K
KAPLAN-RD
ZHANG-DD
BURKE-MB
THEISEN-OM
GOLDSTONE-JA
MIGUEL-E
HENDRIX-CS
FAIRHEAD-J
ADGER-WN
PERCIVAL-V
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FEARON-JD
BAECHLER-G
NORDAS-R
WOLF-AT
GLEDITSCH-NP
URDAL-H
SMITH-D
BARNETT-J
MEIER-P
*CNACORP
LEBILLON-P
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HEGRE-H
COLLIER-P
REUVENY-R
HOMERDIXON-TF
MATTHEW-R
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GRAEGER-N
DESOYSA-I
RENNER-M
HAUGE-W
STERN-N
LEVY-MA
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