DISCOURSES AND DISTORTIONS: DIMENSIONS OF GLOBAL AND NATIONAL FOREST SCIENCE COMMUNICATION

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Caminante, no hay camino,
se hace camino al andar.

Antonio Machado

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Communication processes may be far from ideals depicted by theories. Limitations and distortions in communication do not limit themselves to formal channels of science and mass media communications but influence the everyday lives of researchers. I was lucky to find myself part of an international group of persons to which overcoming difficulties in such processes was important.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Society is evermore faced with increasing environmental problems. These are of high complexity and of wide geographical impact. Forests have experienced firsthand the pressures of the evolution of society, through processes such as globalization. The increasing demand for timber and other forest-related products has brought problems such as illegal logging, deforestation, and loss of biodiversity which has influenced the life quality of millions. Loss of forest cover and increased consumption of forest related products have brought about increasing demands on forests that have contributed to biodiversity loss, alteration of natural cycles and global warming, as Mery et al. (2005, p. 14) note. Problems faced by the forest do not contain themselves in nation state boards but transcend them. The solutions necessary to solve these problems as well are not contained within the nation state; these problems may thus be solved globally.

Science plays an important role in reducing the uncertainties that the above mentioned pressures have on the environment. Which species are being lost? Do forests or the forest sector contribute to the problems of climate change and loss of biodiversity? Both are examples of questions that need to be answered. More importantly, how can forests contribute to mitigate such problems? These are all questions in which forest science should not remain silent. The results of research that is carried out in this field must be transmitted if it is to be incorporated in processes that are determined to carry out solutions to the problems faced by the forest. Research results must be communicated, the discourse on forest science must then be heard.

Where are the problems of the forest being dealt with and discussed? Attention given to problems such as loss of biological diversity, deforestation, impacts of climate change have increased as media coverage and non-governmental organizations disseminate distressing scientific results (Mery et al., 2005: p.14). The mass media is then clearly an arena that must be considered for communicating science, alongside the scientific community itself, if results should continue to spark scientific debates. Therefore the communications of forest science –the discourses of forest science- may be found in these two arenas.

Communication may be carried out not only in different arenas, but as well with different orientations. Communication that is free from pressures, where all actors who have an interest in the issue participate, can be considered one which gives legitimation to the agreements that are arrived by those discussing the contents of the communications. Such a communication may be an ideal difficult to fulfill in view of different structures that particularly affect science communication.

Inequalities, such as the wealth of nations, influence the way in which science is disseminated. Countries with more resources available to them may carry out more research, of more quality or of more extension than those countries where resources are much more limited. Research being carried out in certain parts of the Earth might

not have the opportunity to integrate important scientific discussions, as the resources to integrate the communication process are missing. If science is truly to answer global problems, such inequalities should be overcome -as global problems require global solutions- specifically through the participation of all affected.

However, now-a-days belonging to a rich nation does not assure more facilities or accesses to communication processes. Scientists from all over the world are confronted with problems of scarce financial resources and great competition. These factors are transformed in direct pressures by the research organizations on their scientists to produce scientific publications, to increment the number of patents created, to obtain a greater number of doctoral students, all in favor of enhancing the position of these organizations in the world-market of science.

The pressures that have been brought upon science have a base in the interaction of science with its societal environment. Science is not cut-off from society but is more and more coming under the looking glass of the lay-person, especially since the problems of society are growing in complexity and may only be answered by the knowledge produced and delivered by science. The interaction of science with the public may be carried out in the mass media; as this is an arena which presents problems and offers room for societal discussion.

The media are not an idle observer in the communication exchanges that are carried out in their pages. They are an actor with own interests that must be met: specifically that of the participation in the market economy. Media will select those topics that help them fulfill their particular needs. The access to the media is thus a barrier not only for scientists but for all those wishing to join relevant public discussions.

There are thus several dilemmas when participating in communicative processes which may help solve global problems. On the one hand, there are difficulties in the science arena where the possibility of communicating might be determined by specific factors, for example the financial resources available. On the other hand, entering the public arena –where forest related issues might be discussed- is not easy with the media as gate-keeper of topics and participating actors.

These are all limitations that move communication processes from ideals which might give more legitimation to the agreements rising from public or scientific discussions. Two interesting questions are thus derived from this. Are ideals fulfilled regarding the communication process of science? And secondly, what are the deviations that are present that shift them from these ideals?

These questions will be addressed in this work based on the example of forest science communication. Specifically the ideal to be examined is that of the existence of a deliberative discourse on forest science, and the existence of structures that move the communication process from this ideal to a distorted form of communication.

2. THEORETICAL BACKGROUND

The main research questions mentioned in the previous chapter are further developed in the following chapters. The theory of Jürgen Habermas is described as an ideal of deliberative discourse in science communication. As Habermas does not provide a tool for explaining distortions from this ideal, the approach of Michel Foucault will be used to fill this gap. Distortions are many and affect not only the overall communication process but individual scientists as well. Specifically, and recognizing that science is inserted in a society where problems are discussed in the public arena that is provided by the mass media, scientists may move their actions from the communicative ideal to more strategic action of orienting their communications to the fulfillment of their own personal interests instead of orienting them to the wellbeing of all; this may as well have reciprocal effects on the internal communication processes of science. These considerations are reflected in the research model that will be finally described giving way to hypotheses which will be tested.

2.1. DISCOURSE AND DISCOURSE ANALYSIS

Reiner Keller (1997, 2004) gives a detailed historical description of the different traditions of discourse and discourse analysis.

Keller (1997, p.311 ff.) sees two main traditions: (1) Discourse is a general everyday understanding of "discussion", "speech" or "argument" which one associates with and examines regarding fundamental rules of linguistic communication and linguistically mediated interaction; and (2) Discourse is a specific content-thematically institutionalized form of text-production (Keller, 1997). This last tradition comprises the "public discourse" as the public discussion of (mainly) political topics transmitted by the media as an indirect conversation between absent actors (p.311). What is common to the two different discourse traditions is that both are interested in examining utterances as formalizations of interpretation patters that uphold certain generalized rules (p.312). The interpretation patterns[1] of an actor are the knowledge, views and opinions of this actor regarding a specific issue. The main components of discourse are speakers, utterance (regarding form and content) and receiver (public), which can be analyzed according to formal and/or content related characteristics and structures.

Keller recognizes both the work of Michel Foucault and Jürgen Habermas (amongst others) as important in the tradition of discourse and discourse analysis. However, Keller sees the latter not as a discourse theory as such, but more as a theory of discourse ethics describing an ideal speech situation which may be used in analysis as a critical benchmark to measure the degree of distortion of the real communication process (Keller, 2004a). Authors have decided on one of the two traditions when carrying out discourse analysis. Many are the issues which are examined through discourse analysis following one or the other tradition. Applied to forestry, research studying discourse following Habermas'

[1] Interpretation patterns, or *Deutungsmuster*, are interpretations of action problems that have come to be taken as valid convictions by a community (Oevermann, 2001); they are the perspectives and interpretations of action and interaction areas of actors of a social group (Arnold, 1983).

tradition include Kleinschmit et al. (2007). Foucault on the other hand, develops a specific scientific conception of discourse which is concerned with institutionalized rule-governed modes of speaking. Works following Foucault's discourse tradition are many in number and mostly qualitative. In forestry, qualitative discourse analysis was carried out by Aicher[2] (Aicher, 2003) and Hütte (1999), this last author following Foucault's theoretical stream carried out a qualitative content analysis focused on a European discourse comparison regarding the concept of sustainable development.

Many of these studies have touched on the vast dissimilarities between Habermas and Foucault. Having some authors gone so far as to tag Habermas as an idealist because he believes that understanding between individuals or actors –which can legitimate the decisions arrived by a society- are the product of idealized speech situations which are not influenced by power structures. Whereas other authors have tagged Foucault as a realist because of his analysis of 'how' situations come to be or are influenced by institutionalized rules and (power) structures. As well both authors have criticized each other: Habermas calling Foucault a 'cynic' and a 'nihilist', while Foucault calls Habermas and 'idealist'.
The starting point of the analysis of these two theoretical currents is to introduce relevant concepts of both Habermas' and Foucault's theories and afterwards their relevance for studying forest science discourse will be presented.

2.2. JÜRGEN HABERMAS' COMMUNICATIVE ACTION

The German philosopher Jürgen Habermas has developed a theory of society based on rational communication. In *Theory of Communicative Action* (1984, 1987), Habermas completes a theoretical background based on the use of language by actors oriented to reaching understandings.
Communicative action is defined by Habermas as the "*form of social interaction in which the plans of action of different actors are co-ordinated through an exchange of communicative acts, that is, through the use of language … orientated towards reaching understanding*" (Habermas, 1982: p.234). Habermas is referring to how language is used by individuals who, when interacting with other actors in society (establishing or maintaining social relationships with other individuals) make statements with the purpose of reaching agreement. When the objective behind communication is to reach some sort of agreement, then communicative action is made possible. Three functions are recognized of communicative action: (1) it should be used when conveying information; (2) it should be used to establish social relationships with others; and (3) it can be used to express the individuals own opinions and feelings (Edgar, 2006: p.22). An important aim of bringing about understanding through discussions carried out communicatively is to define what is to be understood as shared knowledge (Habermas, 1998: p23).

In order for individuals to act communicatively, or to perform any speech act, 'universal validity claims' must be raised by actors and, they must be willing to undergo scrutiny (can be vindicated). If an actor desires to participate in a process of mutual understanding,

[2] Aicher follows Haajer's tradition of discourse analysis, who in turn follows Foucault's tradition.

then the validity claims[3] that the actor must make are that s/he (Habermas, 1998: p.22 ff.):

1. must utter something intelligibly
2. must give (the hearer) something to understand
3. must make oneself thereby understandable
4. must come to an understanding with another person

When an actor raises these validity claims s/he is engaging in making statements that are comprehendible (intelligible) to the receiver. The intention of communicating true propositions so the receiver shares the communicator's knowledge must be met. If the receiver is to accept the utterance of the speaker as credible, the speaker must have the purpose of expressing his/hers intentions truthfully. The receiver must as well be open to consider the arguments that the speaker is issuing. Finally, the speaker must choose to express something that is right or complies with the norms and values that prevail in the specific community. In summary these validity claims represent meaning (comprehensibility), truth, truthfulness, and rightness. If these claims are met, then the receiver can accept the statement and both actors can therewith agree with each other or raise challenges to what is being said forcing the communication to evolve further.

One precondition for an understanding to be formed amongst participants is that they share a common background that under Habermasian conception is called the *lifeworld*. Lifeworld is the stock of skills, competences and knowledge that ordinary members of society use, in order to negotiate their way through everyday life, to interact with other people, and ultimately to create and maintain social relationships (Edgar, 2006: p.89). The lifeworld expresses the historical traditions and 'processes of socialization' (Hillier, 2002: p.31) in which people have been embedded in and which allows them to come to understandings. Thus, when people interact with others making utterances they are supposing that these others share their background knowledge (share their lifeworld) which allows them to understand each other[4]. In doing so, they are sharing three structural components of the lifeworld: their culture, their society, and their personality. When actors mutually understand and agree on their situation, then they share a cultural tradition; as members of a social group, actors coordinate their actions through recognized norms; and in performing both these actions, actors internalize values and develop individual and social identities. And so, actor's values, representations, and identities reflect and are reflected through their lifeworlds (Hillier, 2002: 31).

If the scientific community is considered, then the lifeworld of scientists would be that which allows scientists (or the members of the scientific community) to *understand* and *communicate* with one another. As a scientist, an actor has a specific formation (specific skills and competences) which allows him/her to undertake research in accordance to a specific (scientific cultural) background, (scientific) norms, and personal identity, finally

[3] Validity claims are commitments that speakers make, often unwittingly, to justify what they have said and what they are doing (Edgard, 2006: p.167).

[4] Habermas (1987, p.121) exemplifies the concept of lifeworld through the example of an older construction worker who sends a younger one to fetch some beer, telling him to hurry up and be back in a couple of minutes. In doing so, the older construction worker supposes that the situation is clear to all those involved and that the younger worker understands what he has just express. If this is the case, then both actors involve share a common lifeworld.

being able to communicate their research to other scientists, and in doing so form social ties or relations within the community.

In opposition to the lifeworld is what Habermas has labeled the *system*. System is a structure of elements that are selected and complexly organized so that only certain relationships between them are possible (Edgar, 2006: p.145 ff.): the system is governed by its own rules. If society is just understood as a system then it is a 'bad society' because it corrodes human freedom and renders life more or less meaningless. If the actions of individuals when socially interacting are increasingly conducted according to the rules of the system then individuals lose their freedom to live and give meaning to their lives and appear to be following the rules just because they are rules rather than because they make sense to them (Edgar, 2006: p.154). As a result of the existence of the system, individuals have two ways in which they deal with social interaction, either communicatively (see above) or strategically. When an individual is influenced by the system –or by the steering media that form it (money and power), says Habermas, she/he does not act communicatively but rather instrumentally (or strategically[5]) where there is no common orientation of the actors, but an orientation to individual success[6], or in other words where individuals assess the efficiency of actions in achieving a given goal (Edgar, 2006: p.104).

Social systems are organized through *non-symbolic steering media*. In order for a society to function as a system, individuals must be able to recognize and respond to the demands that the system places upon them. The non-symbolic[7] steering media provide the indicators to certain type of action that allows the goals of the system to be realized (Edgar, 2006: p.103). Two are the main steering media that Habermas recognizes: *money* and *power* (Habermas, 1987: 202). Money runs economic systems and can coordinate highly complex projects, as in e.g. financing international complex scientific projects. Power works similarly, where those who have been given legitimate power can both compel others to behave in a certain way and can assign power to others, so that these can in turn control others; as a scientific research coordinator may order his/hers subordinates to carry out specific tasks, in turn they can order their research assistants to carry out other activities. In both cases communication is not required; actions are governed by following the rules of the economy or the rules ordered by superiors respectively in the examples cited previously.

The system gives individuals resources to make sense of their lives and makes it possible to simplify understanding, and so always allows individuals to participate in complex social activities. Habermas sees the use of the system necessary and in some way highly beneficial, but as economic and administrative systems intrude more and more into everyday life, as money and power interfere more and more, then the strategic action that governs the actions of individuals within the system begins to wear down the communicative skills that are the basis of the lifeworld. And so, according to Habermas, as systems expand (due to e.g. the expansion of market or administrative forces) a

[5] Strategic action: when individuals act according to their own personal interests and not in search of common understandings with other; or in other words when individuals are oriented to the actor's success (Habermas, 1998: p.63).
[6] Defining success as: "the appearance in the world of a desired state, which can, in a given situation, be causally produced through goal-oriented action or omission" (Habermas, 1984: p.285).
[7] Non-symbolic because the actions indicated by these media are independent of how an individual make sense and gives meaning to it (Edgard, 2006: p.103); no one needs to ask why the actions incurred happen. Non-symbolic media in opposition to symbolic media (e.g. peoples skills and knowledge).

colonization of the lifeworld occurs: where individuals' freedom and meaning are corroded, where there is a suppression of the expression of common interests, communication is hindered and distorted, and agreement-oriented communicative action is menaced by the systems goals (e.g. profit making). When this happens systems are not any more a mean to an end, but an end in itself (Edgar, 2006: p.19).

The collision of the lifeworld with the system takes place in *the public sphere* (Hillier, 2002: p.32).

For Habermas in complex societies:

> *(T)he public sphere consists of an intermediary structure between the political system, on the one hand, and the private sectors of the lifeworlds and functional systems, on the other. It represents a highly complex network that branches out into a multitude of overlapping international, national, regional, local, and subcultural arenas* (Habermas, 1996: pp.373-74).

The public sphere is an arena where the political system on the one hand and various lifeworlds on the other interact. It is an open, permeable, and shifting space where networks for communicating information and points of view are built touching upon different levels of society and cultures (Habermas, 1996: p.360); it is made up of social institutions that allow for free and rational debate between citizens.
According to Habermas (1996, p.374), a public sphere is differentiated by e.g. functional specifications and policy fields which are still accessible to laypersons. The public sphere is also differentiated into levels according to the density of communication, organizational complexity, and range from publics found in taverns up to abstract public spheres of isolated readers, listeners, and viewers scattered across large geographic areas, or even around the globe. Particular spheres can be thus found for example: that of citizens and that of the media. In the former, citizens debate politics in networks of people with whom they maintain more or less close contact. In the latter, media -such as newspapers- disseminate information that the public can only experience through them, and provide the public platform for discussion of different topics (such as forest policies). The debates that the different publics, isolated readers, listeners, and viewers carry out may be done face to face or through the exchange of letters and other written communications, and may be mediated by journals, newspapers and electronic forms of communication (Edgar, 2006: p.124).

Figure 2.1 gives a picture of how the Habermasian concepts of system, lifeworld, public sphere, and communicative action come together.

On the one hand the lifeworld exists, which refers to all the cultural background that determines how individuals relate with their environment, their peers and other sectors of society. The lifeworld is reproduced through communicative action where speakers are oriented to reaching mutual understandings. On the other hand, the systems are found and are structures that are generally moved by the steering media of power and money and that influence individuals to act not searching common objectives, but individual ones (they act strategically). The encounter between the lifeworld and the systems takes place in the public sphere. However, there is no single public sphere but many public spheres differentiated by functions and levels (amongst other characteristics). In an ideal

situation the influences of the steering media that dominate the systems have are neutralized by rule-making (e.g. constitutions). Consequently, interactions in the public sphere are carried out through communicative action (CA) and not through strategic action.

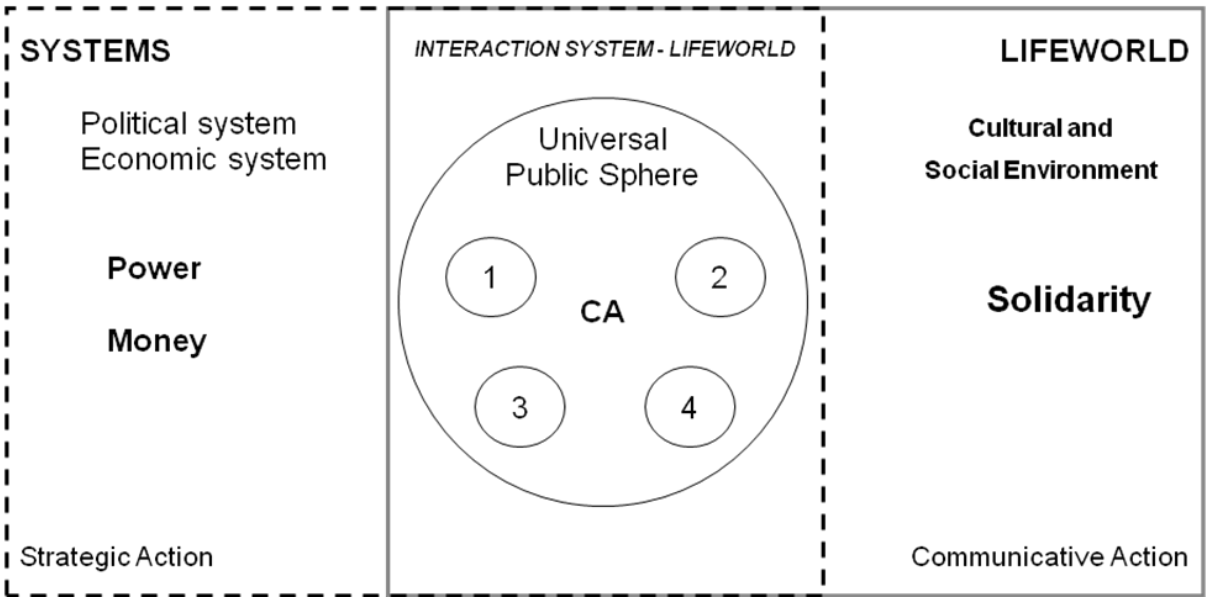

Figure 2.1. Habermas views on Systems, Lifeworld and the Universal Public Sphere; where CA is communicative action and where 1, 2, 3, and 4 represent different public spheres (Source: own construction).

The public sphere is a freely accessible communication forum where problems and opinions are on the one hand presented by speakers and on the other observed and perceived by other actors, and finally discussed and conceded on by all participating actors (Gerhards et al., 1998: p.38). In order for the agreement that is reached within the public sphere to be legitimate this space, and the communication carried out within it, must meet certain principles (Chambers, 1996):

1. *The principle of universal moral respect*: all individuals capable of speech and action are entitled to participate in the process of argumentation; no one may be excluded from participating and no barriers should exclude individuals from debate.
2. *The principle of egalitarian reciprocity*: participants have an equal right to introduce and question claims or to put forward reason. In other words, anything may be said and question.
3. *The principle of non-coercion*: no participant should be prevented (no force may be used) from exercising the right to and of participation.

These principles suppose that understanding and agreement are generated solely by '*the force of the better argument*'. The better argument can be identified through the communication in the public sphere because participation is assured and is free of coercive forces. The better argument is then the one which surges as the culmination of the communication process; it is the public discourse that emanates from the communication process.

Following the definition of Ferree et al. (2002), public discourse will be here understood as: "public communication about topics and actors related to either some particular policy domain or the broader interests and values that are engaged" (p.9). Or in other words:

discourses are considered the everyday practices of giving reason (argumentative speech) for or against controversial validity claims.
The universal public sphere is thus the place where actors interact in order to deliberate on the problems of society. In order for the decisions that are reached in this sphere to be considered legitimate, the public deliberation carried out must follow the principles above mentioned. Thus, in an ideal deliberative society, problems are exposed and discussed in the public sphere, all actors who have something to say regarding such problems may speak, bringing to the discussion their own interpretation patterns, without worrying that any coercive forces act that prevents them from speaking or participating.

2.2.1. THE PUBLIC SPHERE OF (FOREST) SCIENCE

Defining science is a difficult task. John Ziman (2000) brings several concepts in to play: a set of procedures, a subset of a field of knowledge, an agent, and a component of society, amongst many others. There are commonly accepted definitions which coincide with all these concepts and go further on. There are as well different types of science; for example natural and human sciences. Ziman excludes from his term 'Real Science' those disciplines belonging to the human sciences as they do not comply with common accepted norms (Mertonian norms, see table 2.1) of what science should be (p.307) and, additionally, they deal with belief systems, something that should not be a part of 'Real Science'.
What is common to many definitions of science is the creation or construction of 'knowledge'. Entire fields of philosophy have as well been dedicated to the study of what is knowledge, how knowledge is constructed, what scientific methods should be applied to obtain the knowledge, etc.
Forest science is a field within natural science. It is a field dealing with observing nature, particularly forests, and translating it to the '*humans in the cave*' (following Latours' comment on the allegory of the Cave by Plato). They are embedded in a communicative context. Thus, in order for forest scientists to communicate with the public (or humans unlucky enough to still be chained within the cave) an arena must be found where the communication between these two representatives -scientists and public- can take place.

As previously mentioned, the universal public sphere is comprised of many sub-spheres that are differentiated according to different criteria (e.g. location and culture). One of these social forums where problems are identified and discussed is the scientific community or the scientific public sphere.

The scientific community cannot be seen as an isolated entity, but can be described through its social activities (Felt et al., 1995: p.57). Robert K. Merton has stated that as a social entity, science communities comply with certain values and norms that are binding for scientists and as such comprise the ethos[8] of science (Merton, 1973: p.270-78). These values and norms have constantly come under attack as changing visions of what is science have presented themselves. Table 2.1 summarizes Merton's norms for science (commonly known as CUDOs):

[8] Merton understands the ethos of science as "that affectively tones complex of values and norms which is held to be binding on the man of science" (Merton, 1973: p.270).

Table 2.1. Merton's norms for science (Source: Merton, 1973: p.270-278)

Norm	Definition
Communism (communalism)	All scientists are able to access the scientific results of all other scientists. Scientific results are a product of social collaboration and are assigned to the community.
Universalism	Claims to truth are evaluated in terms of universal or pre-established impersonal criteria, and not on the basis of race, class, gender, religion, nationality, or personal qualities.
Disinterestedness	Scientists are rewarded for action in ways that outwardly appear to be selfless. Passion for knowledge, altruism concerning the benefit of humanity.
Organized skepticism	All ideas must be tested, and are subject to rigorous, structured community scrutiny.

The norms advanced by Merton have striking similarities with Habermas' ideas concerning communicative action. Table 2.2 displays this comparison.

Table 2.2. Merton's scientific norms mirrored in Habermas' theory of communicative action (Source: own construction)

Merton's Norm	Habermas' validity claim/principle
Communism	Principle of egalitarian reciprocity
Universalism	Principle of universal moral respect and non-coercion
Disinterestedness	Speakers act selfless in pursuit of a common purpose/good
Organized Skepticism	Principle of egalitarian reciprocity

If these norms are taken as valid for the scientific community, and considering that a particular ideal goal of science is to reach consensus –subordinated to that of finding truth- on what is considered scientific knowledge, then to consider this community as a public sphere is valid.

In Habermas' ideal situation, scientists are the participants in this sphere who, when sharing lifeworlds and interacting communicatively, reach agreement regarding what is considered valid scientific knowledge. As the knowledge that arises in this sphere is fundamental for the identification of societal problems and their solutions –helping along the way civil society in the identification of problems-, it is important to pay attention to the discourses that develop through communication. The knowledge that arises from scientific discussions serves as input for the universal public sphere, where all actors which are affected by the problems can deliberate on the solutions that science might present through the institutionalized knowledge (knowledge recognized by the scientific community). As Baber (2004) has put it: "the use of knowledge is vitally important because the goal of public deliberation is to solve a problem together with others who have distinct perspectives and interests" (Baber, 2004: p.334). Baber notes that the beginning of deliberation in the universal public sphere deepens with the process of arriving at a share definition of problems which is dependent on facts.

In science, the peer review process can be seen as a rational process based on communicative action (Gross, 1990) between the reviewers (peers) and the authors of the article. Alan G. Gross has described how this process is the first step towards public status for scientific claims, towards the transformation of these claims into scientific knowledge (Gross, 1990: p.195). Gross' states that linking Habermas' theory of communicative action -through the analysis of speech act theory- to the peer review process is justified because of the coinciding aims of the theory and the researched area namely, a rational agreement. Rational agreement is the explicit purpose of the theory of communicative action and is as well the self-declared purpose of peer review, or for that

matter of science (Merton's scientific ethos). Speech act theory calls for a request to be made, in this case the submission of the article to a scientific journal, which will finally be deemed successful (or not) depending on shared social norms (scientific norms regarding what is sound research). Gross sees the decision of the referees as an "assessment of the persuasiveness of a submitted paper" (p.195). The assessment of the reviewers contains questions or comments that serve the author for improving the article (raising validity claims) -in case of a positive decision (they are raising validity claims). This interaction between author, reviewers and editors is a communication network that can be analyzed in terms of the criteria of an ideal speech situation (mentioned earlier). Once the communication has come to an end, the resulting published knowledge (science) is a consensus agreed on by authors, reviewers, and editors.

Assuming that this process is a representation of a deliberative communication process is not without criticism. Particular criticism has to do with the destiny of those arguments that, because of negative decisions, are not heard by the scientific community or, the unequal distribution of power between authors on the one hand, and reviewers and editors on the other (these having more power). These critical points will be addressed in section 2.2.2 and onwards.

If the article is approved through this process it is published and becomes visible for all others in the scientific community to discuss. Once an article is published, a new process begins where communicative action is as well found. The publishing of the article allows the scientific community to share the insights of the scientists who publish. The article published, aside from conveying facts or opinions of the scientists regarding certain topics, allow the establishment of a social relationship between scientists in the community. This is what Habermas recognizes as the use language is given in social interactions (Edgar, 2006: p.164). Thus in science, writing a scientific article is seen as one way scientists have to interact with their community; to establish social relationships with other scientists. Here, the use of language is focused on engaging in scientific discussion triggered by the paper published. The use (or discussion) of the topics can be formally captured through indicators such as citations. Through citations other scientists are reacting to the utterances formulated by scientists and in doing so engaging in discussion. A citation of an article may imply many things: agreements with the knowledge presented, critique of the knowledge presented, or input for further research. Citing an article implies that the scientific community has become aware of the knowledge within it and is discussing its relevance. Citations thus convey the importance of the article (knowledge presented) for the scientific community; no assumption can be made regarding whether citations means approval or disapproval on the part of the community regarding the knowledge claims it makes. What can be claimed is that the scientific community through citations, is recognizing the articles, they are reacting to it, and thus deliberating on the contents communicated through them.

Each step within the pyramid presented in figure 2.2 filters what is accepted within the community as true scientific knowledge. Thus, at the end of the communicative process, discourses of forest science are found. Throughout the scientific community claims of scientific knowledge are being made. These claims, in order to become a part of the discourse must be presented though specific channels of communication. In the case analyzed here, these claims must be presented in written form to scientific journals

recognized by the community (scientists are thus initiating a communication process with a request). Here already a barrier exists in the communication process: not all the knowledge claims made by the scientific community are presented and thus eventually have a chance to enter the discourse. Many are the scientists who do not take part in this specific form of scientific communication and therefore many are the claims of knowledge that are left out. Those claims that are 'put down in paper' enter the peer review process of the scientific journals. Again here a barrier exists that filters even more those articles that will end up being given the chance to form part of the discourse namely, the specific requirements of the scientific journals of the publications to be submitted. However, if these conditions are fulfilled, the peer review process may begin. If, as described in the previous paragraphs, the claims of scientific knowledge have successfully arisen from this power-charged process, they are published and achieve the visibility of the scientific community. Here once more claims are filtered as not all those articles put to the review process achieve publication. Many are rejected. Therefore more claims are lost in the pyramid of forming the communication process that ends up in the discourse on forest science. The integration in the discourse is not assured by the scientific article being published. Only after the articles are put up for scrutiny of the scientific community, is recognized by them, and reacted to it through citations, can the claims of scientific knowledge be seen as integrating the discourse on forest science: becoming afterwards, a part of the scientific knowledge available –and accepted- on a specific issue. This discourse is thus not the result of 'the better argument' but of the power structures that distort it from the ideal result of a deliberative process.

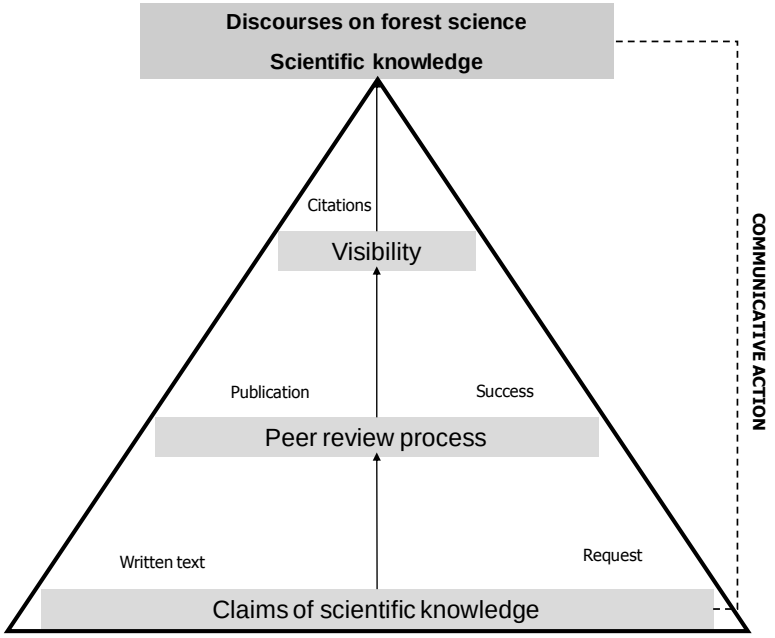

Figure 2.2. Communicative action in the process of knowledge formation through peer-review processes

The communication processes depicted through figure 2.2 is however not free of power structures that influence its outcome for example dominance of English as the language of science (Ammon, 2001; Crystal 1997, amongst many others); deviations from what might be considered as valid claims of knowledge; and distortions within the

communication process initialized by the submission to a peer-reviewed publications. All these are points that will be addressed in the following section.

2.2.2. CRITICIZING HABERMAS

If Habermas theory of communication is applied to forest science and the examination of its discourses, then many points arise that make it difficult to explain reality in terms of Habermas' theory.

The ideal speech situation is something that is recognized by Habermas as being elusive:

> "*we are quite unable to realise the ideal speech situation; we can only anticipate it*" (Habermas, 1970: p.372).

However, even if it is elusive and difficult to achieve, it is not illegitimate to aspire to it. As Hiller says: "the ideal speech situation can serve normatively as a guide for the process of communication and as a critical standard against which actually achieved agreements and (policy) decisions can be measured" (2002: p.35).

Gross (2002) considers the distortions of communication that exist in the peer review process. He explains, for example, the inability of authors (after submitting the article) to initiate speech acts. Authors only respond to questions and comments made by referees and editors: they react. Table 2.3 summarizes his considerations.

Table 2.3. Distorted communication in peer review process as seen by Gross (2002)

Habermas' condition	Distorted Communication
1.Equal opportunity to initiate speech acts	- Authors not initiators but responders - Limited rounds of referee critique - No interactive clarification
2.All speakers reveal themselves, making their discourses transparent	Limitations on how communication takes place: - Discourse must be free of emotion - Discourse must be polite
3.Freedom to use speech acts	Prohibition of authors to issue commands
4.Equal control over exchange	Authors are inhibited from asking critical questions

This table indicates an unequal distribution of power between authors who submit papers and editors and referees who evaluate them, which is a clear deviation from the ideal speech situation that promotes rational consensus.

However distorted the peer review process may seem there are structures built into the process which help correct these deviations (Gross, 1990: pp.199 ff.). For example, editors generally assume the role of power neutralizers between referees and authors by e.g. favoring authors when decisions amongst referees are split or by shielding authors from abuses on the part of referees. If abuses occur, it is likely that those who misuse their positions will not be considered further by editors as referees. Regarding the power of editors, the market of scientific journals takes care that they do not abuse their power, this because editors rely on authors to keep journals going and authors have the liberty to choose to which journal they submit their articles.

In the peer review process, to seek out the ideal situation is necessarily a limited task since this comes at the cost of professional time and costs regarding the creation and communication of new science. Or as Gross concludes (1990, p.203): "*rational consensus is a good we can pursue without regard to its possibly undesirable effects on other, equally desire goods*". So it is not the fulfillment of the ideal speech situation that should be pursuit as the target of research regarding the scientific discourse on forest, but to examine how close or far the dominant discourse is from it. The ideal speech situation is not met in the peer review process, but the correction of the distortions built into the system allows arriving at a rational consensus regarding what is in the end publishable science.

For the peer review process, Gross (2002) has applied the ideal speech situation and has concluded that the communication that takes place is far from being ideal. However, he points out that seeking the fulfillment of the ideal speech situation requires a scarce good such is 'professional time'. If the ideal speech situation is followed, discussions between authors, peer reviewers, and editors would take as long as needed until a fully rational consensus is met. This comes to the cost of professional time (a point also made by Flyvbjerg, 2001: p.91): scientists must dedicate more time in the process of exchange with reviewers and editors and less time creating and timely communicating potentially valuable science (Gross, 1990: p.2003).

University and research institutes are evermore being assessed according to their scientific productivity, having consequences on the resources allocated to them. Productivity of science is being measured according to several indicators such as: number of scientific publications in peer-reviewed journals, number of patents created, and number of doctoral students amongst others (Weingart, 2005). In an era where "governments, business and trusts must decide scientific priorities and funding" (King, 2004: p.311) being included in the discourse of forest science sheds positive light on those actors who participate in it. These evaluation criteria act on the scientific institutions and their scientists as pressures to ensure a more productive activity. Those who publish, who create patents, who increase their number of doctoral students will be favored by allocation of more financial resources than those who do not (or not in the same amount). Seen through the lens of communicative action, this is coercion on actors and their action-freedom. In view of these evaluation criteria, actors may choose to stop acting communicatively –stop striving for the common goal of science to create true knowledge- and start acting strategically –orient their actions only in view of securing their own personal research support.

The communicative action view of the scientific communication process ignores as well many aspects of reality that can be attributed to power structures. On the level of scientific knowledge, power structures influence what is considered as sound knowledge by the members of the scientific community. The community and its members agree on how scientific results should arise so as to be valid. In a given time, a given agreement is established through which all new knowledge is considered and discussed. Deviations from this agreement may signify that the knowledge developed may not be considered as such by the members of the community. If however these rules are complied with, the next step is to capture the knowledge in the formal form (amongst others) of a written text.

To be able to reach the greater international scientific community, these texts must be written in a language understandable and admitted for and by all. In the present times, this language is English (Ammon 2001, Crystal 1997). Therefore, scientists who wish to internationally transmit their research results must do so in English. This is an entrance barrier to the world of scientific publishing. Surveys regarding problems scientists have when exposing their work to international communities have revealed that writing an acceptable English language article is not an easy task for those scientists whose native language is not English. It is here where, on an international level, Habermas' principles are not necessarily met: not every member of the community has equal access (the same chance) for presenting their information. On a national level this is different. Scientists within their local communities dominate their native language and do not have the same problems creating texts. Thus, on a national level this condition is met. If this hurdle is overcome and an article is written in English (for an international aimed communication), the next step is to submit it for consideration in an international (national) peer-reviewed journal.

The free accessibility to the public sphere is also a point widely criticized. When examining forestry issues that cross nation boarders, Kleinschmit et al. (2007, p.433) speak of asymmetrical communication in the public sphere that favors richer nations in disadvantage of poorer nations or behaviors between northern and southern countries. Even though the authors apply this to the public sphere of the mass media, communication asymmetries in the scientific public sphere is also a realistic notion both on an international and national level. The amount of resources available to scientists can be seen as a limitation for participating in the scientific public sphere. Considering global science, countries that dedicate a greater share of their Gross National Product on research and development have a greater chance to develop research[9], publish their research results and, consequently, include their interpretation patterns in the dominant discourses on science (King 2004). Regarding a national context of science, resources are as well scarce and unevenly distributed through those organizations and their scientists dedicated to research. Thus, within a country asymmetries in communication may also be found which distort the single country scientific communication process.

The resource limitations that scientists are subject to not only act on the possibility of carrying research per se, but also on the possibility of engaging in scientific discussion regarding research results put forward by other actors. The accessibility to produced knowledge finally depends on the resources available to scientists, their research institutions and their nations. If scientific consensus is formally measured only through the amount of citations a published article receives then, and for the process of consensus in science to be seen as legitimate, it is fundamental that all actors have access to these articles and have the possibility to cite them freely. This may not be possible for many nations, research organizations and individual scientists who have limited resources available to them.

To this point, aspects have been discussed that raise questions regarding the applicability of Habermas' theory of communicative action and public sphere to the analysis of science and its discourses. Summarizing these points:

[9] Relating the expenditure of single countries to their scientific output in terms of scientific publications has been carried out by different authors and a direct relation existing between the two has been observed (King 2004, Wagner et al. 2001).

- Limitations exist regarding time available for scientists to embark in a deliberative process with other actors in the public sphere of science. Time is seen as a scare resource available to scientists.
- Pressures exist to which scientists are confronted with regarding their scientific productivity. Evaluation of science taking place in the face of scarce financial resources act as a pressure factor on science and scientists.
- Limitations exist regarding the overall (financial) resources available to scientists and to countries to carry out research and thus be able to contribute to the creation of knowledge and its' dissemination.

With this, it is clear that power structures are present in the peer review process. So a deep analysis of the scientific discourse must consider these power structures and their influences. Additionally, these criticisms make necessary the incorporation to Habermas' model theoretical considerations that may capture the limiting structures (or power structures) present in science which act distorting communication. Therefore Michel Foucault's work on discourse, power and knowledge will be briefly considered and discussed if and how it makes sense to link it with Habermas' views.

2.3. MICHEL FOUCAULT

The work of Michel Foucault has been intensely discussed throughout the years. His work can be seen as an abstract approach to discourse and discourse analysis (Fairclough, 1992: p.37 ff.) which has been the basis of much research in the social sciences. Contributions that make his theory so interesting for many are his views on the relationship between discourses and power, the discursive construction of social subjects and knowledge, and the functioning of discourse in social change. Foucault's emphasis is upon the domains of knowledge which are constituted by rules (of formation) which define who speaks and what is said in societies.

Foucault's theoretical considerations changed over time. He was first concerned with an 'archeological' investigation of discourse, which focused on types of discourse as rules for constituting areas of knowledge. Later he shifted to a 'genealogical' investigation that focused on the relationships between knowledge and power, and finally turned to an ethical view on 'how the individual is supposed to constitute himself as a moral subject of his own actions' (Foucault, 1984: p.352). The objective here is not to go into detail of every aspect of Foucault's work, but to present those with relevance to this work[10].

2.3.1. DISCOURSE, POWER, AND KNOWLEDGE

Foucault understands discourse as a relation between speech and thought, being the statement the basic unit which makes proposition, utterances, and speech acts meaningful. The relation between speech and thought can have an enormous influence on

[10] For discussion on Foucault's work refer to Foucault, 1984; Dreyfus and Rabinow, 1982; Sarasin, 2005; Fairclough, 1992; and Ruoff, 2007.

the knowledge forms of a culture. A linguistic expression has a function, in discourse, which serves the production and social maintenance of complex knowledge systems.

Discourse is the compilation of disperse statements (*discursive formations*) appearing in different places which are constructed through the same pattern or *rules of formation* (Foucault, 1972: p.38). Discourse is responsible for the construction of truths which are erected within the historic system of thought (Ruoff, 2007: pp. 91 ff.). For Foucault, discourses are a consequence of historic processes and every discourse -with its characteristic historic rule formation- can establish its own values and truths. What is considered as discourse then depends on the historic time and place of its appearance and whether or not statements have complied with the accepted rules of formation; if this is the case, then the statements are given meaning and discourses arise. The analysis of discourse then delivers information on the institutional embedded stabilized practices of discourse production; it reconstructs the mechanisms that allow things to be said in determine places: "not all that can be said will be said: and not everywhere can everything be said" (Keller, 2004b: p.45).

This tradition of discourse analysis put forward in "*The Archaeology of Knowledge*" (Foucault, 1972) is seen as a snapshot of a certain historic moment. In his further work Foucault goes on to study discourse and its relation with power and knowledge.

In "*The Order of Discourse*" (Foucault, 1981a), Foucault brings together the concepts of discourse and power. Discourses are linked to criteria of empowerment and exclusion as for example academic degree or recension status (Keller, 2004b). These criteria differentiate between possible legitimate speakers and non-legitimate speakers; they constitute therewith subject positions. Foucault says that truths are the result of power struggles and that what is true is only a claim within a certain speech or truth game (Keller, 2004b: p.50). Thus for Foucault, discourse is a string of elements which operate within a general mechanism of power. So discourse must be seen as a consequence of events, for example political events, which serve as a vehicle of power (Keller, 2004b: p.99).

But what is power? For Foucault power is omnipresent because it is produced "from one moment to the other, at every point, or rather in every relation from one point to another" (Foucault, 1990: p.93 ff.). Relations of power are consequences of the division, inequalities, and disequilibrium which occur. He states that power reaches into every aspect of individuals, it inserts itself into their actions and attitudes, their discourses, learning process and everyday life (Foucault, 1981b: p.39). Hence, Foucault's focus when studying power is on relations of asymmetries, non-reciprocity and hierarchy and on the ways in which they include and exclude, make central and marginal, assimilate and differentiate, in contrast to Habermas which focuses on symmetry, reciprocity, and universality (Hillier, 2002: p.59).

Foucault stresses the impact of power on every aspect of life, including on the inner-self of individuals. The individuals are shaped by power and what they say or do or what they do not say or do are all consequences of the internalization of power structures. Through *discipline* (Foucault, 1977) individuals exercise self-control and adapt themselves to the structures present and shaped by power in a given time. Discipline is the power

mechanism which enables controlling all from society up to the smallest element of society, namely the individual; it is all those mechanisms which make possible the control of the operations of the individual, which assures the constant subjection of its forces and imposed upon them a relation of docility-utility (Foucault, 1977: p.137). The individual is then internally coerced because of the constant observation and vigilance that they have been put through. Constant vigilance is at some point internalized by the individuals and acts as a self-control mechanism, as a normalization of sorts; a mechanism of power. Thus, there is no need for actual constant surveillance because individuals have shaped their behaviors and actions in face of the fear of discipline: this is what has been labeled as *disciplinary power*. The idea behind discipline is how to be able to monitor individuals, how can their behaviors and qualifications be controlled, how can their performances be increased, how can their abilities be enhanced. In other words: how an individual can be put in the place (is obedient) where he/she is most useful. The disciplining of societies means "*that an increasingly better invigilated process of adjustment has been sought after –more and more rational and economic- between productive activities, resources of communication, and the play of power relations*" (Foucault, 1982: p.219).

In order to study power, Foucault recommends that one must move from the traditional view of power-sovereignty (or juridico-discursive)[11] -that one must 'cut of the king's head'- to the construction of an 'analytics' of power: "*that is, toward a definition of the specific domain formed by relations of power, and toward a determination of the instruments that will make possible its analysis*" (Foucault, 1990: p.82). For Foucault the study of power should not be limited to studying institutions because power relations are rooted in a system of social networks.

In social networks, in institutions, in statements and objects, in instruments, practices, research program, and skills is where knowledge is established (Rouse, 1999: p.110). According to Foucault, knowledge is the "*group of elements, formed in a regular manner by a discursive practice, and which are indispensable to the constitution of a science, although they are not necessarily destined to give rise to one*" (Foucault, 1972: p.182). Foucault wrote extensively on the reconfiguration of knowledge in the human sciences, emphasizing that the reorganization of knowledge constitutes new forms of power and domination (Rouse, 1999: p.92). So intertwined are the concepts of power and knowledge for Foucault that even when writing he writes them together (as power/knowledge or power-knowledge). For Foucault: "*power produces knowledge … power and knowledge directly imply one another … there is no power relation without the correlative constitution of a field of knowledge, nor any knowledge that does not presuppose and constitute at the same time power relations*" (Foucault, 1977: p.27). The forms and possible domains of knowledge are determined by power-knowledge and its processes and struggles and not by the subject of knowledge that produces a body of knowledge. According to Rouse (1999, p. 93 ff.), Foucault was interested in examining in which context bodies of knowledge became intelligible and authoritative. The discursive formations, or fields of knowledge, were structured by "*concepts and statements that were intelligible together, how those statements were organized thematically, which of those statements counted as 'serious', who was empowered to speak seriously, and what questions and procedures were relevant to assess the credibility of those statements that were taken seriously*" (Rouse, 1999: p.93). A statement, a technique or a skill taken alone does not count as knowledge; only in so far as how it is

[11] Here Foucault is recognizing his opposition to the Habermasian view on power based on systems of laws.

used, and thus connected with other elements over time, does it constitute significant knowledge (Rouse, 1999: p.110).

The way in which knowledge is used and organized produces conflicts which in turn generate new discussion and reorganizations of knowledge. The conflicts generated (or problems being conveyed by discursive formation) and the strategies employed to solve it give rise to *resistance*, which can lead to discourses influencing others by it.
Foucault takes as a starting point the forms of resistance against different forms of power. Every form of power (or power relation) implies a strategy of struggle. In order to resist power relations, one must shed light on them, locate them (their position), and find out their point of application and the methods they use. Foucault suggests that to find out what power relations are about one must start by analyzing the struggles that have been carried out in order to resist it. These struggles are in opposition to the effects of power which are linked to knowledge, competence, and qualification: struggles against the privileges of knowledge; they are also an opposition against secrecy, deformation, and mystifying representations imposed on people (Foucault, 1982: p.212). "*What is questioned is the way in which knowledge circulates and functions, its relations to power*" (Ibid, p.212). Thus, according to Rouse (1999, p.110), Foucault is not identifying knowledge and power but recognizing the strategic alignments that constitute each contain many of the same elements and relations: "*How knowledge and power come together is historically specific and may vary significantly in different domains*" (Ibid, p.111).

2.3.2. FOUCAULT AND SCIENCE

How can Foucault's work be linked to forest science, or more precisely: what is the relevance of Foucault's concepts to the study of forest science and its' discourses?

From Foucault's theoretical background, discourse on forest science is to be understood as a consequence of a set of constraints that both limits the possibility of what can be said and constructs the identities of those who participate in it (Torgerson, 2003: p.132). These constraints or prohibitions (that determine which questions can or cannot be raised) and the system of exclusion (who is authorized to participate) are all consequences of internal discipline (Hajer, 1995: p.49). What is accepted as meaningful knowledge in forest science then depends on a system of rules that determine which actor (here scientists) may speak and what is it that he/she can say (e.g. which research questions can be raised). The accepted and meaningful subjects, objects, and knowledge arise having power relations as a background. These power relations are deeply embedded in the social structure of the scientific community, and in turn influence the rules of discourse formation and the shaping of the individual actors (scientists).

Following figure 2.3, the interaction between discursive (e.g. written texts) and non-discursive (e.g. body language) practices shape and enable who is allowed to make statements, who is empowered, who and what statement is credible, which organization and how serious all these power-filled interactions end up influencing and shaping subjects, the objects of reality and the discourses; finally, and thinking of how the scientific community is constructed, shaping what is considered empowered and accepted knowledge or science. Power in the scientific process is not only found in a hierarchal

manifestation of who (e.g. to which country/organization these actors belong) ends up speaking, but manifests itself on the micro level of individual scientists shaping how they view the process of knowledge formation and the role they are 'allowed' to take in this process. The rules of knowledge creation in science might differ from the ideal science norms that Merton has postulated, in so far that the equality and free access to participation may not be guaranteed by the scientific community or may not be thought to be guaranteed by the individual scientists.

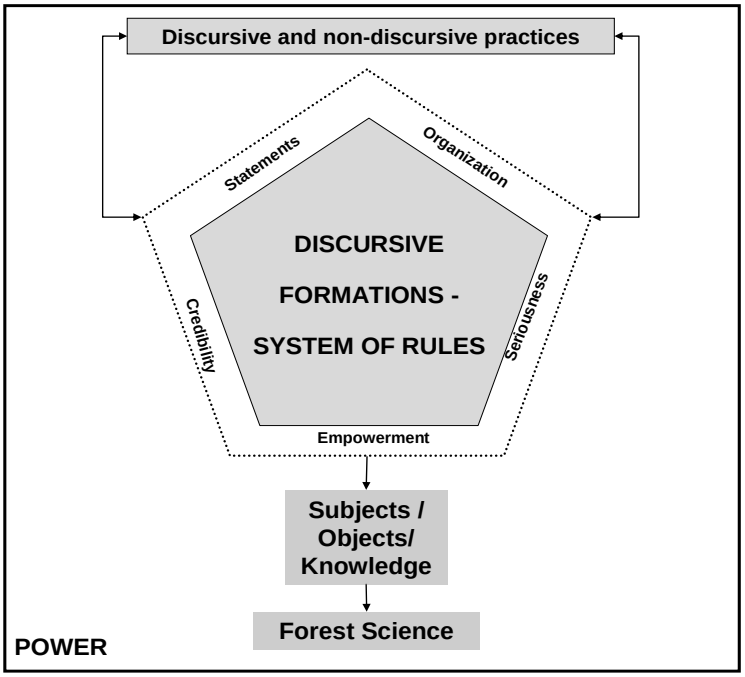

Figure 2.3. Power and Discourse according to Foucault (Source: Adapted from Rouff, 2007)

In order to make clear how power structures act within forest science either on an international or national level, Foucault's analytics of power may be followed. A study of power in this field would imply revealing the existence of power structures that are influencing the different scientific cultures, as this would then be the first step in resisting the power structures, and maybe bring on change.

A power influence on discourse which can be expected in science, and to name one relevant for this study is that of the process of citation allocation and register. Economic power (seen as monetary resource availability) influences which knowledge is available to scientists from specific establishments, as subscription to scientific journals have a monetary cost. Only those organizations/countries that have sufficient resources available may have unlimited access to the knowledge produced and published, and thus only they will have the opportunity to cite and determine what knowledge is important within the community. Therefore, the dominant discourse in science is dependent on economy power (this being only one of many possible dependencies). Furthermore, on an international level criteria for entering mainstream science may act as exclusion criteria for actors which do not comply with them, consequently limiting the free accessibility to knowledge creation (e.g. English as the universal language of science).
Who is a potential speaker in the discourses within the field is determined by clearly defined (ruled) procedures (exclusion criteria). This is in accordance to the concept of

discursive formation of Foucault (discourses and discursive practices). Who is a potential speaker, who determines the interpretation patters within forest science depends on power processes: selection process by journal editors, peer reviews on a first moment, and on a second moment society itself which attributes meaning to the discourse by assigning citations.

Through the analytics of power of Foucault, analyzing the discourse on (forest) science brings understanding of how power acts in the scientific community: determining which scientists are able to speak, which are empowered by others to do so, and what can be said or in this case written. Foucault says that one can resists these power structures by means of raising conflicts and getting involved in new discussions which, if successful, in turn will become the new knowledge accepted within the community. But when resistance is successful in the sense that the 'old' power structures are torn down, according to Foucault this will only give way to 'new' power structures. Foucault does not give directions of how one can achieve the breaking down of power structures; he gives the answer for the question of how it is, but does not given any insight into how it should be or what should be done to provoke change. Change not necessarily referring to the elimination of power structures but change in the sense of approximating a more deliberative communication process.

2.3.3. FOUCAULT CRITIZISED

"… *(Those) who follow the tradition of Michel Foucault are often reluctant to say if anything can be done to counter the influence of the oppressive discourses they identify… let alone refashion them"* (Dryzek 2006, p.22). This criticism is central to the development of this work.
In everyday life, Foucault's thoughts perfectly describe the power relationships and discourse formations of the world of science in particular and society in general. However, the view that these structures will not change or if they do, they will way to new structures of power that will end up having the same arrangements is not a view shared in this work.
Foucault lacks a direction –he denies that such a direction can exists- of action which Habermas can deliver. Foucault, as Hillier states, never considered his main task to offer alternative possibilities for acting but rather, to shed light on the specific dangers that power/knowledge produces (Hillier, 2002: p.62). For Foucault, the subject is shaped by discursive relations such as power relations, existing structures, etc. This would imply that for science, scientists and their discourses are shaped by the dominating structures that exist within the scientific community; they comply with the rules and structure dominating. The idea that scientists' discourse is shaped by the governing structures would imply, that their generation of knowledge is as well shaped by these existing (power) structures and that the scientific discourses which have an important impact on society are those that have been shaped by these power structures and not, for example, by agreement. This could be dangerous (in the Foucauldian sense) in so far that the knowledge and solutions transmitted by the discourse on forest does not reflect a consensus amongst all those that are affected by the problems faced by the forest, but reflect the knowledge and solutions transmitted by those in specific power positions. And it would further raise the questions of why those who are not part of the discourse should even carry out research, if that which is being integrated into the discourse is only a

consequence of power structures and not consequence of other characteristics as, for example the quality or relevance of the research.

2.4. LINKING HABERMAS AND FOUCAULT

Discourse analyses have followed one or the other tradition: Habermas or Foucault, as there are general differences that make it difficult to combine both theoretical currents – some authors go so far as to say it is impossible (Flyvbjerg, 2001). Few studies have focused on their common features: for example Hillier (2002). What is relevant here is not integration one into the other, but expanding one with the other. The failure of the Habermasian ideal –the distortions present- may be explained by Foucault's approach. That is why to decide in favor of one theory in order to analyze the forest discourse on science (or in general any political process) is to ignore fundamental aspects of the other. Thus, if Habermas' perspective for research is chosen, then power structures that influence the creation of discourse are ignored. If, on the contrary, Foucault's perspective is chosen, reality is described but no recommendations may be expressed regarding e.g. how to reverse power structures influencing discourse; since there is no ideal situation to aspire there is no need to encourage change. As Hillier has expressed regarding policy processes: "… *understanding of the who, how and why issues of such power relations, together with communicative negotiation may help to challenge the domination of elites and professionals in determining the discourses and practices that comprise the reality of policy-making*" (Hillier, 2002: p.26). Not only in policy-making is shedding of light on power structures important, but in order to make science a consequence of a more deliberate communication process –in order to make science more participative-, then the power structures present within this sphere must also be revealed.

Habermas recognizes that to link his ideal theory of communication with empirical investigations that conceive politics primarily as an arena of power process, is somewhat difficult. However he does not see both views as contradictory. He comments (Habermas, 1996: p.287) that "*there is no opposition between the ideal and the real*" and that the question in the analysis of process is to choose basic concepts in such a way "*that it can identify particles and fragments of an 'existing reason' already incorporated in political practices, however distorted these may be*". Hence, Habermas is admitting that power structures might be incorporated in the model of discourse ethics, if this is the way in which reality can be empirically analyzed. Habermas does explain the effects on discourse of communication behaviors of actors located in the center (State) and periphery (civil society, NGOs) of the political system. However, no mention is done to the effects on discourse of other characteristics of actors such as gender, class, or country of origin.

Attempts have been made to bring together aspects of both authors that may help explain and improve different aspects of reality (e.g. policy discourse) such as Hillier (2002) which is applied to land-use planning. For the discourse on forest science, no attempts have been made[12].

Here, the starting point for analyzing the formal scientific communication regarding forestry is anchored on the theory of communicative action of Jürgen Habermas. If

[12] As far as the knowledge of the author goes.

science is seen as a public sphere and the norms of science -as put forward by Merton- accepted, then the discourses that arise from this sphere should represent the agreement of the entire scientific community. Yet, the existence of these norms in science has been disputed and labeled as an ideal (Felt et al., 1995; Shorett et al., 2003). Criticism focuses on pointing out that these norms have evolved through time and even at the time of their presentation were very difficult to find in their pure form. Consequently, and because of the existence of social processes that take place within the scientific community which influence the direction in which science develops as well as the forms which it takes (Felt et al., 1995: p.57), Michel Foucault's considerations regarding power structures influencing discourses (e.g. hierarchies within scientific disciplines) must be taken into consideration in order to help understand the distortions from the ideal deliberative discourse. Foucault's theory allows examining in which ways asymmetries of power and resources affect the *"…'universal rights' of liberty and equality…"* (Hillier, 2002: p.58), these are here analyzed through the access to discourse of actors (scientists). Thus, these power structures act on communication causing distortions that shift the science discourse on forest from the ideal picture posed by Habermas (regarding communication) and Merton (regarding scientific norms).

With the previous considerations in mind, figure 2.4 describes the model relevant for the analysis here undertaken. Limited communicative action should be then found in the formal process of knowledge formation of science through peer-review process in scientific journals and citation patterns, and power structures (such as who is allowed to speak, who has the necessary resources to speak, or who has access to the discussions) are found far and wide in the scientific community influencing every step of the process of determining the dominant forest science discourse.

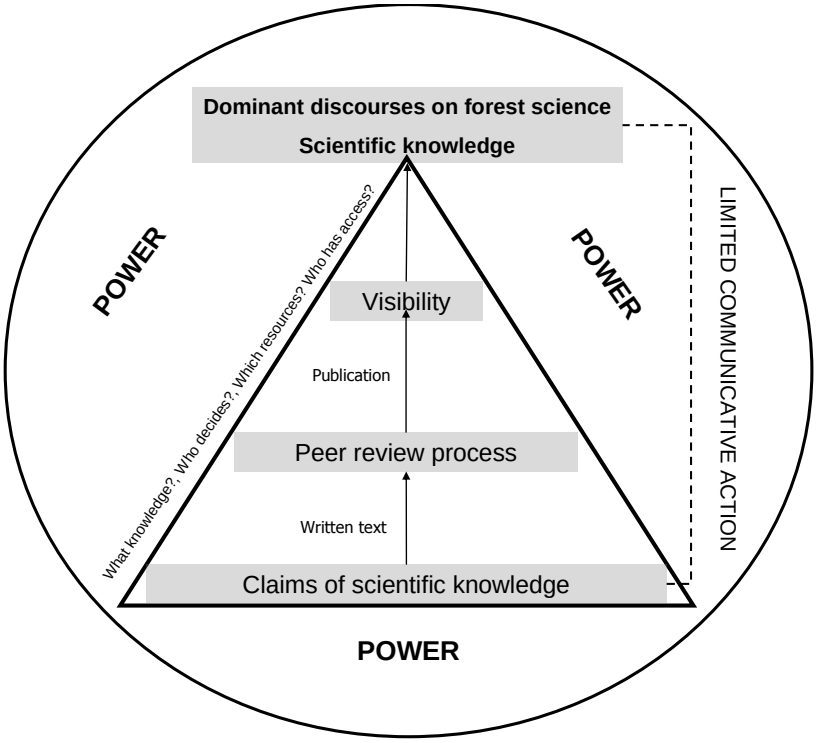

Figure 2.4. Research model linking Habermas' and Foucault's theoretical considerations (Source: own construction)

The critic points to Habermas' model of communicative action and public sphere mentioned earlier –the distortions in the communication process- can be explained by Foucault's views on power, knowledge and discourse.
Thus, Foucault finds power operating in structures of thinking and behavior which Habermas sees as free of any power relation influence. Habermas thinks that limiting political and economic power is enough to make speakers equals in communication processes. Foucault, on the other hand, observes that both social power depending on economic dependence and/or political domination and internalized sense of the right an actor can have to speak or not to speak, can prevent actors from being equal speakers (Hillier, 2002: pp.59 ff.). In the communication process in the universal public (and scientific) sphere, power (in this study economic power and social/scientific norms) then influences who is seen as a speaker and what is allowed to be said. For this study, the power structure that is understood to be acting on the scientific discourse is that of economic power. One country will have more power if it has more economic wealth than others. This influences individual scientists and their publications patterns as it may be assumed that as nations become richer (increase in their economic power), the availability of resources for science may increase. If the resources increase, then scientists may have more possibilities to make their discourse visible than those who have fewer economic resources –economic power- available.

Within the scientific community, power structures are present that make difficult the fulfillment of communicative action in the ideal sense Habermas has posed. The previous discussion has tried to bring together theoretical considerations of both Habermas and Foucault that make for a more realistic description of how discourses in forest science arise by incorporating elements associated to power. Thus, if this model is accepted and an analysis of the scientific discourse on forest is to be undertaken, then the factors that characterize the discourse should first be identified and analyzed.

2.5. GLOBAL AND LOCAL DISCOURSES

Globalization has reached into many corners of society. The discourses on forests, be them scientific or public, are no exception. The forest and its problems have ceased to be topics of only local or national interests. Consequences of e.g. deforestation or forest fires (to name some) have reached outside the limits of single nations. Especially extreme catastrophic forest fires have consequences for the climate of the entire globe. Discussions on how to solve these problems have also ceased to be centered on a local level. Networks of actors and institutions have been built to deal with the consequences of environmental problems. Global institutions, e.g. the Intergovernmental Panel on Climate Change (IPCC), the World Bank, have gone on the tackle problems that have local causes but global consequences. These institutions and the processes associated with them not only accommodate diverse national interests and facilitate cooperation, but they help construct a politics that at once crosses geopolitical borders and transcends them (Martello and Jasanoff, 2004: p.3).

The efforts to give solutions to environmental problems affecting the totality of the globe has been in practice since the 1970s, where efforts have been made to fight acid rain, ozone depletion, biodiversity losses, climate change, and desertification. These efforts

have signified a closer linkage between scientific and political actors, and a higher participation of civil society. All these actors bring their knowledge, availed by their own experts or counter-experts, into the discussion of environmental problems. The discussion can be held on different levels, according to the objectives to be pursued. When national forest policies (e.g. forest conservation acts) are in the making, discussion will be most likely to be held in national spheres such as national scientific journals or national mass media. However, such topics are no longer only of national concern. Evermore nations have come under pressure to act according to global agreements; and so the discussions not only have a local connotation but acquire an international or global one as well.

Global discussions are mainly carried out in spheres that may be, in principle, accessed by all actors with some kind of interest in the issues. The global scientific sphere may be represented by international reaching scientific articles which reflect the global scientific discussions of the moment. A global universal public sphere is more difficult to identify. Mass media with an international focus can be used as an approximation of a global universal public sphere, even though limitations must be recognized regarding which media can really be considered global and the accessibility of participants to it. This limitation must also be considered when trying to find a global scientific sphere.
It is relevant to study both scientific and media discourse on a national and international level in order to identify whether the power structures that influence the creation of knowledge have effects on the characteristics of discourse such as which actors are shedding light on relevant forest issues. In this work, both global and national discourses regarding forest science will be then examined.

2.5.1. THE SCIENTIFIC DISCOURSE ON FOREST SCIENCE

The aspects of discourse and discourse analysis that will be here considered regard the discursive practices of actors, as well as the power relations that shape the discourse.

Here, the formal communication of scientific articles has been chosen as the object of study. The discourse found in this particular arena is named the scientific discourse on forest science (in contrast to the public (media) discourse on forest science). These articles have been formally characterized through the source that published them, through the citations they received, through the type of article that they are (ranging from theoretical papers to experimental and technique descriptive), the type of funding they have been developed through, and of course which issues they touch upon.

2.5.1.1.CENTERS AND PERIPHERIES IN SCIENCE

As mentioned previously, distortions in the ideal communication process of Habermas may be due to asymmetric communication behavior of different nations. Johan Galtung's theory of structural imperialism sheds more light to this problem. Galtung (1971) notes that, because of differences in economic, political, and cultural structures richer Nations have dominated the international society in detriment of poorer nations. Galtung differentiates between countries positions in the Center and Periphery of an international

world order. Within this world order, a nation becomes a Center when power structures exist that favors it over other nations that would then belong to the Periphery (Shils, 1988: p.254). Thus for both Galtung and Shils, a nation would be classified as belonging to the Center or the Periphery according to the inequalities that are present when considering different parameters. Relationships of inequality may exist within geographical space regarding wealth, knowledge, authority, and power which gives rise to Center-Periphery structures (Hannerz, 2001). Most common Center-Periphery relationships are the ones which refer to North-South relations and economic dependencies between industrialized countries and non-industrialized countries. A Center country has more riches than Periphery one, this is what Galtung then understands as imperialism (Galtung, 1971: p.84). For Galtung (p.91-92) different types of imperialism occur depending on the type of exchange existing between Center and Periphery nations: economic, political, military, communicating and cultural. A subtype of cultural imperialism is, for Galtung, the scientific imperialism. He explains that there will be scientific imperialism when the Center provides the teachers and the definition of what is worthy of being taught and the Periphery always provides the learners. Translating this to scientific discourse, the Center nations will be the ones that contribute with interpretation patterns regarding problems or issues (definitions of problems, new knowledge regarding these problems) and the Periphery countries will be the ones that adopt and use these patterns to their own problems. Galtung exemplifies this through the patterns of scientific teams from the Center who go to the Periphery nations to collect data, for its subsequent processing, analyzing, and theoretical formation in the Center universities. A finished product (publication, journal or book) is afterwards sent to the Periphery for its consumption.

Science is not an arena where these Center-Periphery structures are absent. Wagner and Leydesdorff (2005) have mapped the network structures of science on a global level by examining the patterns of co-authorships of articles. Their main finding reveals that in the time period between 1990 and 2000 the global network of science has included more nations but, that Center-Periphery structures have become more pronounced. Studies have also been carried out for specific disciplines like tropical soil sciences (Arvanitis and Chatelin, 1988). For forestry, however, no studies have taken place[13].

The existence of Center-Periphery structures in science imply that the dominant discourse on science reflects the interpretation patterns of the Center and the Periphery is thus marginalized. Research is carried out mostly in the Center, and the scientists from these Centers are the ones which better position their knowledge, views, and opinions regarding the problems faced by nature and society. The dominating knowledge arisen from these structures not only reproduce problems of the Center, but also that of the Periphery: existence of cultural (scientific) imperialism. The issue becomes to what degree is the domination of the Center countries present? Does the Center limit their research, and thus their interpretation patterns, to problems faced in or by their own countries, or is there an '*outsourcing'* of research in the sense that the problems faced by the Periphery (in terms of carrying out research in the Periphery) are as well covered by the Center?

The question for the scientific discourse on forest here becomes, whether it behaves as any other scientific discourse (discourses representing other disciplines or the entire

[13] To the knowledge of the author.

community of science) where Center-Periphery structures are present. If they are, then the global scientific discourse on forest is not really global, but dominated by Center countries, and is thus an example of an empowered discourse.
Thus, what is important is to identify whether Center-Periphery structures are present, identify which countries are Centers, which Peripheries, and identify the 'outsourcing' of research.

If these structures are present, and the participation in global discourse is dominated by industrialized countries that represent Center countries then, through scientific collaboration a nearing to the ideal situation of a deliberative discourse may be achieved, where Periphery countries can gain access and eventually influence discourse.

2.5.1.2.SCIENTIFIC COLLABORATION

The process of globalization has reached far into all aspects of society and science is as well not unfamiliar to this process. Many developments in science and technology have been the results of international collaborative efforts and many indicators show increasing ties between scientists to share data, conduct joint research, and develop common standards (Wagner et al., 2001). Caroline S. Wagner notes that scientific research is becoming more globalized (increasing amount of countries are building their scientific capabilities and participating in world science), more collaborative (a growing proportion of projects and the publications they produce result from collaborations by investigators from various nations), and more "*distributed*" (scientific teams are collaborating across greater distances and involve more widely dispersed expertise; Wagner et al., 2001: p.xi).

Collaboration is the culminating process of communication between different actors or organizations regarding a specific issue. As Lozano notes, collaboration may be seen as the peak of a pyramid which's base is communication (understood as how persons understand and how information is transferred), followed by coordination (informs the actors as how and when the must act) which gives way to co-operation (taking and sharing the values of the group), finally leading to collaboration (or using the information, divergent insights and spontaneity to solve problems and develop new understandings; Lozano, 2007: p.372). From an inter-organizational perspective, Lozano describes collaboration appearing when organizations jointly develop proposals, share information, plan joint workshops and raise funds together, amongst other activities. From several definitions of collaboration two elements arise: working together for a common goal and sharing knowledge (Hara et al., 2003: p.953). This is similar to what Habermas states is the basis of communicative action, namely creating rational consensus.

As international collaboration in science and technology, Wagner et al. (2001) understand the conducting of joint projects or the sharing of common data towards a shared research goal by scientists coming together from different countries (p.1). Collaboration in science is also seen as the resulting network of either individual scientists or research organizations, which have communicated sharing data and/or resources with the aim of using the information they have gained to produce a scientific product (be this research reports, books, or scientific articles).

Scientific collaboration may be undertaken at different levels. Wagner et al. (2001) note that international collaboration in research and development was in the past usually characterized as consisting of two kinds of activities. On the one hand, "*big science*" projects, which included many countries building and sharing large scale equipment, and on the other, development assistance programs, which aimed at helping developing countries apply science and technology to their specific problems. A third activity has increased throughout the last 30 years, namely that of scientist-to-scientist collaboration (Wagner et al., 2001: p.39).

Collaboration may bring many benefits to those actors that engage in it, but also many costs. Gaining from differences in perspectives, gaining knowledge and learning new approaches, and solving problems are some benefits of collaboration (Lozano, 2007: p.372). The most obvious benefit of scientific collaboration is the scientific knowledge gained through it.
Resources available to individual scientists influence the capacity to collaborate. Not only organizational resources but the status of scientists within their organizations may favor collaboration. Studies have found that the higher the status of individual scientists the more probable it is for them to collaborate with other scientists (Pao, 1992; Knorr et al., 1979) a higher status implies more access to resources, to scientific personal, and money.

On an international level Wagner et al. (2001, p.2 ff.) give reasons that may be behind scientific collaboration. Factors that favor international collaboration, but may come with great costs, are dispersed scientific excellence, international contacts, increasing facilities of communications and travel. Collaboration may also be born from the need to share equipment, to access foreign natural resources, carry out specific field experiments, to serve a corporate, government or national mission more than from the desire to share knowledge[14] (Wagner et al., 2001; Hardy et al., 2003). Other reasons for collaborating include structural ones such as the need of specialized skills from a variety of scientific disciplines. Governments also encourage the funding of international collaboration because of the missions it has set out to achieve, namely missions of foreign policy, national security, humanitarian aid, or economic competitiveness. Thus, scientific collaboration is a strategic action which not only has a scientific basis for its occurrence but a political one as well.

For environmental problems (sustainable development in particular) the Brundtland Report has recognized that "the search for common interests would be less difficult if all development and environmental problems had solutions that would have everyone better of" (WCED, 1987: p.48). This is a call for undertaking collaborative efforts so that equilibrium may be reached that favor all actors involved. Efforts of collaboration in forest science have already been made. The existence of the International Union of Research Organizations (IUFRO) is one example how scientists from all over the world gather together and share their knowledge and experiences in order to provide scientific information and solutions to global problems. Other formal agreements have been also been completed in order to promote partnerships on forest science e.g. the Memorandum of Understanding in February 2006 by nine forest science organizations in the Western-Balkan region (EFINews 2006).

[14] Authors have surveyed reasons behind scientific collaboration, e.g. (Melin, 2000). They have found that not only sharing knowledge and gaining access to data and equipment, but also personal relations are reasons why scientists collaborate.

The implications of collaboration for discourse can be explained if firstly the idea is accepted that participation in scientific discourse is desired by scientists because, by doing so, all scientific interpretation patterns regarding issues or problems -and eventually their solutions- are included. For a deliberative discourse, on a global level, international collaboration has then a fundamental meaning. It offers possibilities for countries to be linked into a global community and form part of the discourse on specific topics. International collaboration offers the communication process of countries –and individual scientists- the opportunity to communicate in a deliberative way and overcome the obstacles of the expected empowered discourse.

If all these benefits are accepted as true motivations for collaboration, then the question becomes, if forest science is also benefiting from collaboration. Do different types of collaboration exist? and if collaborative efforts exists, are these distributed equally amongst countries[15] that can create opportunities for the inclusion of interpretation patterns of other actors (or countries) regarding the problems the forest is face with? These are all relevant questions to study if recommendations are to be made which might allow a new governance of science based on more participatory processes.

Within the Habermasian view of society and the sociological view on science, the scientific sphere is not isolated from other spheres but socially interacts with them. Since these interactions are present, then the question arises whether they have any influence in shaping the scientific discourse on forest both found within the scientific community as that found in the universal public sphere. The linkage between these spheres will be discussed in the following chapter.

2.6. INTERACTIONS BETWEEN SCIENCE, SOCIETY AND MASS MEDIA

For various authors (e.g. Habermas 1992, 1996 and Ferree et al., 2002) the public sphere is an arena where societal problems are presented and openly discussed. The discussion of these problems supposes interactions between specific forums of the public sphere that are affected. Each of these forums is comprised of individual or groups of actors who go public with their particular interests, of an audience which observes the speech acts being carried out, and of actors located behind the scenes who define their interests, create strategies on how to better position themselves in the specific forum, and make alliances (Ferree et al., 2002: p.9). Politics, the economy, the worlds of arts and culture, the scientific community, the mass media, and the general public are all forums where the previous components are found. As problems affecting actors in each of these forums arise, interactions between the specific actors of the forums surface.

[15] If inequalities regarding collaborative efforts in science exist, then Center-Periphery structures reveal themselves. A Center nation, in terms of an interaction structure, would be one that collaborates intensely, on the contrary, a Periphery nation one who does not (Galtung, 1971: p.103). So, a distinction is made regarding Center-Periphery structures according to an absolute property (as with scientific productivity) and Center-Periphery structures according to the interaction structure present (collaboration). Thus, a nation could belong to the Center when examining the total number of scientific publications, but belong to the Periphery when examining the collaboration ties present.

As societies grow in complexity, the population looks to science for answers and solutions to the problems affecting nature and society. The times of science as an isolated entity have passed, and the access to scientific knowledge is in principle open to anyone (Weingart, 2001: p.15 ff.). The social change that has come about has been highlighted by two specific processes: the "*scientification of society*" (Verwissenschaftlichung der Gesellschaft) and the "*socialization of science*" (Vergesellschaftung der Wissenschaft) (Weingart, 2001: pp.17 ff.). With the former, Weingart understands the increasing penetration of more and more life and action areas by scientific knowledge and a generalization of research behavior in all societal areas (i.e. a systematic and controlled reflection of all aspects of society). The latter is understood by Weingart as the increased influence different areas of society have on science as the contact between them become more and more narrow. The pressure for legitimation of science has increased because of the increment in the amount of science being carried out and the diversification of research questions oriented more to societal contexts (application and uses of research oriented more to the needs of society). Consequently, science becomes more oriented to political and economical objectives as well as on the representation of it and its perceptions in the media.

Two key interactions within the public arena that are important to this work are exposed by Weingart namely, that of science with politics and that of science with the mass media (Weingart, 2001; Weingart, 2002)[16].

The first interaction -namely science with politics- is based on the necessity to solve societal problems. Politicians are pressured by society to deliver effective and legitimate solutions to their problems which are supported by the 'unbiased' knowledge of the scientific community. The decisions undertaken by politicians must be based on, justified, or publicly demonstrated by scientific knowledge (Weingart, 2001: p.129). And so science has two roles to play for politics: on the one hand it serves politics with instrumental knowledge for solving problems and on the other hand, it is a source of legitimation for political decisions (Weingart, 2001: p.27). The more complex societies and its' problems become, an increase in the involvement of science with politics can be appreciated.

On the one side, "*politics either request special scientific expertise or creates its own*" (Weingart, 2002: p.704) through, e.g., publicly owned research centers, establishment of science advisors in the government, amongst others. Yet, politicians often do not present -or are not aware- of different aspects of the knowledge that they integrate into their discourse but present that knowledge which supports their decisions and leave out –either intentionally or unintentionally- those other aspects of scientific information that might not fully support their views. An action not only undertaken by politics but, and because of the increased competition for expertise, by other groups in the political system who present the knowledge given to them by their recruited scientists. And so, the more involved science becomes with political actions the more central role it plays in the definition of problems, to which's solution it is then asked for advice (Weingart, 2001: p.141). Science becomes a political actor amongst many others in the political system and participates in the setting of the political agenda.

[16] Weingart also notes the narrow relationship between the economy and science (research funded by industry and oriented to solving problems that this arena faces), which influences science by changing research priorities and time frames in research processes as well as strategies of secrete-keeping (Weingart, 2001: p.31).

In turn, scientists look upon politicians (and the economy) to approve the necessary research funds and for institutional safeguarding (e.g. what issues can and cannot be subject of research). This necessity has consequences for the legitimacy of science. According to Weingart, the interaction of science with politics has lead to the destruction of the image of science as being independent of any type of other interests. He exemplifies this -through the cases of Three Mile Island and Chernobyl (Weingart, 2002: p.703)- by describing the selective process that politics, and the economy, uses of the knowledge offered by scientists to support the position that politicians wish to represent.

Weingart names this interaction, or coupling between these two fields, as the "*scientification of politics and the politicization of science*" (Weingart, 1983). On the one hand, the more science becomes involved in the political processes the more importance it has on determining the problems that it is then asked to solve. On the other hand, "*knowledge, as it enters the public arena is inevitably judged and valued by society*" (Weingart, 2002: 704), in other words: scientific knowledge is not anymore perceived as independent of political interests and scientists may be viewed as having lost their autonomy (in the sense that they represent those specific interests and are not anymore representatives of objectivity).

There are different arena where scientific knowledge is required, as seen in the previous paragraphs. Knowledge must be then integrated into different sections of society or the public sphere. Consequently, knowledge may enter the public sphere through many channels. However, the more visible channel in which knowledge is distributed to the population is through the mass media.
In his book *Democracy in America*, Alexis de Tocqueville dedicates a chapter to the importance of newspapers to public associations. He observes that the power of newspapers is to "…*drop the same thought into a thousand minds at the same moment*" (de Tocqueville, 1998: p.220) which can lead to common action if individuals are singly convinced of the ideas proposed by it. Tocqueville sees newspapers as a fundamental institution for democracies, where people separated by distance can be brought together through experiences that touch them individually without having to have experienced them first hand. Through the reporting of these experiences, newspapers act as a beacon for common actions that might be taken by individuals confronted with the media. In other words –and applied to policy making-, because of how rare it is for individuals to directly observe or experience (forest) policy activities, the mass media play an important role in providing information for political opinion-making (Krott, 2005: p.166).

The influences attributed to the mass media and conceptualized through different theories has not be fully proven or exactly measured. However, and through different empirical studies, there is strong evidence that these influences exist (Noelle-Neumann, 1997). The agenda-setting function of the mass media (McCombs and Shaw, 1972) supposes that the opinion of the population, as well as the policy agenda is influenced more or less by the contents appearing in the mass media. The importance of the mass media is as well amplified by the "*assumed pervasive influence*" (Ferree et al., 2002: p.10) it has on all participants of a policy process and especially on the formation of public opinions. Krott names three self-deceptive assumptions that are made by politicians when weighing the opinions appearing in the media: (a) media coverage conveys the opinion of the general population; (b) most of the public play attention to the media; and (c) the public

orients their behavior according to media reports (Krott, 2005: p.174). These assumptions shape the reactions of the politicians to the events covered by the media; be them reacting to unfavorable coverage or to those that are positive to them.

The mass media as "*master forum*" (Ferree et al., 2002: p. 10) is used by actors, not only politicians, from other forums be it as participants or as observers (e.g. politicians, readers, viewers, etc.). As participants, actors work out strategies to gain entry to this forum in order to present their points of view or interests regarding a specific topic (interpretation patterns). As observers, actors may be influenced by the discourses portrayed in the media be them political, social or cultural. The mass media, then, act as a showcase for various discourses from other areas (or forums) and participants can measure their success through the inclusion of their interpretation patterns and the positive or negative comments made to them. Gerhards et al. (1999) put forward the model of media public sphere in which the media act as an intermediary between speakers and public. The universal public sphere thus becomes a (mass) media public sphere (newspapers, radio, and television), in which societal problems are largely reflected and those who wish to influence how the public views these problems, do so by launching their interpretation patterns to it (Weßler, 1999: p.19).

The interaction of the scientific community with the media has traditionally been viewed by scientists as necessary for translating and transmitting 'true knowledge' to society at large (Weingart, 2001: p.253). This one-way interaction between science and media has come to be known as the 'popularization of science'[17]. This is now-a-days generally seen as an outdated model because of the assumptions it makes regarding a passive and unspecified public on the one hand, and a mass media without any recognized function on the other. Throughout time, however, other attitudes have been observed regarding how scientists consider the media. On the one hand, research organizations depend more and more on public relation departments to deal with the media. On the other hand, science has become aware of the importance of the media for mobilizing public support (Weingart, 2002); support which is increasingly important in times when decision of research spending are ever more being made outside the scientific community (outside the peer-reviews system; Nelkin, 1987). Nelkin notes that the rising costs of science have made scientists seek support for large-scale projects from industry or directly from governmental agencies bypassing traditional ways of fund-raising which rely on the scientific peer-review system (Nelkin, 1987: pp.147 ff.). Consequently, the scientific community makes use of media-oriented strategies in order to 'sell science' through the media, as this is a forum various actors look upon and are influenced by (especially decision makers and donors).
Therefore a new form and intensity of communication of science with the public sphere has been born. This relationship is based on the tighter relation existing between science and its social environment and on the modified roll of the media observing this relation change (Weingart, 2001: p.252).

These attitudes observed in the scientific community are symptoms of a phenomenon that has been named the *medialization of science*.

[17] The popularization of science assumes a monopoly of true knowledge on the part of science. Science produces scientific knowledge and transmits the knowledge in a generalized form to the public through the mass media; having science control over the process. On popularization of science see: Weingart, 2001; Dunwoody, 1992; Hilgartner, 1990; Shinn and Whitley, 1985.

2.6.1. MEDIALIZATION OF SCIENCE

Medialization is a concept used to describe how certain areas of society orient themselves to the success criteria of the media (Kepplinger and Post, 2008). This concept finds its' most open representative in Peter Weingart and what he calls the connection of media to the actors involved in the spheres of politics, science, and the economy (Weingart, 2001) .

Weingart describes medialization as follows:

> *With the growing importance of the media in shaping public opinion, conscience and perception on the one hand and a growing dependence of science on scarce resources and thus on public acceptance on the other, science will become increasingly media oriented* (Weingart, 1998: p.872).

An analysis of medialization of science seeks to answer the question of the direct or indirect - intended or not intended- effects of media on the internal dynamic and organization of science, as well as the interdependency between both sectors. The medialization of science may as well be viewed through the looking glass of Habermas' communicative action. This will be dealt with in section 2.6.3.

In order for medialization to occur (Weingart, 2001: pp.237 ff.) first the autonomy of the mass media, which is reflected in the shaping of reality by the selection criteria of the media, must be recognized. The media are not the passive transmitters of knowledge that the popularization model assumes, but active actors constructing their own reality -as well creating knowledge. Therefore, even if within the sphere of science a deliberative discourse arises, the discourse that originates from the discussion of the scientific issues in the arena of the mass media may be a result of power structures that act distorting the communication process from a deliberative one.

In the discursive room between science and politics, the media have a role to play in the construction, the dissemination and placing of topics that are relevant for legitimacy (Weingart, 2001: p.253). To describe this situation, Kepplinger analyzes the traditional "*four-level cascade model of successive media effects*" (Kepplinger, 2007: p.4), where the coverage of the mass media on specific issues has effects –either direct or indirect- on the general public, and on decision makers. This model, however widely accepted and used, lacks vision on the direct influence of media on its' subjects of coverage (in the case Kepplinger describes, usually politicians or decision makers). Kepplinger calls these direct relations the "*reciprocal effects of mass media*" or the impact of the mass media on those who were portrayed by the media –subject of media coverage (Kepplinger, 2007: p.7).
Applying this model to science, media is influenced by the events or actions that science creates (media reports and comments on them). In turn, sciences' (or scientists') cognitions, appraisals, emotions, and behaviors are influenced by the media reporting (what Weingart sees as the media-science interconnection). The media reports also directly influence reference groups (general population, decision makers) who are aware of them and modify their attitudes, emotions, actions, and behaviors accordingly. This holds true when regarding that the media play an important role in forming the opinions of the general population, as they can rarely experience firsthand the (scientific) events

described by it (Krott, 2005: p.166). Consequently, the general population evaluate the news, form their opinions, develop some kind of emotion toward the reported news, and most probably shape their e.g. consumer or voting behavior accordingly. The shaping of these opinions influences in turn decision makers which are pressured by their constituencies to act accordingly through e.g. assignation of resources to certain fields of science and not to others. Decision makers are as well directly influenced by the news coverage.

The scientific actors are left to speculate with the effect that media might have on the reference group (assignation of resources, acceptance of research fields), strengthening, weakening, or altering the direct effects of reports. Because these speculations would not have occurred without the reports, their impact on science is seen as an indirect effect of media coverage. The reciprocal effect depicted in figure 2.5 is then the medialization of science.

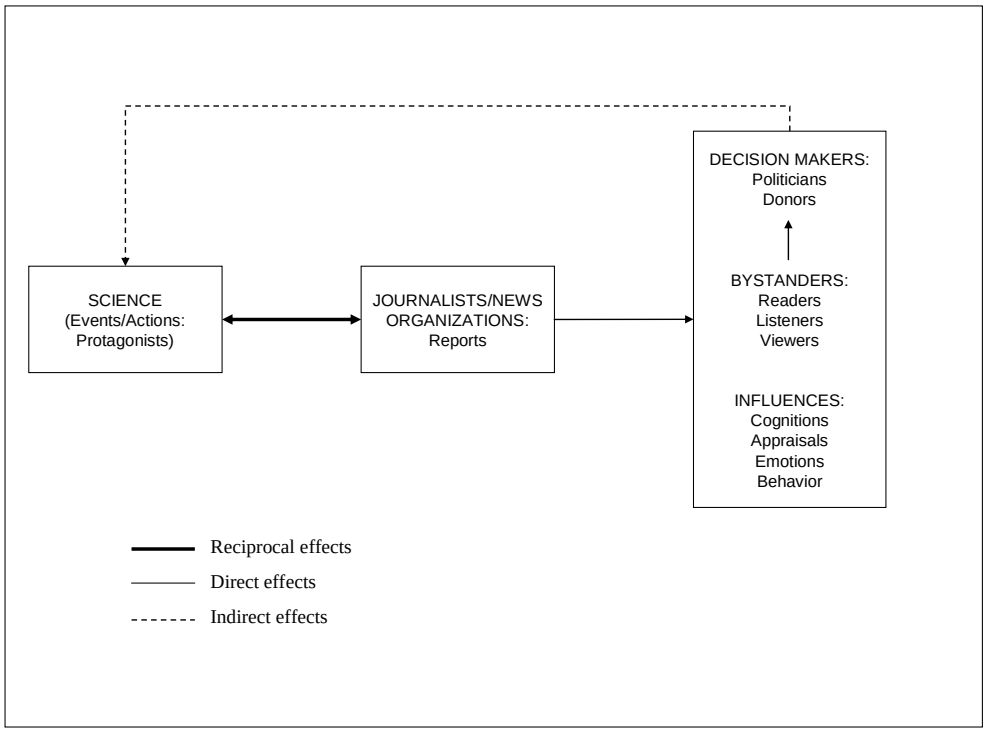

Figure 2.5. Model of media effects applied to science (Source: Kepplinger 2007, modified)

Studies have shown the impact media reports have on the core of knowledge production (Shinn and Whitley, 1985). Kepplinger and Post (2008, p.25) describe how an intensive reporting on science can make certain events appear in a positive light to the population, the politicians, as well as donor organizations and can finally have an effect on the distribution of the financial resources that support science. The final effect is what they call a "loss of autonomy of science", the external steering of science by the media.

The empirical study of Kepplinger and Post (p.25) finds evidence of the effects of media reporting on the science of climate change (medialization of science) and the respective scientists working in the field (be those physicists, chemists, geologists, amongst others). First evidence of medialization found is that media coverage has an influence on the distribution of research grants (74% of all scientists surveyed agreed to this). There is also

a distinction regarding what type of research has been financially favored and which have not: human influence on climate change and climate modeling are examples of fields that are favored with more resources, on the other hand paleoclimatology or natural variability of climate are fields that have not been favored. Second evidence for medialization that they find is the influence on which topic is researched, in other words, on the strength of individual research fields. 62% of the scientists recognize an influence of the media coverage on the scientific process in climate science; 85% of them agree that because of this coverage, it is mostly the human influences on climate change that is being researched, 32% find that fields like the natural variability of climate is not being researched. This leads them to the conclusion that medialization of science is present and that the "scientific process of climate science is driven by a non-academic force which lacks scientific quality and reduces its autonomy" (p.28). These results give evidence on the existence of inequalities which influence outcomes for science; this will be further discussed in the following chapter (2.6.2) dealing with medialization as a distortion of a deliberative discourse.

Previously, scientific communication has been seen as an arena that is based on limited communicative action. Limitations, such as lack of and competition for financial resources, provoke distortions in the lifeworld of the scientific community which can lead actors to pursue individual objectives in detriment of common objectives. The medialization of science has risen because of limiting factors acting upon science. These limitations influence the communication process in so far that scientists apply media-oriented strategies to position themselves. The communication process of science is then in some way steered by the media, which can be seen as a distortion in the communication process of science.

2.6.2. THE DISTORTION OF COMMUNICATION

Distortions for Habermas, as seen earlier, can be of different nature but here the colonization of the lifeworld by the system is relevant. For Habermas, systems are those structures that operate through the steering media of power and economy. Examples of systems are the capitalist economy and bureaucratic administration (Hillier, 2002: p.32).

2.6.3. MEDIALIZATION AS DISTORTION OF SCIENCE DISCOURSE

The steering media of power and economy influence the universal public sphere and the actors communicating within it. Here, the mass media has been taken as an approximation of the universal public sphere. Thus, steering media have an influence on the mass media. The steering media bring about changes on how speakers (scientists) interact within the mass media. The orientation to individual success is a consequence of the steering media on the lifeworld of the actors (Habermas, 1984: pp.285 ff.). Therefore, actors cease to act communicatively -they do not act based on reaching mutual understandings- and begin to act strategically: where actions are oriented to individual success. When acting strategically, speakers make statements as '*means of influencing*'

(Habermas, 1982: p.237). It is expected that the speaker acting strategically will, by doing so, bring others to reach decisions that are favorable to the strategically-oriented actor.

As the medialization phenomenon explains the orientation of science to the rules of the media as a means of gaining attention of actors in charge of assigning resources or as a means of gaining legitimization from the general public (forms the steering media takes), then this orientation can be seen as strategic action in the sense explained by Habermas. And as strategic action is a form of distortion of deliberative discourses, then the medialization phenomenon is a distortion of communication in the public sphere. If medialization is found in the mass media sphere (approximation of the universal public sphere), or in the sphere of (forest) science then it can be said that the communication in these spheres is distorted, that it is not oriented at reaching a mutual consent but oriented to the individual success of the actors participating.

2.6.4. FACTORS THAT PROVIDE EVIDENCE FOR MEDIALIZATION

Weingart (2001, pp.244 ff.) recognizes phenomenon that have indicated the increased importance of the media to science, namely: the instrumentalization of the media by science to conquer priority conflicts and the mobilization of public support. Empirical evidence of the strategy of gaining attention through mass media has been provided by Phillips et al. (Phillips et al., 1991). In their study they find that even the perception of scientific knowledge within the scientific community is influenced by the mass media. However, the instrumentalization of the media by science is a difficult (if not generally impossible) task. And so, to make use of the media for their own purposes, science needs to call on the selection criteria of the media. In this section, these selection criteria and their instrumentalization by scientists are portrayed.

1. In order to transfer the scientific knowledge to the media –and also to the political elites- currents of policy research have identified as important certain rhetorical structures. Metaphors are one of these rhetorical structures that gain importance in the success of the politization of knowledge and the transfer of it to a mass media public sphere (Nelkin, 1987: p.10 ff.; Weingart, 2001: pp.251 ff.). Nelkin emphasizes that metaphors are used to define experience and to evoke shared meanings; through analogy and imagery explaining and popularizing complex material can be done most effectively and can affect how people perceive, think and act. Thus by using metaphors, scientists can help shape the public's understanding of the transmitted scientific knowledge. Description of concepts, information and argumentation, photographs and other condensing symbols are as well other strategies used by scientists (and other actors) in forming discourse (Ferree et al., 2002).

2. Research in climate change has shown that scientists themselves transform research objects into fields of political action by assigning responsibility, options of actions and references to societal context (Weingart et al., 2000) in other words, by politicizing the issue. However, these results have emphasized that a politization of an issue by scientists might occur, depending on whether the issue is potentially concerned with the safety and well-being of the population at large, and are thus of immediate political relevance and have high news value for the media (Weingart et al., 2000: p.280). In

order to study how actors assign blame, or for that matter position themselves in a favorable light in front of others, interest positions will be examined. Volker von Prittwitz characterizes actors, who interact with the environment, according to the interest positions[18] they represent. Three interest positions can be identified in environmental politics (von Prittwitz, 1990: p.116): 1) the interest of the causer of an environmental difficulty is to maximize his/her utility by maintaining or encouraging activities taking place or using resources which produce damage, this while keeping their costs at a minimum; 2) the interest of the victim of the environmental problem is the rapid and complete solution to the problem affecting them and the prevention of new environmental damage; and 3) the interest of helpers or addressees who wish to conquer the environmental problem because of the utility they obtain when the problem is solved. Scientists, as political actors, are focused on identifying the environmental (forest) problems that society must deal with and when possible present, through their scientific knowledge, possible solutions, they might be particularly focused in identifying causers of these problems. The occurrence of naming causers can be taken as a sign of medialization. If blame is assigned, then a story becomes more interesting to report on and the points of view of the scientists and the science he/she is representing will have more chance to be integrated into the discourse.

Mike Schäfer (2007) has further contributed to operationalization the concept of medialization for empirical purposes. He sees that medialization can be either verified or denied in the degree that three basic assumptions are present. These assumptions are: extensiveness, pluralization, and controversy (Schäfer, 2007: pp.28 ff.). Each of these assumptions helps to identify the standing, positioning, and framing of the issues.

3. As the linkage between science and society becomes narrower, the attention the media gives to science increases. On the one hand, science becomes the object of permanent observation by the media: the inner structure of science, its' processes concerning conflict solution and quality safeguard, amongst other processes become public. Science is then constructed by and in the public sphere. On the other hand, the permanent observation by the media may as well change science: reacting and adapting to the expectations of the public sphere (Weingart, 2005: p.28). This can be seen through the change in time of the number of articles on scientific topics. For any given issue, through time, an increase in the number of reports both in the media and in science discourse can be expected if the issue is to be labeled medialized. Under the concept of e*xtensiveness*, Schäfer (2007, pp.28, 31) understands, for the mass media discourse, an increment of the medial presence of science as well as a strengthening of the discussion of science by the media. The more science issues are dealt with in the press, the more important that issue may be perceived by the public sphere. This increased perception may as well alter the treatment of the issue by science in that it is forced to address it more thoroughly. Thus, through time, medialization will indicate an increase amount of coverage in both spheres: in the media and in science.

If the importance of the mass media in constructing reality is recognized and recognition is given to the role of the public sphere in the safeguarding of resources for science, then it is to be expected that two dimensions may reflect this change (Schäfer, 2007: p.30):

[18] "Interessendreiecks" or triangle of interests.

4. It is expected that in the construction of the discourse on science (both in the media and in the science sphere) the dominance of scientists and their arguments has ended. In other words, the speakers in the discourse have grown to include other actors than scientists and their argumentations. This is understood by Schäfer (2007, p.30) as the *pluralization* of discourse namely, where those speaking may now not only include experts (scientists) but also experts representing opposing positions, as well as other actors (politicians, lay public, etc). The inclusion of any actors in the discourse and the possibility for them to include their arguments regarding the specific topic is defined as standing (Ferree et al., 2002: p.86). To be given a voice in the discourse and with it having the possibility to create power (in terms of visibility for their arguments) is a valuable good that actors seek. In the media discourse this possibility is given by journalists, in scientific publications by the authors of an article. Standing in both levels reflects and enhances acceptance as an actor on a given (policy/scientific) issue (Ferree et al., 2002: p.87). Following the medialization theory, expectations regarding science discourse in the media are that there should be a variety of actors involved in the discussion of the topic, that the domination of scientists has ended. In the science discourse within the scientific community, evidence of pluralization would signify that scientists incorporate in their articles other sources of information than only scientists.

5. Science is evermore being held accountable for the social implications and benefits of their research. In this context, Schäfer (2007, p.30) expects that the coverage on science issues become more and more disputed or controversial, in other words that the coverage of science issues become less uncritical or affirmative and more controversial. This is what Schäfer (p.31) refers to when explaining the medialization assumption of *controversy*. Schäfer analyzes this assumption by looking to the interpretations of the topics by the actors participating in discourse. This is done by looking into two dimensions: the judgments and the interpretations the speakers make regarding the issue (Schäfer, 2007: p.110). Regarding the judgment made by speakers, this may influence the way receivers (general public, politicians, or scientists) perceive the issue[19]. Judgments may be positive, negative, ambivalent or neutral. When one of these judgments preponderate the discourse, then there can be no controversy regarding how a topic is discussed. On the contrary, if no clear judgment domination can be seen, then the topic delivers evidence of being highly controversially discussed. It is to be expected that in science discourse, and because of the norms prevailing within the scientific community, that no judgments are made regarding an issue (neutral judgment); if this is true than medialization of science has not occurred within the scientific discourse. In the media discourse, expectations are that the science discourse on forestry is more controversially discussed, and so the judgments made vary between positive, negative and ambivalent. Regarding interpretation of issues, medialization would expect that science incorporates the same interpretation patterns of the media into their own discourse (Weingart, 2001).

6. The propagation of *public relation departments* in research organizations, universities, museums, etc are indicators of the growing importance given to media by science. Other indicators for the repercussions of media orientation by science are the

[19] Schäfer notes that this has been studied in media analysis under the name of the "persuasion" thesis: this is the assumption that there is a tendency to transfer the mass-media-communicated judgments to the recipients (Schäfer, 2007: p.110).

increasing amount of public relations activities carried out by institutions and scientific journals. These PR activities are directed at, amongst other, enhancing the image of an institution and supporting a specific research area (Nelkin, 1995).

7. The acceptance that the media play a fundamental role in constructing reality for society on the part of scientists, and accordingly modifying their *views/behaviors* regarding what communicating through the media might mean to their particular interests, can also be seen as a factor that reveals the existence of medialization of science. In other words, if recognition is given to the direct or indirect effects that media might have on decision makers –regarding allocation of resources-, on the general public –as a window for gaining legitimation, or even on peers –gaining visibility, then this can be seen as further evidence of the medialization phenomenon.

The previous sections have presented the theoretical basis for the research undertaken. It becomes necessary to clearly present the research model, questions and hypothesis that derive from this theoretical discussion.

2.7. RESEARCH MODEL AND HYPOTHESES

Starting point is the process of science communication. Forest science, as well as any other science, through formal and informal channels communicates within its' community as well as with society at large.
Formal channels of communication within science, such as publications in peer reviewed science journals, are important products of the formal process of communication because they determine what is considered as true knowledge within this community. The scientific ethos recognizes that in order to create true knowledge consensus amongst the participants of the community must be met. This is the same point Habermas makes when speaking of communicative action: in order to reach legitimate decisions, communication processes must be imbedded with communicative action which's premise is to reach decisions based on a coercion-free, participative agreement amongst actors. However, this is an ideal difficult to find in reality because of the existence of power structures that influence every step of the communication process causing distortions. Since Habermas does not provide a tool for explaining the distortions of communication from the ideal communicative process –through communicative action- the Foucauldian approach will be used. Specifically, Foucault's considerations regarding discourse, power, and knowledge provide a framework that explains the influences of these power structures in the formation of discourse. Thus, in the process of communication of science within the community, communicative action cannot be fulfilled in its ideal case, but more in a limited one.

Power acts distorting the communication process within science. The question here becomes to what degree these power structures have influenced the discourse on forest science; to what degree does the situation of the discourse on forest science move from the ideal deliberative discourse proposed by Habermas. The resulting hypothesis to be examined, and accepting that these power structures exist, is that *the scientific discourse on forest is an empowered discourse*. Empowerment will here be examined on a global level seen through the presence of Center and Periphery structures in the participation in discourse;

an empowered discourse will expect that Center actors dominate the discourse on forest science.

Habermas' foundation for communication is that individuals act with the objective of reaching an understanding. Power structures influence the communication processes causing distortions. There might be ways in which, even though these distortions are present, they are resisted by the scientific community through specific actions that make take the discourse nearer to an ideal form of deliberation. Particularly, this view implies making room for those parties with an interest in the particular issues being discussed. The inclusion in scientific discussion may be done through collaboration –particularly through international collaboration. Therefore, *collaboration is a form of approaching a deliberative scientific discourse*.

Power not only affects the communication process within the scientific community, but also the communication process outside the scientific community; namely provoking distortions on the communication process within the universal public spheres. When speaking about the universal public sphere where all problems of society are discussed, Habermas approximates it to the sphere of the mass media. Studies have shown that the mass media does not fulfill the basic conditions of a public sphere where all can freely participate; thus always in presence of an empowered public sphere. The objective here is to examine the effects that the steering media such as money (financial resources) and power, which cannot be bracketed out, have on the communication within this sphere, as well as within the science sphere. In view of the importance of the media in constructing reality, and the increasing competition of science for scarce financial resources, the question that arises is whether the communication of discourses on science regarding forests within both these spheres will be characterized by strategic action revealed through the medialization of science. Thus three hypotheses are constructed to answer this question: 1) *the forest science discourse in the scientific community is medialized*; 2) *the forest science discourse in the universal public sphere, approximated by the mass media, is medialized*; and 3) *individual scientists recognize the medialization of science*.

These questions and hypotheses will be both examined on a national and a global level.

Figure 2.6 graphically summarizes the research structure and the hypotheses here mentioned.

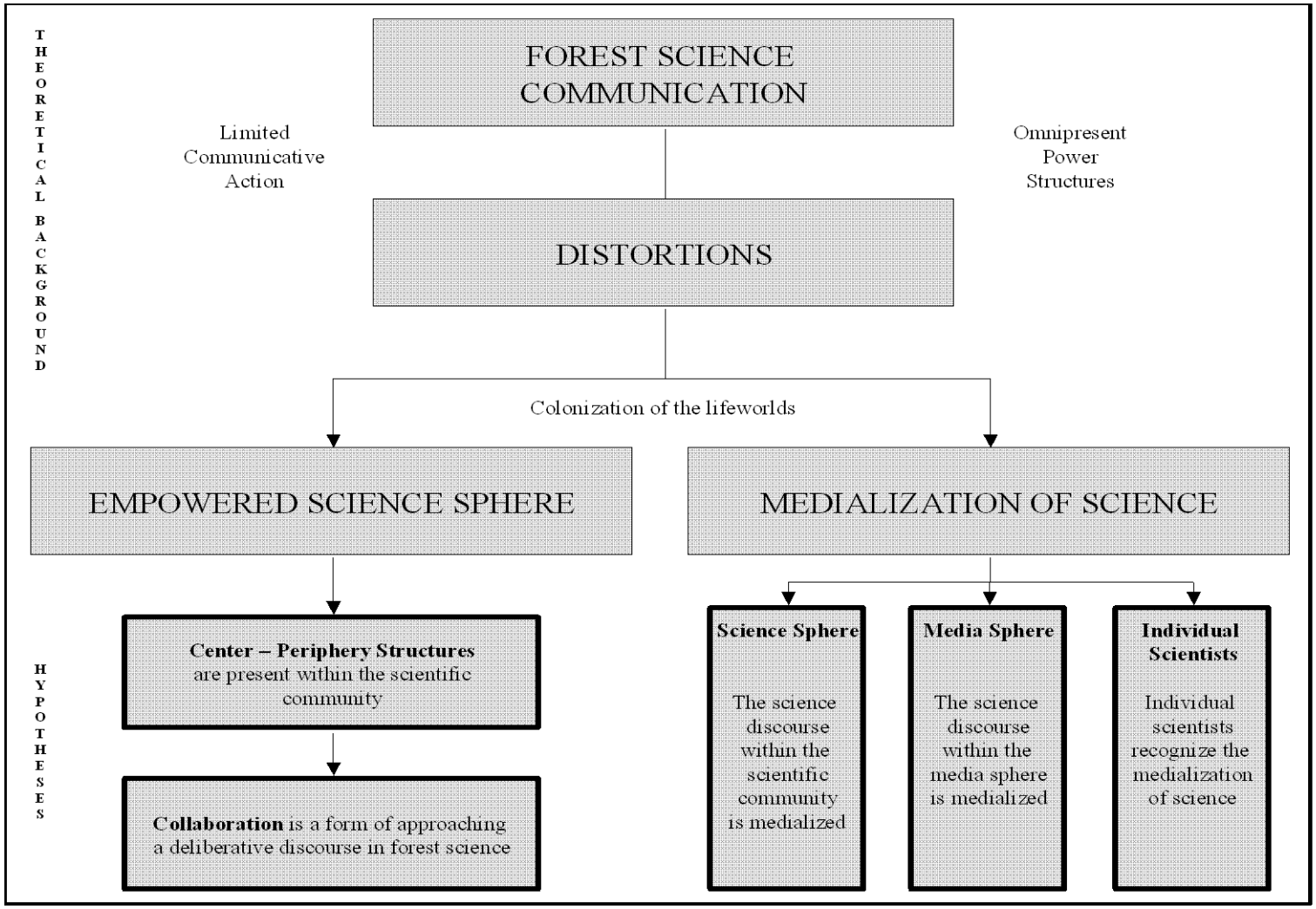

Figure 2.6. Research model and hypotheses (Source: own construction)

3. METHODS AND MATERIAL

In order to give answer to the research questions posed in the previous section as well as to either verify or falsify the hypotheses presented, it is necessary to go into the details regarding the methods selected and used to examine the empirical material gathered.
The following section will introduce the methods used: discourse analysis, content analysis, bibliometrics and web-based survey. After this, detail information on how the material of analysis was gained is given.

3.1. METHODS

Methods are means of reproducing reality which lead to statements on a specific sample that can be applied to an entire population (Friedrichs, 1973: p.189). Methods are many in number and in varieties of ways combinable.
In this chapter, the different methods used to gain and analyze the data are described and discussed. Firstly, an insight into discourse analysis is presented, followed by a description of content analysis and the construction of the theoretically based category system. Bibliometrics is introduced as a method to obtain the object of analysis of the scientific discourse on forests. Finally, an in order to gain insights into the behaviors and opinions of individual scientists working in the forestry field a web-based survey was applied resulting in the need to explain and discuss this particular method.

3.1.1. DISCOURSE ANALYSIS

There are many traditions of discourse analysis. In the previous chapter attention has been given to the discourse traditions of both Habermas and Foucault. However different these theoretical currents are, they do have specific elements that may complement one another. On the basis of a social process grounded on limited communicative action, the discourse on forest science is in this work examined (both on a scientific level as on a public one). Discourse is here understood as: *the communication about topics and actors that are relevant to the scientific discussion on forest and three selected topics.*
The scientific discourses portrayed in scientific journals, as well as the public discourse on forest science, are inspected in order to examine the limitations to the communication process of forest science (such as the existence of Centers and Peripheries and the medialization of science). Once the discourses that are of interest were defined and the research questions drafted the next methodological step, according to Keller (1997), was to select the process of analysis that is to be undertaken. Figure 3.1 mirrors the methodological steps as seen by Keller (1997) and undergone in this work.

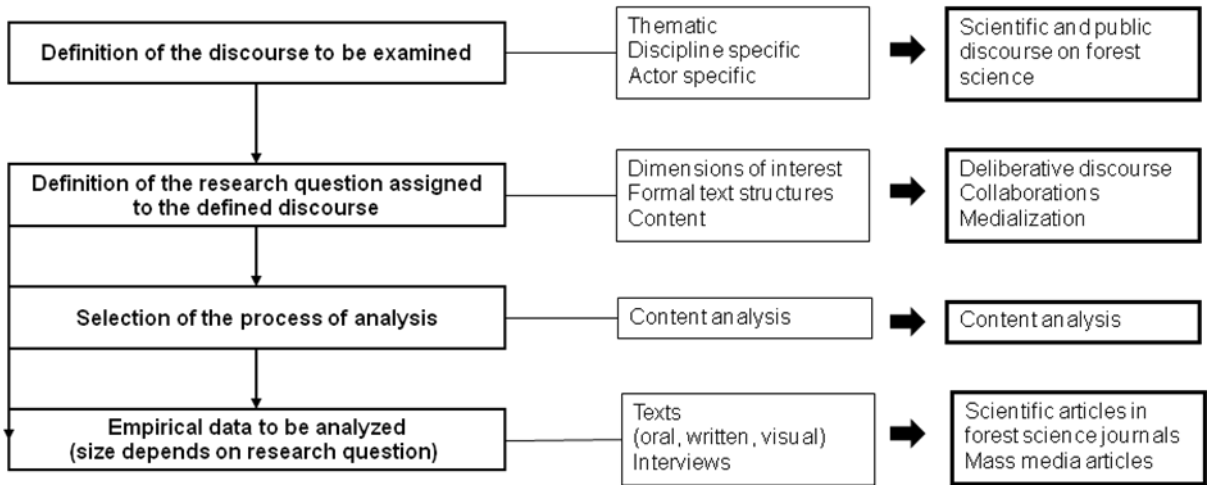

Figure 3.1. Methodological aspects of discourse analysis as seen by Keller and applied in this work (adapted from Keller, 1997**: p.326)**

The left side of figure 3.1 shows how Keller sees the necessary steps that must be taken to carry out a discourse analysis. The arrows on the right side of the figure show how these steps materialized in the work here undergone. Content analysis has been chosen as the method to discover the characteristics of the discourse on forest science and the possible distortions present. The material that has been selected cover a time span of 10 years: 1994-2003 and involves articles from scientific peer-reviewed journals, as well as mass media articles both on a national and global level. This specific time span was chosen because of the international political events that have been carried out in the previous years (such as the Convention on Biodiversity) and during the time frame (Kyoto Protocol) which have relevance for forestry and forest science specifically. This is seen as a fruitful time frame where discussions both in the mass media and in the scientific sphere may reflect consequences of these particular political events.

3.1.2. CONTENT ANALYSIS

A quantitative-qualitative content analysis has been chosen as the adequate method for carrying out the discourse analysis. Commonly, content analysis has been used in research of political communication as well as in mass media analysis since it can reliably and validly interpret texts, pictures, movies, and music pieces (Friedrichs, 1973: pp.317-18). Mass media studies, regarding public spheres, applying content analysis include Ferree et al., 2002) and applied to forest issues: Krumland, 2003), and Hütte (1999). In Krumland (2003), content analysis was carried out on texts from daily newspapers in order to examine the political effect media reportages have on the positions of the forest and nature conservation sectors. In Hütte (1999), content analysis was carried out to make a European comparison of the technical discourse for both forest and nature conservation sectors on the concept of sustainability.

Content analysis is a method which systematically and objectively captures characteristics of processes of social communication (Friedrichs, 1973: p.315). Social communication will be here understood as: *a process in which -within a social environment- an actor (sender) 'says' something (message) in a certain medium (communication channel) which is to be received by another actor (receiver;* ibid.). Or as Laswell has so famously summarized: "who says what to whom, why

and with what effect?" (Laswell, 1948). Content analysis can be carried out to reveal each and all of these questions. It can focus on the senders, the message, the receivers, and/or the intentions and the consequences of the communication process. In this study the focus, within the communication process of forest science, is the questions of who communicates (sender) and on what is being said (message), being the chosen channels newspaper articles and articles published in scientific peer-reviewed journals (see below).

Definitions of content analysis are many in number. Berelson has defined content analysis as the "*research technique for the objective, systematic and quantitative description of the manifest content of communication*" (Berelson, 1952: p.18). Content analysis is objective in the sense that on hand certain clearly specified rules, material is assigned to specified categories. The existence of these clearly specified rules of categorization decrease the possibility that the personal bias of the coders influence the process (Bryman, 2001: p.178). Being systematic means that the application of the specified rules is done in a consistent manner in order to again reduce the possible bias (ibid.). Berelson's definition mentions quantitative descriptions referring to the quantitative accounts of the material analyzed through categories. However, qualitative aspects may as well be incorporated[20], which may lead to a complementary way of doing content analysis, namely a quantitative-qualitative content analysis. Berelson finally mentions manifest content of communication as the research objective, in which he is referring to the actual message being delivered in other words, what is being said.

A complementing definition of content analysis, which is not as restrictive as the previous definitions, is delivered by Früh (2001). He defines content analysis as "*an empirical method to describe systematically and intersubjective-comprehensibly the content and formal characteristics of messages*"[21] (Früh, 2001: p.25). This definition intentionally leaves out characteristics such as 'quantitative' and 'manifest' of the previous definition which, according to Früh, have been the cause for more confusion than clarification. Früh states that a main qualitative criterion of content analysis is that the results must be independent of individuals (must be objective) in order for conclusions to be valid; it must allow results to be repeatable, communicable, and criticizable (p.37).

There are many advantages of content analysis (see Bryman, 2001: pp.189-90; and Früh, 2001: p.39): it is a transparent research method; it allows longitudinal analysis; it is an unobtrusive method, because it considers, for example, written texts as newspaper articles or scientific journal articles, being thus not dependent on the cooperation of test persons; it is a flexible method: researcher is not tied to certain deadlines regarding the data collection; no changes in the research object are present throughout the research; and it allows information to be generalized about social groups that are difficult to gain access to. All these qualities make content analysis the adequate method for carrying out the research here undergone.

Considerations must be given to the disadvantages of the method such as (Berelson, 1952: pp.191-92): the documents up for analysis must be authentic, credible, and representative of all possible documents, if they do not fulfill this criteria the conclusion of the analysis must be taken with consideration; some interpretation on the part of

[20] For example: incorporating 'frames', through which the points of views of the different speakers are collected.
[21] Own translation.

coders is always possible and so it is impossible to construct a category system that leaves out some interpretation; problems arise when latent content (the hidden meaning of a message) instead of manifest content (apparent content of the message) are examined; an answer to the question of why a content occurs is mostly based on inferences.

The analysis of content is carried out, once hypotheses have been erected, through a category system, which allows the coding of the units relevant to the problem dimensions, which in turn reflect the hypotheses. In the category system the various dimensions of the hypotheses are operationalized. The category system is the most important part of the method because on it depends the quality of the research, being then content analysis only as good as the categories which make up the substance of the research (Berelson, 1952). Here, the research categories research categories employed all have a theoretical background. The objective of the construction of categories is to be able to make statements about the structure of the researched material through frequency or multidimensional tables (Friedrichs, 1973: p.322).

For this work, two units of analysis are considered. On the one hand the entire article (be this a mass media or scientific article) and on the other, the speaker and her/his statement.

Regarding the entire article, formal categories comprising physical units (physically delineated aspects; Krippendorff, 1980: p.61) are recorded such as journal source, article date, number of authors, and type of article (such as articles, review, or editorial, which have been proven to have on average a substantial citation impact Moed and Leeuwen, 1995: p.461). On the other hand, the primary source of structure and meaning of a text is the speaker; the speaker decides what to say, how to say it, and what others should take it to mean. Not one speaker speaks in a text but many can do so. Thus, the statements of the different speakers carrying out either directly or indirectly speech acts in the articles (both media and science) comprise the second unit of analysis; these statements are the propositional units of analysis (by which the objects –statement of speakers- and their attributes –such as interest position assigned to others- are recognized; Krippendorff, 1980: p.62). By statement is meant *all those speech acts incurred on by one speaker relevant to the topics being examined* (Ferree et al., 2002: p.50). Speakers and statements are coded when they have direct relevance to forest and one of the three issues selected.

3.1.1.1. CATEGORY SYSTEM

The category system, contained in a coding book, is crucial for carrying out content analysis. Since here the objective is to examine both media and science discourse on forest two category systems were built. In order to be able to compare relevant categories no great changes were carried out, however certain categories were only applicable to media discourse and others only to science discourse. Both these category systems were based on the theoretical considerations presented in the previous chapter and can be seen in annex I.

The category system must comply with five important points (see Bryman, 2001: pp.188-89; and Holsti, 1969: p.95). It must have discrete dimensions (dimensions are totally

separated, no overlap between them); it must have mutually exclusive categories (no overlap in the categories supplied for each dimension); it must be exhaustive (for each dimension, all possible categories should be available); it must give clear instructions: categories must be well defined (interpretation about each dimensions and what factors to take into account for each category must be clear); it must be clear about the unit of analysis (such as newspaper article or statements on defined topics); and the classification must be consistent to allow comparisons.

The category systems reflect both a formal-descriptive approach relating to the entire article as unit of analysis and a diagnostic approach where answers to questions such as what the speaker means with their message and which characteristics it possesses (Früh, 2001: pp.41-2).

The theoretical discussion, resulting in the five hypotheses tested required specific categories to be constructed in order to obtain the data for proving them. Two main groups of categories were built according to the hypotheses constructed. The first group of categories refers to those which needed to prove the existence of a deliberative or empowered discourse, as well as determine whether collaboration is a form of a deliberative discourse. The second group refers to those variables that help to verify or falsify the existence of medialization of science. Table 3.1 gives an overview of the different categories that were constructed based on the previous theoretical discussion. Details of the categories may be found in annex I.

Table 3.1. Overview of categories providing evidence of deliberative science discourse or medialization of science (Source: own construction)

Deliberative Science Discourse	Medialization of Science
-Publication source -Publication year -Country ▪ Affiliation of author ▪ Country or location of event -Collaboration ▪ Number of authors ▪ Affiliation institution ▪ Type of collaboration	-Extensiveness ▪ Year of publication -Pluralization ▪ Interests position: speaker -Controversy ▪ Assessment event / statement of speakers -Communication tools ▪ History, technology, metaphors, symbols, descriptions, others -Politization ▪ Interest positions: speaker / causer

For both systems, categories regarding the entire article were coded. Such as date, source, authors (number of authors and country and institution affiliation of authors for the scientific articles), place of event (country and level of event), assessment of event were coded.
Speakers and their statements were coded within the propositional unit of analysis (represent standing). On this level, categories such as assessment of statement, the interest position speakers place others in, the existence of risks, the solutions mentioned and if solutions were mentioned, what type of political instruments was used when giving solutions, and the communication strategies they used were coded. For the media category system, the country of speakers was also coded. For the science category system only the affiliation country of authors writing the article could be recorded.

The speakers were coded according to their main occupational sector. Speakers can be scientists, members of the government, politicians, enterprise representatives, non-governmental organization representatives, single persons or communities amongst others (full list and definition of actors and their occupational status is found in the annex I). Journalists as well as other members of the mass media were as well coded. Especially journalists in the mass media discourse have an important role when speaking, as these are the actors that write introductions to topics and in doing so bring their own interpretation patterns in the discussion. In the scientific discourse, actors were coded by looking to the reference section of the articles. If the reference indicated a contribution to a scientific journal, or a scientific book, then these actors were coded as scientists.

The statement of speakers was coded regarding the interest position (in accordance with von Prittwitz, 1990) they assigned to other actors involved in the issue discussed. The framing of the issues was then done considering the actor-group acting as speaker and the party they named as responsible (causer) for the problems faced in the issue. The same categories as when coding the occupational sector of the speaker were used adding society and nature as actors that can be the causers, victims or addressees of the issues at hand (these cannot be direct speakers).

The assessment of the event as well as the speaker's statements, were coded as positive, negative, ambivalent or neutral assessment.

Regarding the communication tools, metaphors, descriptions, historical references, and the use of symbols were coded as strategies that speakers make use of when delivering their statements and which can later serve as evidence for the medialization degree of the discourse.

3.1.1.2. CODING PROCESS

After the category systems were built, the training of coders was carried out. In this phase coders were familiarized with the category systems, sample articles were jointly coded at first and then separately and results afterwards compared. If differences in categorizing arose, further clarification and training was undergone. The coding process implied the use of a software-based data mask (in SPSS).

Coding must be done in a consistent manner (Bryman, 2001: p.189). There must be inter-coder (coding must be consistent between coders) and intra-coder (each coder must be consistent over time) reliability in order for the category system to be valid. Inter-coder reliability was assured in that the same selection of articles, coded by different persons, was controlled and compared for their results. Minor differences were revealed and afterwards corrected; reliability between coders was high. The same procedure was repeated after all articles had been coded. The intra-coder reliability was examined through coding a selection of articles again after some time had elapsed since their original coding. Results were consistent.

3.1.3. BIBLIOMETRICS

The question of which aspect of the communication process and discourse formation within science is to be considered as an object for study is a complex one. Choosing one aspect of scientific communication such as the formal communication through scientific publications may be seen as short-sighted in view of the great amount of other formal (books, monographs, project reports, etc.) and informal (verbal exchange, grey literature, etc.) communication taking place in scientific communities. However, to carry out an analysis on both of these levels is an immense task, and so the field must be narrowed down to units that are manageable to analyze. Formal scientific communication, as is the case of scientific articles in peer-reviewed journals, is chosen as unit of analysis because the straightforwardness of its essence: knowledge is textually expressed, presented to peers for reviews, accepted and brought to the whole of the scientific community through its publication; without which, it is difficult for knowledge to be accepted as such by the entire community (Felt et al., 1995: pp.66-67). Each scientist with something to say (who has created knowledge) can create formal texts (articles) which are later submitted for their inclusion and discussion within the community through peer-review processes, gaining then the necessary legitimation for the created knowledge.

To study this particular form of science communication, a method was needed which helped determine how to select the scientific publications to be considered as well as help evaluate these objects in view of answering the particular question of scientific collaboration. Bibliometrics is a set of methods used to study or measure texts and information, it has now-a-days frequently been coupled with the measuring of scientific productivity, as these tools have been proven to mirror the intellectual influences of actual scientific work (Borgman, 2000: p.145). Tools of bibliometrics are, for example, citation frequencies: which record the number of citations a scientific article has gathered throughout time and, journal impact factor: which records the frequency with which the "average article" in a journal has been cited in a given period of time, usually one or two years after its publication date (Moed and Leeuwen, 1995: p.461; van Leeuwen et al., 1999: p.489). Bibliometrics is usually used to study structures, such as citation and co-citation maps within and between disciplines, and more generally for visualizing literatures (Borgman, 2000: p.147). Bibliometric indicators may be also used as a measure of comparison within a specific discipline (King, 2004).

Here bibliometrics was used to help in the acquisition of the material used for the analysis of the scientific discourse as well as for mapping collaboration patterns between scientists (through their country of affiliation) within forest science.

3.1.3.1.PUBLICATIONS AS RESEARCH OBJECT

Scientific communication may be carried out both in formal and informal ways. Contact with colleges, entries in blogs, and personal communications count mainly to the latter form of scientific communication, while books, articles in scientific journals, and contributions in conferences count to the former. To focus research on one product of the scientific communication is to narrow down the generalizations that research conclusions may arrive at. However, to carry out research on all products of scientific

communication is an enormous task that exceeds the possibilities of this work. Thus, the question becomes which product of the scientific communication process discourse analysis should be carried out upon.

Scientific articles in science journals are seen as the central product of natural sciences. True knowledge will only be seen as such if research results circulate within the community, in other words: what is not received will not be seen (Weingart, 2001: p.100). Additionally, publications in the form of articles in journals are an acceptable research object because they represent parts or complete processes of problem-solving research (Qin et al., 1997: p.894): they are post hoc in nature and emphasize the end-product of research. The central assumption widely accepted is that when scientists have something important to say they do so by vigorously publishing their findings in the open international journal literature22 (van Raan, 2004: p.26). The assumption that research results can be considered true scientific knowledge only after they have been made public (accessible) and made available for scrutiny by the entire scientific community -and in such a way contributed to the growth of the total stock of knowledge- is largely accepted where scientific publications are seen as recognition of the accomplishment in science (Weingart and Winterhager, 1984: p.98). Forest science is part and is largely dominated by natural science. This has consequences for the communication process of forest science, as research emanated from this field is as well largely disseminated by scientific publications (as results from a survey carried out in the IUFRO World Congress 2005 in Brisbane, Australia showed). There for the assumption that forest science research results can be considered scientific knowledge only after it has been published, holds true. And so, to carry out discourse analysis having as object of research scientific articles will deliver results that represent the scientific discourse on forest.

However, not all scientific articles published in all scientific journals can be examined. A prioritization of the publications to be analyzed must be made. Citations indicators are used as a means of ranking and selecting the articles to be analyzed. Citations are an indicator that scientific publications are read and the information within it processed, in other words that articles are identifiable objects of the scientific communication (Weingart, 2001: p.104). Publications that are not cited are lost in the communication process. Analyses have shown that more than half of the articles published will never be cited (Garfield in Weingart, 2001: p.105). Observation has also shown that there is an 80/20 rule in citation analysis: about 80% of all citations go to only 20% of all articles published.

For this analysis for each year within the time frame analyzed (1994-2003) a ranking based on citations was made (see material section for more details).

3.1.3.2.LIMITATIONS OF CITATIONS

King (2004), when analyzing the quantity and quality of science for different nations, notes that a potential problem for using citation data is that individual papers may skew the results of an analysis. This happens when an article has been highly cited because it

[22] It is widely accepted but as well biased to those disciplines where publications are the main carrier of scientific knowledge (van Raan, 2004: p.26).

has been discredited or because its authors over-cite their own work (King, 2004: p.311). The first problem has not been dealt with in this work because the objective was not to examine papers which have had a good or bad impact on forest science, but to examine papers that have influenced forest science in any way. If a paper has been discredited, it has at least served the discussion of the issue and it may be the source of creation of 'better' knowledge. The second problem regarding authors over-citing their own work was dealt with by eliminating the self-citations[23] the author or authors of the given paper.

Other bias that has to be considered is the language bias. The citations delivered by the *Scientific Citation Index*[24] (SCI), even though very selective, are biased to English language journals (Arvanitis and Chatelin, 1988: p.114). Journals and articles which are written in other languages (e.g. Spanish) are not incorporated into the database, necessarily influencing the number of citations an article may receive. This is especially important when considering articles written by authors from developing countries. Their research findings published by peer-reviewed journals may be cited relatively more frequently in national journals that are not part of the journals considered in the SCI database. Consequently, bibliometric awareness of an article does not necessarily equate to peer-awareness (van Raan, 2004: p.36).

Arvanitis and Chatelin (1988) have carried out analysis for tropical soil science. They concentrated on examining the national strategies of developing countries on publishing their research results finding, that the scientific production of Third World countries is actually higher than usually estimated through tools such as the SCI. Their analysis of scientific production, based on the multidisciplinary database PASCAL, produced results that contradict studies using ISI-database (articles published in scientific journals forming part of the data base of the Web of Science) regarding the inclusion of Third World countries in scientific discussions (Arvanitis and Chatelin, 1988: p.115). For the year 1983, they found that the South produced half the research on tropical areas (or 11% of the total of the world research in agricultural science). This number goes beyond the 6% usually admitted for Third World countries (Garfield, 1983) based on SCI. Therefore this is an indicator that science produced in countries outside the scope of journal-countries appearing in the database of the Web of Science is underrepresented. Using a database like the one used by that study would of course reduce the bias of mainstream science (or English written literature) however, and because PASCAL is a database created for pure scientific reasons and not bibliometric ones, no indicators of the publication's impact are available through it. Thus, no statement could be made regarding the international impact of scientific articles and their contribution to the global discussion of the topics and thus to discourse.

The 'Sleeping Beauty in Science' phenomenon is another aspect that must be considered when using citations as indicator of importance. A publication may go unnoticed (may be sleeping) for a long time and then, almost suddenly, it attracts a great amount of attention (it is awakened). Thus, articles may be ignored in the debates of topics because they have yet to be awakened. However, for this analysis this bias does not alter the conclusions arrived at, because the analysis here undergone were made considering the citations of

[23] Self-citations are citations given by the authors of publications to their work in consequent work. This may negatively influence the citation index of an article as there is a risk that authors cite their own work in order to appear centrally involved in the scientific discussions.
[24] Owned by Thomson Scientific.

articles until a specific date in time, namely December 2005. Thus, the results are based on the dominant discussion (or discourse) carried out till that specific time-frame. Articles that were dormant and have since then woken up will not have influenced the scientific discussion at the time.

3.1.3.3.COLLABORATION

Collaboration in forest science is here measured as multi-authored articles that have been published in forestry journals (both international and national). As an indicator for collaboration, multi-authorship is contested as an adequate measure. However, this indicator has generally been considered as an unobtrusive indicator of collaboration (Gordon, 1980) and has frequently been the source of scientific studies on collaboration (Katz and Martin, 1995; Bordons and Gómez, 2000; Arunachalam, 2000; Wagner and Leydesdorff, 2005; and Wagner, 2008; amongst many others). In these previous studies, collaboration was examined through articles extracted from the *Science Citation Index*; networks were built and analyzed according to the affiliation organizations of the individual scientists and countries where these organizations are located.

Collaboration was characterized according to the affiliation institutions and affiliation country the authors of the scientific articles belonged to. According to this, classification of an article would fall into one of the following 5 categories (Qin et al., 1997: p.897): 1) no collaboration; 2) collaboration in a department; 3) collaboration between two or more departments within an institution; 4) collaboration between two or more institutions within a country; and 5) international collaboration.

If international collaboration took place, then the affiliation countries of the scientists were used to map the collaboration between countries. When an article was a result of collaborative work between two or more countries, then a record was added to each of the countries that appeared. This method for measurement is known as the whole-count (or normal count) method (Lindsey, 1980; Wagner and Leydesdorff, 2005; Wagner, 2008) and is widely used in bibliometric analysis. If an author had more than one affiliation institution and/or affiliated to more than one country, the first institution/country to be mentioned was the one included, others were disregarded.

In order to map Center-Periphery structures and collaboration patterns, the data gathered for the specific publications was considered. Sociometry or network analysis gives information on the structure of a group, the position of individual group members, and the informal structure of the group (Friedrichs, 1973: p.255). Here the first two elements are important because the aim is to examine the structure of the group of scientists participating in forest science and the position of individual countries (affiliation countries of the scientists) within the structure of collaboration.

Social network analysis was used as a means to identify the relations of collaboration in the networks of forest science, as well as the productivity and geographical distribution within the scientific discourse. The productivity of the networks in forest science sheds lights on the existence of Centers and Peripheries in the world forest science. The collaboration networks gives insight on the countries which are more or less active in

their collaborative efforts (who collaborates?) and the collaboration ties that are present (who collaborates with whom?).

Graphic visualizations of the collaboration taking place in forest science were carried out. Such network visualizations have been carried out by many authors in their efforts to map world science, specific disciplines, and individual scientists' collaboration patterns; amongst many other analyses (Katz, 1994; Hara et al., 2003; Wagner and Leydesdorff, 2005; Wagner, 2008).

Regarding the nodes (elements of the networks) to be considered for revealing both the Center-Periphery structures as the collaboration patterns, the affiliation country of the authors of the scientific publications were used: this was the same data as the one used to reveal Center-Periphery structures. Regarding collaboration, links were established between the nodes when articles were co-authored by scientists from different countries.

3.1.4. WEB-BASED SURVEY

A self-completion questionnaire was placed on the Internet to reach the wide audience of scientists working globally in the field of forest science. The aim of the survey was to collect information on the research, publication and collaboration patterns of scientists, as well as to examine their individual and institutional communication behavior. The questions posed in the questionnaire gathered information used as indicators for the hypotheses dealing with Center and Peripheries and collaboration in science, as well as for the hypotheses dealing with medialization characteristics recognized by individual scientists.

As the universe targeted through the survey was all scientists working globally in the field of scientists it is impossible to estimate the size of such population. Efforts were made in order for the survey to reach the wider audience possible, but it will have never reached the entire universe. And so the conclusion derived from the examination of participant's response must be taken solely significant for those who answered the survey and may not be generalized to universe of scientists working in the field. As Best et al. (2001, p.132) note, only diverse -and not representative- samples of Internet users (in this case scientists) can be generated or reached when using this method.

The advantages of a web-based survey are many; see Bryman (2001) and Best et al., 2001). 1) It is cheap to administer because of the geographical distribution of the participants (worldwide); the Internet can be accessed in almost all parts of the world where the scientists work, providing access to many of potential research participants. 2) It is quick to administer: following the Internet link provided a great mass of participants could be accessed. 3) Interviewer effects are absent: since there is no interviewer, they cannot affect the answers participants might give. 4) There is no interviewer variability, in which interviewers ask questions in a different order or in different ways. Finally, 5) they are more convenient for participants because these may complete the questionnaire whenever they want and at the speed they desire.

The disadvantages of web-based surveys are also many, see Bryman (2001) and Best et al., 2001). 1) It is not possible to prompt participants if they are having difficulty answering the question. 2) It is not possible to probe or elaborate on their answers (usually important with open-ended questions). 3) Some questions may not be noteworthy of some participants. 4) There is a risk of questionnaire not reaching the correct participants. 5) It is difficult to ask many questions. 6) It has limitations concerning the language used (questionnaire was in English) and the accessibility of it. 7) There is a greater risk of missing data because it is easier for participants not to answer some questions[25]. 8) There is not a universal access to the medium; not all the population that is to be considered may have Internet access.

Efforts were made in order to include as many scientists as possible. With the cooperation of the International Union of Forest Research Organizations (IUFRO) and its' members, advertisement of the survey was carried out; relevant electronic newsletters and forestry discussion groups included the invitation to participate. Such practices have been commonly used when servicing internet surveys (Best et al., 2001: p.133). Through this, all possible forest science related electronic groups (instead of individuals) was hoped to have some chance of being selected. However, the registration to such groups is based on the wish of actors to participate, being many Internet users (who are also scientists working in the field of forestry) not subscribed to such groups or newsletters, having no opportunity of being selected. This is a situation that makes almost impossible to overcome the problem however, other forms of sample selection (for example through Email listings or heavily trafficked Web sites) as well do not solve the problem (ibid.). The target audience here is the *global* audience of scientists working in the field of forestry, and on a global level no other communication medium assures some chance of including all the relevant actors. A sacrifice regarding the generalization of the survey conclusions had to be made.

The survey was created in the framework of the international project "Entstehung und Qualität des medialen globalen Walddiskurses[26]"(EQMGWD) carried out in the Department of Forest and Nature Conservation Policy and Forest History of the Georg-August University Göttingen, Germany with the cooperation of IUFRO and financial resources from the *Volkswagen Stiftung*. The software UNIPARK for academic used was applied in the construction and servicing of the survey.

The survey was publicized through different newsletters and electronic discussion groups where the explanation of the survey's aims were portrayed and a request made to follow the URL embedded hypertext link which would then lead to the survey.

The survey applied can be found in annex II. Important to clarify here are the questions relating to the research and publication behavior of scientists as well as those communication characteristics of scientists and their organizations that can shed light on the limitations of a rational consensus-based form of discourse creation and on the medialization of science respectively. Consequently, closed-ended questions were asked regarding the work-time-allocation of several tasks scientists' undertook (amongst these:

[25] This was dealt with in that for many questions participants were faced with a warning that they had not answered correctly and a request to rethink their answer.
[26] Emergence and quality of the global medial forest discourse (own translation).

writing of scientific publications and communicating with the media), their attention to the media and the scientific discussions taking place through it, the existence of public relation departments in their organization and their involvement with such activities as well as the main sources of their scientific information, and their publishing and collaboration productivity.

Once the survey was published and completed, the data collected was cleaned and filtered so as to reduce the associated errors. Answers were checked to see whether participants had delivered consistent answers, for example if they had answered the questions or they had just clicked their way through the survey.

3.2. MATERIAL OF ANALYSIS

The material to be examined are on the one hand mass media articles relating to three specific topics and their relation to forest science and on the other hand, scientific articles dealing with the same three issues and their relation to forest science (see below for selection process of topics). Both these materials are examined for a global and national level. However, since what classifies here as relevant material in both dimensions is enormous, a selection of the universe is necessary. For the scientific discourse, five specific forest science peer-reviewed journals have been selected and searched. The top 25% most cited scientific articles dealing with the issues were selected. For the mass media discourse on a global level two internationally oriented prestige media have been selected; on a national level one prestige newspaper has been selected. For the mass media, on both levels, all articles dealing with the three topics and forest have been included. Thus, the material represents the entire population of possible material. This implies for the analysis of results that no need for statistical procedures was needed. Results are then solely based on the frequency of occurrence of specific dimensions. Here, the steps taken to capture the discourse on forest science are described.

3.2.1.1.JOURNAL SELECTION

Journals were selected for both levels of analysis, namely global and national. A central assumption for using peer-reviewed journals to extract the articles analyzed is that in forest science peer-reviewed journals are the dominating or at least major means of communicating in this field (van Raan, 2004: p.27) both on a national and on an international level.

3.2.1.2.SELECTION OF GLOBAL JOURNALS

For the process of analyzing the global scientific discourse on forest science a process of selection was undertook in which international forestry journals were compared and selected based on four main criteria:

- The *Journal Impact Factor*[27] (JIF) for each journal appearing in the section of forestry of the Web of Science[28] was gathered for a 10 year time frame (1994-2003), average for this period calculated and afterwards ranked[29]. Journals which did not have a *JIF* for any of the 10 years were eliminated from the process of selection.
- Journals had to have *English* as the main language of publication, as English language is supposed to be the global language of science (Ammon 2001; Crystal 1997). Thus any journal which did not publish in English was not considered.
- Journals had to offer a wide selection of *forestry science topics* within their pages. Journals which focused on limited topics of forestry science were eliminated from the process of selection[30].
- Finally, the journals selected were the top five ranked journals, according to the ten year JIF ranking, and which fulfilled all criteria listed above.

Table 3.2 shows the five internationally international renowned journals that were selected for the analysis:

Table 3.2. International forest scientific journals selected for the analysis

JOURNAL	PUBLISHED SINCE	TOPICS PUBLISHED
Canadian Journal of Forest Research[31]	1971	All topics of forestry: biometrics and mensuration, conservation, disturbance, ecology, economics, entomology, fire, genetics, management, operations, pathology, policy, remote sensing, social science, soil, silviculture, wildlife and wood science.
Forest Ecology and Management[32]	1976	Articles linked with forest ecology, forest management; applications of biology, ecology, and social knowledge to management and conservation of forests.
Forest Science[33]	1963	Contributions dealing with: silviculture, soils, biometry, disease, recreation, photosynthesis, and tree physiology, as well as all aspects of management and harvesting and policy analysis.
Forestry[34]	1927	Aspects of research, practice, and policy that promote sustainable development of forests, woodlands, and trees.
Journal of Forestry[35]	1902	Economics, education and communication, entomology and pathology, fires, forest ecology, geospatial technologies, history, international forestry, measurements, policy, recreation, silviculture, social sciences, soils and hydrology, urban and community forestry, utilization and engineering, and wildlife management[36].

[27] The Journal Impact Factor (JIF) is a tool used to measure how often articles in a specific journal have been cited. The total number of quotes during a year of the two immediately preceding years' issues (for example quotations in 1994 of the journals published in 1992 and 1993) is weighed against the number of articles published in 1992 and 1993 of that journal. A JIF of 1.5 for one year means that every article published in the journal the previous two years is cited on average 1.5 times.
[28] Stand: 2005.
[29] 10 year average of the *JIF* can be found for all forestry journals appearing in the web of science (as of 2005) in annex IV.
[30] For example, the journal Forest Ecology and Management has a 10 year *JIF* average 0.872, publishes a wide variety of subjects in English, thus it was included as possible candidate for selection. On the contrary, Tree Physiology in spite of having a 10 year *JIF* (1.816) and publishing in English, concentrates on all aspects of tree physiology including: responses of forest, crop and ornamental tree species to acid rain, air pollutants, ultraviolet radiation and global warming; the genetic transformation and micropropagation of trees; tree growth, reproduction, nutrition, photosynthesis, and environmental adaptation; and the relation between tree structure and function (http://www.oxfordjournals.org/our_journals/treephys/, last seen 14.09.2008) was not selected.
[31] http://pubs.nrc-cnrc.gc.ca/rp-ps/journalDetail.jsp?jcode=cjfr&lang=eng (last seen 21.08.08).
[32] http://www.elsevier.com/wps/find/journaldescription.cws_home/503310/description#description (last seen 21.08.08).
[33] http://www.safnet.org/periodicals/forscience/ (last seen 21.08.08).
[34] http://www.oxfordjournals.org/our_journals/foresj/about.html (last seen 21.08.08).
[35] http://www.safnet.org/periodicals/jof/ (last seen 21.08.08).
[36] http://www.safnet.org/periodicals/jof/ (last seen 21.08.08).

3.2.1.3.NATIONAL JOURNAL SELECTION

In order to make a reliable comparison between the global and national level a similar selection procedure was to be undertaken as the one described above. Chilean scientific journals are not incorporated in the journal impact factor index, which made it necessary to search within a Chilean databank for possible journals. Such databank is *SciELO (Scientific Electronic Library Online)*.

SciELO Chile covers a selected collection of Chilean scientific journals and is being developed by the National Commission of Scientific and Technological Research (CONICYT) as part of its policies of promotion to national research and dissemination of its results. The project is an initiative of the Foundation of Support to the Investigation of São Paulo State and the Latin American and Caribbean Center on Health Sciences Information. The project envisions the development of a common methodology for the preparation, storage, dissemination and evaluation of scientific literature in electronic format. At present seven Latin-American countries including Spain take part in *SciELO*: Argentina, Brazil, Chile, Colombia, Cuba, Spain, Venezuela. Through the internet portal, users can carry out searches in the whole of *SciELO* collections or on the level of a specific country. In Chile, the site provides full access to a selected collection of scientific Chilean journals and their articles[37]. The journals indexed in this database must comply with certain characteristics which include: a minimum of two years of age, continuity in its publishing regularity (minimum two times a year), an average of 70 to 80% of representation of authors external to the publishing institution so as to assure wide coverage, and it must also include title, summary, and keywords in English[38].

The databank counts with a category on agriculture and forest research. Within this category, journals were identified that mainly dealt with forestry issues. Unfortunately, and due to the recent creation of the databank, no journal impact factor or record of article citations was available at the time of data collection. Thus, the possibilities had to be limited to those journals which regularly appeared in the determined time-frame. Only one scientific journal fulfilled the criteria of publishing a variety of topics in forestry and which appeared constantly throughout the 10 years. This journal was *Bosque*.

Bosque is a forestry journal published by the Faculty of Forest Science of the Austral University in Valdivia, Chile. It has been published since 1975 and publishes articles on management and production of forest resources, science and technology of wood, silviculture, forest ecology, natural resources conservation and rural development associated with forest ecosystems. Articles can be published in Spanish or English.

3.2.2. MEDIA SELECTION

In order to study the global media discourse on forest science, two internationally oriented print media and one Chilean print media were selected for analysis. Print media was selected due to pragmatic reasons of research; to carry out analysis of discourses

[37] http://www.scielo.cl/scielo.php/lng_en (last seen 21.08.08).
[38] http://www.scielo.cl/criterios/sp/ (last seen 21.08.08).

propagated by international television or radio is a tremendous task that goes beyond the scope of this work.

3.2.2.1.GLOBAL MEDIA

The globalization process has of course reached and has been propagated by mass communication. Today, access to media products is easier than years ago. Recipients from the entire world view, hear, or read news delivered by many internationally-oriented mass media. However, an international orientation of the mass media does not assure its political or social influence. If a media does have an influence not only on society (the general public) but as well on other media, then it can be referred to as a leading or opinion leading media (Wilke, 1999: pp.302-03). A media will be considered a leading one when complying with certain criteria: 1) a strong circulation or reach; 2) it should be used by the social ruling class, by decision makers, and by participants of the elites; 3) journalists make use of it acting as multipliers of the information and viewpoints reflect in it; 4) it should also be cited frequently by other media; 5) based on content (through agenda-setting and/or framing) and/or formal (arrangement, design, layout, etc.) characteristics a media can be seen as a leading one; and 6) leading media can become quality media -if it is sustained on exclusiveness, journalistic accomplishment, as well as on renowned personnel- and afterwards become prestige media enjoying excellent public reputation. Only those media that stand out for the wealth of their news and the depth of their investigations can be considered quality media (Maherzi, 1997: p.121).

Newspapers such as the *International Herald Tribune*, the *Wall Street Journal* and the *Financial Times* are considered international quality publications (having readers throughout the globe), even though their circulation is far from that of some national newspapers (Maherzi, 1997: p.121). Since both the *Wall Street Journal* and the *Financial Times* are newspapers that generally reproduce economic or financial issues, they were not considered for this analysis. The *International Herald Tribune*, on the other hand, does report on wide variety of issues throughout a wide variety of locations. Another print media that has international orientation is the weekly *Time Magazine*.

If the medialization of the discourse on forest science on a global level is to be analyzed, then both these international publications seem to be good candidates for carrying out the research.

Recognition that these publications represent a western-orientation to news and issues must be made. Both these publications are owned by actors of industrialized countries and thus might favor in their reports western-oriented issues and actors. However, in their reports they try to cover all geographical locations. *Time Magazine* even has worldwide editions such as *Time Europe*, *Time Asia*, *Time Canada*, and *Time South Pacific*. This is a bias that must be accepted, if the research concentrates on English speaking media. For future research considering international media written in other languages than English might be a reasonable step to take if the objective is to study global media.

3.2.2.2.NATIONAL MEDIA

A survey administered to the members of the Chilean elite and published by the United Nations Development Program (PNUD, 2004) revealed that the mass media were the most powerful members of the elite[39]. According to them, the mass media is the actor that has the most influence in Chile in comparison to 31 other actors such as economic and financial ministries (second place) and big economic groups (third place). Non-governmental organizations and union associations take the 31st and 32nd place respectively. The survey reveals (PNUD, 2004: pp.195-98) the perception that mass media is powerful because they force the elite as a whole to act in a more transparent way. As well, the relevance of the mass media in Chile is based, according to the PNUD, on the increasingly manifest need of the population to demand explanations from those who run the country. The public is thus increasingly demanding an opening of the obscure environments of power. "*The (Chilean) elites comprehend that their strategies of action depend on the access to the mass media*" (PNUD, 2004: p.196); in accordance to this, intentional strategies carried out by the elite arise in order to take part in public discourses.

The perception that the mass media are the actors which have gained more power in the present time is mentioned by the Chilean public in a national survey administered by the PNUD. An interesting result is that the public value the mass media as allies when encountering situations of abuse or necessity (PNUD, 2004: pp.197-98) however, they do not perceive them as part of the most powerful actors in Chile (these being the government, entrepreneurs, and political parties).

Another interesting result relevant for this research is that in Chile, the majority of the elite maintain contacts with the mass media. Table 3.3 reflects firstly the most powerful actors perceives by the elite (Power environment); here the elite recognized the power of the mass media ahead of all others. Secondly, the elite was asked to share with which actor the maintained important formal or informal links, the mass media was the most named actor ahead of research centers and much ahead of political parties (contacts column in table 3.3). Finally, the elite was asked to name which actors served as interconnector (interconnectors column in table 3.3) to others so that without their help they would not appear within the different networks; the mass media here lost in favor of research centers and universities, amongst other actors. Thus, from the point of view of the contacts, the influence of the mass media for the Chilean elite is highlighted through the result. An even more interesting result is that research centers and universities appear as first actors that help the interconnectiveness of powerful actors. The PNUD reflects that along with delivering information and diagnosing problems they serve as an instance of encounter and interconnection for the Chilean elite.

[39] Members of the Chilean elite were defined by this study as the minority of social actors of a country which concentrate the most share of power which not only allow them to differentiate themselves from the common population and exercise high-level functions but which are compelled to in some way justify their forms of actions (PNUD, 2004: p.173).

Table 3.3: Elite: contacts and interconnectors (Source: PNUD, 2004, p. 200)

Ranking	Power Environment	Contacts	Interconnectors
1	Mass Media	Mass Media	Research Centers and Universities
2	Economic Ministries	Research Centers and Universities	Economic and Legal Advisers of High Level
3	Big Economic Groups	Senators	Banks
4	Central Bank	Chamber of Deputies	NGOS and Associations
5	Political Ministries	Economic Ministries	Entrepreneur Associations
6	Church	Banks	Senators
7	Entrepreneur Associations	Political Parties	Mass Media

As mass media is seen in Chile as a powerful actor by the elite, and accordingly, they create strategies for gaining access to them (and thus to public discourse), mass media is a relevant research object to examine on a national level. For the Chilean public, mass media is a recognized ally in the control of powerful actors. This perception allows assuming that the public look to the society-relevant discussion taking place through the mass media and might be then influenced in what is proposed through it. Additionally, the mass media play a role for the research organizations as these are a source of contact and information for the news coverage of the media. If contact between the national media and national research organizations is taking place, then this makes even more relevant a study on the orientation of science to the criteria of the media. And so, the mass media play an important role for the Chilean society being it, through this perspective, relevant to study. As a global and local comparison is to be undertaken it is necessary to have a similar point of comparison regarding the discourse. Therefore, the Chilean printed mass media is the subject of study.

The political influence of the mass media in Chile has been recorder through the actions which took place until 1973 (Corrales and Sandoval, 2004). The Chilean mass media until that time was always clearly classifiable into a specific point of the political spectrum. In many cases actors of political parties either associated or owned some sort of printed mass media (Corrales and Sandoval, 2004). This situation is modified after the coup d'état of 1973, where all 'political press' was afterwards band; leading to the situation where the two most important press consortiums, friendly with the military regime of the time, found themselves with no immediate competitors and were free to dominate the market. After the return to democracy this situation was expected to change however, according to Corrales and Sandoval, due to the lack of adequate policies and the view taken by the newly elected government that the market would regulate itself, this has not been the case.

According to the National Press Association of Chile (ANP, 2006) in Chile today there are 96 printed publications, of these 59 correspond to publications edited at least four times a week (for example daily newspapers) and 37 to publications with less than four times a week as frequency of publication. At first glance, Chile today seems to reflect a multiplicity and variety in the offer of written press however, the situation is still characterized by an oligopoly (or better said duopoly) in the area of printed media. The two mayor concerns that concentrate the printed media are the group of enterprises of *El Mercurio* (belonging to the *Edwards Family*) and the *Consorcio Periodístico de Chile Sociedad Anónima (COPESA)*[40] (Sunkel and Geoffroy, 2001; Corrales and Sandoval, 2004).

[40] Journalistic Consortium Ltd.

The more important of the two, considering market share and influence, is the *El Mercurio* group. This group owns the majority of daily newspapers throughout Chile (Corrales and Sandoval, 2004) the most important of the publications being the newspaper of national distribution *El Mercurio*. *Copesa* is the second most important owner of printed media, owning amongst others the newspaper of national distribution *La Tercera*.

Historical data on circulation of the printed media in Chile is not available. Only after 2003 statistics were gathered and published by the National Press Association of Chile (ANP). These statistics reflect the importance of both of the above mentioned daily newspapers in Chile. Table 3.4 summarizes the tendency shown in Chile regarding the circulation numbers of the daily newspapers. *El Mercurio* clearly dominates these numbers both during the week and weekend. *La Tercera* on the other hand, ranks second in circulation only on the weekends. Popular daily newspapers such as *La Cuarta* and *Las Últimas Noticias* rank respectively second and third on weekdays but fail to do so on weekends. Both these newspapers are owned by the Press Consortiums mentioned above (Sunkel and Geoffroy, 2001: p.29).

Table 3.4: Circulation numbers for Chilean daily newspapers (Modified from: ANP, 2007)

	Monday-Friday	Saturday-Sunday
El Mercurio	143.301	225.190
La Tercera	108.039	210.030
Las Últimas Noticias	132.479	173.922
La Cuarta	141.087	163.936

Circulation numbers were on the one hand criteria for pre-selecting *El Mercurio* and *La Tercera* as research objects which on the other hand represent newspapers with a recognizable influence on the elites of the country. This is especially the case for *El Mercurio*, which historically has been present in the political debates of the country. Such has been the influence of the newspaper throughout different phases of the history of the country, that many authors, amongst them Correa (Correa, 2005: p. 52) coincide with naming it as the media which -along with political parties- supported the right-wing discourse of the Chilean elites of the time before and after September 11th of 1973[41]. *La Tercera*, on the other hand, has as well been associated with the right-wing political parties of the country, but has not been the object of much research as its competitor.

Both of these daily newspapers were considered for analysis, finally deciding on *El Mercurio*, due to the availability of the newspaper in its printed form in a specific Chilean library, and the completeness of its internet search engine[42].

3.2.3. SELECTION OF TOPICS AND ARTICLES

For the selection of which themes were to be analyzed, a joint analysis of topics appearing in the global forestry journals and in internationally oriented mass media (namely *Time Magazine* and the *International Herald Tribune*) was carried out.

[41] Date of the coup d'état.

[42] *La Tercera*'s online search engine only registers complete articles since 1998, making it difficult to make a comparison between this media and *El Mercurio*. Additionally, the newspaper was not completely available in its' printed form in the library in Chile where the articles from *El Mercurio* were gathered.

3.2.3.1.TOPICS

Using the database *Web of Science*[43] (WoS), scientific abstracts were searched considering key-words, journal source (the five journals), type of publication (articles, editorials, and reviews), language of publication (English), and time-frame (1994-2003). Key words were chosen based on classifications of forest science research categories of the International Union of Forest Research Organizations (IUFRO) and the Food and Agricultural Organization (FAO) which cover the whole range of forestry disciplines. Once all categories were searched for the total articles, each category was compared to the total number of global mass media articles regarding forest (once these were classified according to their main forest-related topic) and issues with most visibility on both media were selected. The topics which were chosen are[44]:

- Global Warming / Climate Change: Focuses on the role of forests in all those events that have to do with the problematic of global warming or climate change. For example the role of forests, and its components, as sinks or sources of greenhouse gases like carbon dioxide.
- Biodiversity: Biological diversity found in forests (for example flora or fauna species) and the events that affect them or the consequences of these events are topics dealt with in this category.
- Forest Fires: Fires events that arise in the forests as well as that affect it. Fire as management option for the forest is as well an example of the diversity of issues that are concentrated in this category.

3.2.3.2.SCIENTIFIC ARTICLES

Once the topics were fixed, the next step was to select the relevant scientific articles to be analyzed. The key-word search delivered for global warming/climate change 478 articles, for biodiversity 408 articles, and for forest fires 728. These high numbers did not guarantee that all articles were specifically related to the topics selected. Thus, new selection criteria were established.

Using the *Web of Science*, all article abstracts and key words were downloaded. An article was then selected to continue in the selection process if key-words –such as e.g. biodiversity, climate change, and fires- were mentioned in the abstract and if in the abstract description the relevance of the article to forest and the respective topic was made clear. From this, the articles were reduced to 199 for Climate Change, 287 for Biodiversity, and 228 for Forest Fires.
A further step in the selection process was carried out using the *Science Citation Index* available from the *Web of Science*. This tool provides access to up-to-date bibliographic information on the world's leading scholarly science and technical journals covering more than 100 disciplines[45], in which forestry is one of them. Every single article was searched

[43] Web of science (WoS): is a database that indexes an enormous amount of scientific journals which allows users to navigate articles and references.
[44] Forest scientific disciplines such as "harvesting, wood delivery and utilization", "mensuration, growth and yield", or "industry and wood processing" produced in this time frame considerably more articles, however the presence of these topics in the international media is almost non-existent.
[45] http://scientific.thomsonreuters.com/products/sci/ (last seen 15.09.2008).

in the database and the number of citations that it received until December 2005 was recorded. Citations are seen as an indicator of the impact specific research has had on the community as a whole (van Raan, 2004: pp.26-7). There are of course problems with taking citations as an indicator of impact in the scientific community (as previously seen) however, the objective here is not to make a bibliometric study of forest science, but analyze the dominant discourse in forest science. Thus recognition is given to the problems of using citation as indicator for impact but, discussion on this problem is not pursued.

The final assortment of articles was chosen by selecting for each year of publication the articles belonging to the 25% most frequently cited[46] articles for each year within the considered time-span. The top 25% was taken in view of the 80/20 rule described earlier.

For the selection of national articles, a comparable procedure could not be undertaken, because of the lack of key-word search possibility and the lack of information on citations for each individual article. Thus, every article was included for analysis which, in its' abstract, related to the topics mentioned above.

Table 3.5 shows the total number of scientific articles on both a global and national level considered for the analysis.

Table 3.5: Topics and final number of global and national science articles (Source: own calculations)

Topic	Total global articles	Total national articles
Global Warming / Climate Change	65	1
Biodiversity	92	6
Forest Fires	69	1

As seen from table 3.5, there are an extremely low numbers of articles found in the national scientific journal that refers to the specific issues that were chosen. This does not reflect that the scientists in Chile working in the field of forest science do not carry out research in these specific topics, but is an indicator that this particular journal is not seen as a publishing priority for the scientists. Other and more detail explanations for this particular result may be found in section 4.1.2.

3.2.3.3.MEDIA ARTICLES

Here articles were considered that not only had the three topics as a central scientific theme but as well those articles that touched even marginally upon these topics. This is justified because, as Schäfer (2007, p.86) states, the actually relevant and recipient-effective science reporting is not only the science-centered reporting.

In order to obtain the global mass media articles, the database *LexisNexis*® was used. The key-word forest was entered in the search field, and all articles downloaded for the

[46] This procedure helped reduce the bias in favour of articles appearing in earlier years. An article that was published in 1994 may have more citations than an article published in 2003, thus having a higher probability of being selected if a comparison was made of all articles not considering their publication year. However, articles published at the beginning of a year were considered equal to articles published at the end of the same year. Thus, for one particular year no difference was made.

relevant time-span. A revision of each article, and its subsequent classification was undergone eliminating articles that had no relations to forest as a topic[47].

For the national media articles, first a manual search of the media was done for the years 1998 to 2003 of the particular topics. For the years 1994-1997 an online search was carried out through the search engine of the internet website: *http://www.infomercurio.com/*. The articles found through this website were partly purchased and partly obtained through the interlibrary borrowing service of the University of Göttingen[48].

Table 3.6 reflects the total number of articles finally analyzed for both the international and national mass media.

Table 3.6. Topics and number of global and national media articles (Source: own calculations)

Topic	Total international articles[49]	Total national articles
Global Warming / Climate Change	44	24
Biodiversity	24	26
Forest Fires	51	61

3.2.3.4.PRESENTING RESULTS

As this work implies three types of material (scientific articles, mass media articles, and survey answers), two level of analysis (global and national), and three different issues results will be separated and presented according to these characteristics. Only when necessary will results be aggregated.

[47] Further detail on how international articles were selected can be found in Park (2009).

[48] The major problem encountered by this search approach was the uncertainty of gathering all articles dealing with the specific topics. Even if the internet search delivered the names of all articles that had relevance to the topics, because only the three first written lines of the article were displayed, there was no guarantee that the articles finally bought were relevant to the topics selected. However, all those articles in which the headline induced the relevance for the specific topic were purchased and later through a detail examination of all articles bought, all those articles relevant to forest science and the three different issues were selected and form the database for analysis.

[49] This dataset differs from the original dataset obtained through the project EQMGWD (2008) as the focus for the work presented here were all those articles in which forest science –or science relating to forests- was discussed in the mass media and not all the articles appearing in the mass media that had to do with forest and each of the three (from the five) issues that formed the original project database.

4. RESULTS AND DISCUSSION

The theoretical model presented in figure 2.6 focused on the discourses and distortions of science communication specifically in two different arenas: the science and the public arena. The discourse on forest science emerging from the science arena will be referred to as the scientific discourse on forest science, while the forest science discourse in the public sphere -approximated through the media arena- will be referred to as the media (public) discourse on forest science. Additionally, the opinions and behaviors towards the mass media of individual scientists working worldwide in the field of forest science will be as well object of analysis.

This section is therefore structured according to the hypotheses that have been previously constructed.

The first results here presented deal with the existence or lack of a deliberative discourse in forest science in the scientific arena - the scientific discourse on forest science- examined through particular discourse characteristics as well as through the existence or absence of Center and Periphery structures. Following this, attention is given to the patterns of collaboration existing in forest science as a possible way to resist power dominating structures that are Center and Periphery structures. International collaboration is then seen as a means of reaching a deliberative scientific discourse on forest science.

Following this, medialization of forest science is considered. This implies examining the presence or absence of the different medialization factors explained in the theoretical chapter: firstly in the scientific discourse on forest science followed by the media discourse on forest science. A comparison between the two discourse arenas will deliver evidence on whether scientists are orienting themselves to the criteria of the mass media. Finally, results regarding the particular attitudes and behaviors of scientists working worldwide in the field of forest are presented, in order to examine whether the individual scientists recognize the existence of medialization of forest science.

4.1. SCIENTIFIC DISCOURSE ON FOREST SCIENCE

As mentioned previously, a pre-condition for a discourse to be deliberative is that free and equal participation be assured. The objective of this section is to answer whether the discourse on forest science arising from the scientific arena can be considered a deliberative one or is more an empowered one.

On a global level, more information was gathered due to the numbers of articles that were analyzed. A total of 226 articles analyzed are adequate to examine both the existence of an empowered scientific sphere and the collaboration patterns. The medialization hypotheses also assured analysis through these numbers.

4.1.1. GLOBAL SCIENTIFIC DISCOURSE ON FOREST SCIENCE

Examining characteristics of the global scientific discourse on forest science is the starting point of this analysis. The number of articles analyzed was: for forest fires 69, for biodiversity 92, and for climate change 65. When using these numbers it should be kept in mind that they represent the 25% most frequently cited articles for each issue. Thus, when referring from here on forward to the 'published articles', the 25% most frequently cited articles of each journal are meant.

Table 4.1 shows the number of articles published for the whole time frame analyzed according to each of the journal sources. 92 articles were analyzed for biodiversity, which are mainly found in the journal *Forest Ecology and Management* (FEM). With 72 biodiversity articles published, this journal seems to focus, in comparison to the other issues, on this specific topic. *Canadian Journal of Forest Research* (CJFR) favored less, in relative terms, the topic of biodiversity than the other issues. Nine articles were published regarding this issue in contrast to 23 of forest fires and 27 of climate change. *Forest Science* (FS), *Forestry* (F), and *Journal of Forestry* (JF) all had similar publication tendencies in which few articles regarding the three issues were published. Taking into account this result, one must consider that these last three journals were in disadvantage when comparing them with the previous two in terms of citations received. Both CJFR and FEM are the journals that received over the 10 year time frame the most citations, thus they are the ones that determine in these cases the scientific discourse on forest science.

Table 4.1. Total number of scientific articles according to issues and selected journals (Source: own calculations)

	Forest Fires	Biodiversity	Climate Change	TOTAL
Canadian Journal of Forest Research	23	9	27	59
Forest Ecology and Management	41	72	33	146
Forest Science	2	4	2	8
Forestry	0	6	2	8
Journal of Forestry	3	1	1	5
TOTAL	69	92	65	226

Figure 4.1 shows for each journal examined the percentages of each issue relative to all issues present in a specific journal; so for example, the issue forest fires in *CJFR* reaches 38,98% of all issues in that specific journal. Through the figure it is clear that biodiversity is the dominant topic in *FEM* (49,32% of all articles published in the journal), *FS* (50%), and *F* (75%). JF gave similar importance to both climate change and biodiversity. The only journal in which biodiversity was neither the dominant topic or second to first was in *CJFR*. Here biodiversity loses against climate change and forest fires, being climate change the dominant issue of the three (45,76% of all articles published in the journal).

The topic with least variation through all journals was climate change. Similar percentages are seen in four of the five journals (ranging from 20% to 25%); *CJFR* is the one journal in which climate change breaks this tendency. Forest fires, on the other hand, clearly dominates in *JF*, has similar tendency on both *FS* and *FEM* (25% and 28,08% respectively), and is second in the *CJFR*.

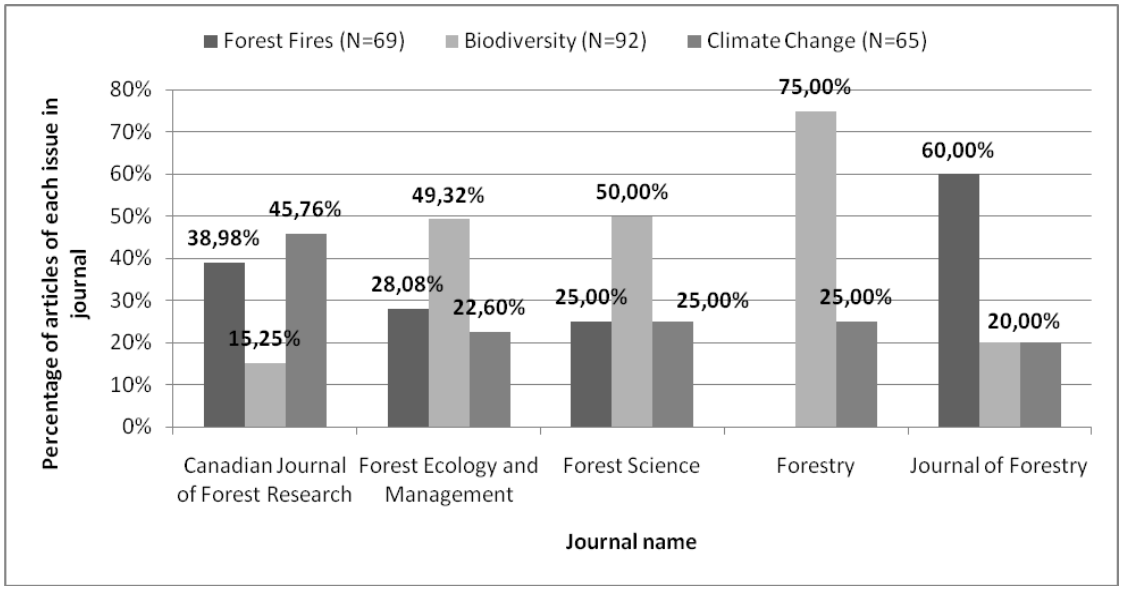

Figure 4.1. Percentage of articles for issues in each journal source (Source: own calculations)

Over the ten year time frame an increase in the number of articles that were published for each issue was observed. Figure 4.2 shows the distribution through time of the different topics and their 25% most frequently cited articles. All three topics began in 1994 with similar number of articles published. In absolute values, biodiversity is the issue which increased the most, going from two articles published in 1994 to 23 articles published in 2003. Forest fires went from three to 14 articles published and climate change from 3 to 10 articles published. This increase in the amount of published articles peaks for the first time in 1999 for both biodiversity and forest fires. Climate change, in the same year, decreases to the level of 1994 (namely three articles published). However, of the three issues it was the only one that increased its numbers in the following year; both biodiversity and forest fires decreased. Furthermore, biodiversity was the non-stop issue beginning in the year 2001 until 2003 with a steady increase. Both forest fires and climate change, even though increasing through time, had ups-and-downs in terms of total number of articles published in the same period. Climate change reached its highest peak in the year 2002 with 14 articles published, forest fires on the other hand peaked in the year 2003 (with 14 articles).

As forests and forest ecosystems have evermore become the source of discussion regarding their role in mitigating climate change through the sequestration of greenhouse gases –or as well as a source of emissions of greenhouse gases- the tendency presented in figure 4.2 might have changed.

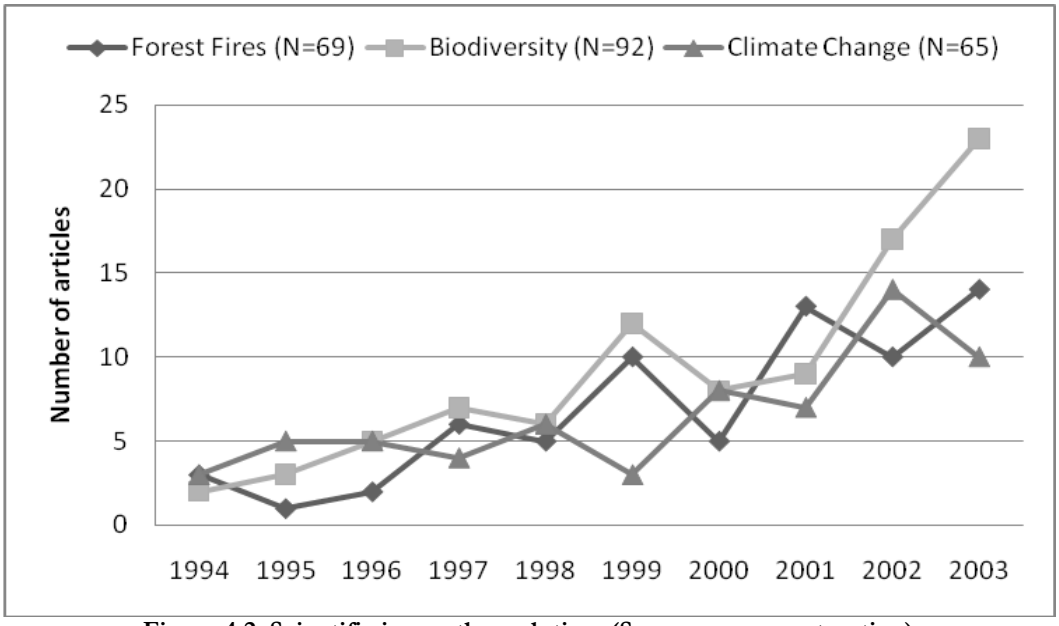

Figure 4.2. Scientific issues through time (Source: own construction)

It has already been mentioned that the contribution to the total amount of articles published by *FS*, *F*, and *JF* is low in comparison to the articles published in *CJFR* and *FEM*. In order to examine the distribution through time of each issue in both these particular journals, figure 4.3 can be observed. From this figure it is clear that *CJFR* has with time become more involved in publishing articles in all three topics. In 1994, this journal only published articles dealing with climate change. As time passed, it included in its repertoire biodiversity and forest fires articles, alternating the issues in the year 1995 and 1996; climate change however, was always present in their publishing strategy. *FEM* on the other hand, started the period analyzed publishing two issues in 1994 (forest fires and biodiversity). Climate change irrupted with great force in this journal in the following year, to afterwards become a stable participant in the issues being published. Comparing the two journals, *FEM* published a relatively balanced mixture of the three topics throughout the period examined, whereby *CJFR* had a great variability in its publication behavior. From the ten year, in three of them (1995, 1996, and 2002) dedication was given to only two subjects (climate change and an alternation between biodiversity and forest fires) and in one of them (1994) to only one subject (climate change).

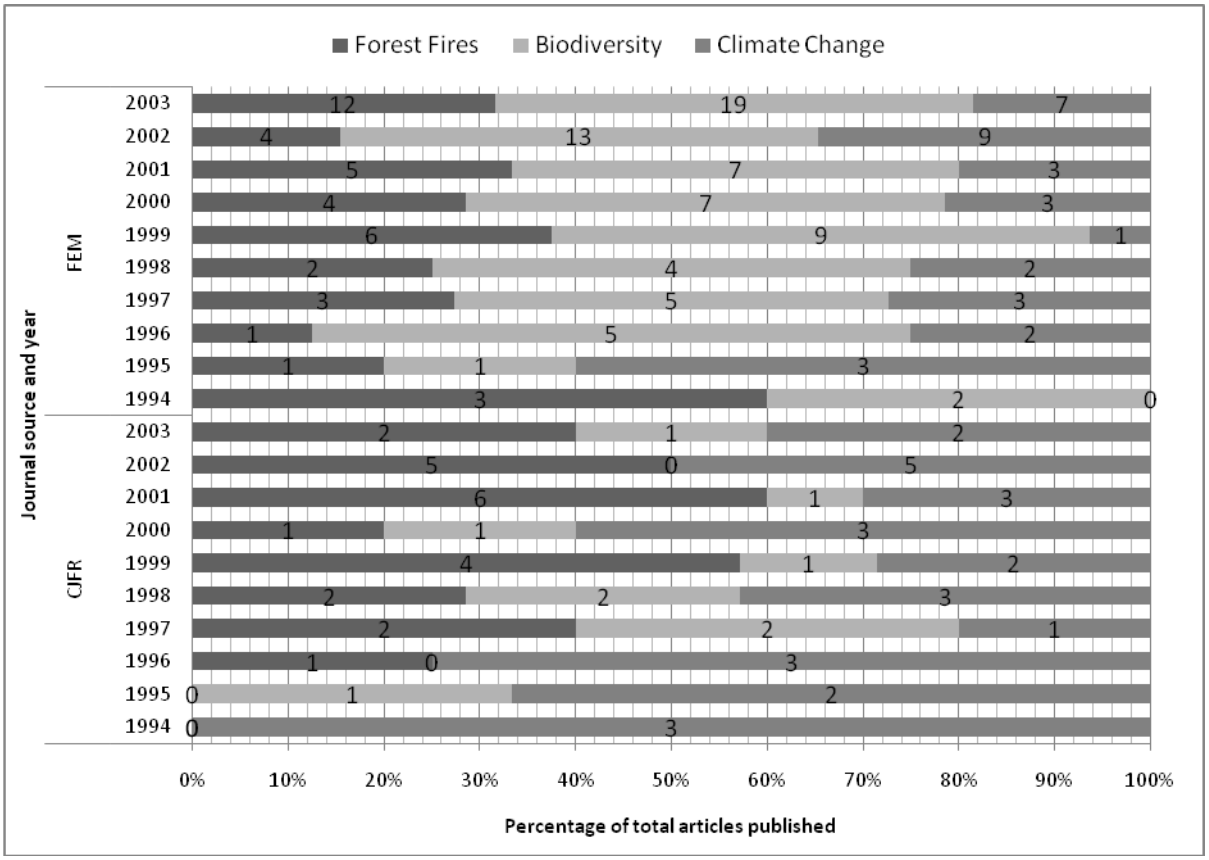

Figure 4.3. Distribution of articles published (in %) per issue, year, and source in *CJFR* and *FEM* (Source: own construction)

The role of forests and thus the necessity for scientific information on the issues that concern them have been made apparent with the uprising of international process such as the Convention of Biodiversity (1992) and the Kyoto Protocol (1997). If these dates are taken as starting points for the development of new research it should be expected that within the following years, both these subjects increase in importance within the scientific discourse. For the time frame analyzed, and from figures 4.2 and 4.3, it seems that the research process and the publication of results regarding these issues is a slow one within forest science.

Up until the year 1999 biodiversity had similar publication growth rates as the other two subjects. In *FME* from this year on it accounted for at least 50% of all issues covered; however in *CJFR* its importance was not reflected. For climate change, in this last journal, the importance of the issue was seen in the three first years of the period analyzed, but decreased in importance the following years (with the exception of 2002). It might be that the scientific discourse served as initiator for the political discourse; meaning that attention on the part of politics was paid to the discussions taking place in the scientific field. However, from the data gathered this cannot be ventured. For *FEM* it was always an issue of some importance. Therefore the impact of these international processes on forest science production cannot be clearly seen through the analysis of the articles and journals selected.

Another characteristic that is interesting to note, and which gives basis for discussions found further on, is the number of authors present in the articles published. Table 4.2 depicts the number of authors found in the 226 articles published for the three issues.

With 272, biodiversity is once again the topic that scores the highest, climate change follows with 239 authors, and finally forest fires with 218. However, if consideration is given to the total number of articles for each issue (namely 92 for biodiversity, 65 for climate change, and 69 for forest fires) a new picture arises: the topic with most authors per article is climate change (3,68 authors per article) followed by forest fires (with 3,15 authors per article), and finally biodiversity with 2,96 authors per article. This result delivers first evidence of the presence of collaboration within forest science (discussed below) -at least regarding the number of authors per paper- as all topics are written in average by more than two authors. The median for all three issues was of three authors.

Table 4.2. Authors in scientific articles in global science sphere (Source: own calculations)

	Total number of authors	Maximum number of authors	Average authors per article	Median
Forest Fires	218	10	3,15	3
Biodiversity	272	8	2,96	3
Climate Change	239	9	3,68	3
TOTAL	***729***			

The maximum number of authors found in one paper was ten; this number was found once in a forest fires article reviewing road paving, fire regime feedbacks and the future of the Amazonian forest where the authors find that decisions of Brazilian government policy regarding investing in new roads will lead to deforestation and forest impoverishment through illegal logging and understory fire (Nepstad et al., 2001). In climate change, one article had a total of nine authors. This specific article dealt with estimations of carbon emissions from Canadian forest fires, which is noted by the authors to impact carbon sequestration by forests as well as emitting green house gases that potentially affect the climate (Amiro et al., 2001). Both of these papers extended through a large geographical area (Canada and the Amazonia) and one regarded a large amount of disciplines (Amazonian paper), hence the need to count with a large amount of collaborative partners; therewith the large amount of authors can be explained. The biodiversity article that scored the maximum number of authors (eight) was a Portugal based article dealing with the effects of prescribed fire on the diversity of vegetation structure and breeding birds of northern Portugal (Moreira et al., 2003).

Figure 4.4 gives detail on the number of authors found in each of the three topics. For climate change the figure shows that only ten articles were written by one author and that the 55 articles remaining were co-authored (84,62% of all climate change articles). For forest fires only eight of the 69 total articles (11,59%) were written by one author and for biodiversity only 16 (representing 17,39%). The articles analyzed were thus in their majority co-authored articles. The knowledge produced and published was the result of a cooperative effort most frequently undertaken by two scientists. For forest fires 24 (34,78%) of all articles were written by two scientists, this same number of authors co-authored biodiversity articles (representing 26,1%), and 15 climate change articles (23,08%) were co-authored by two persons.

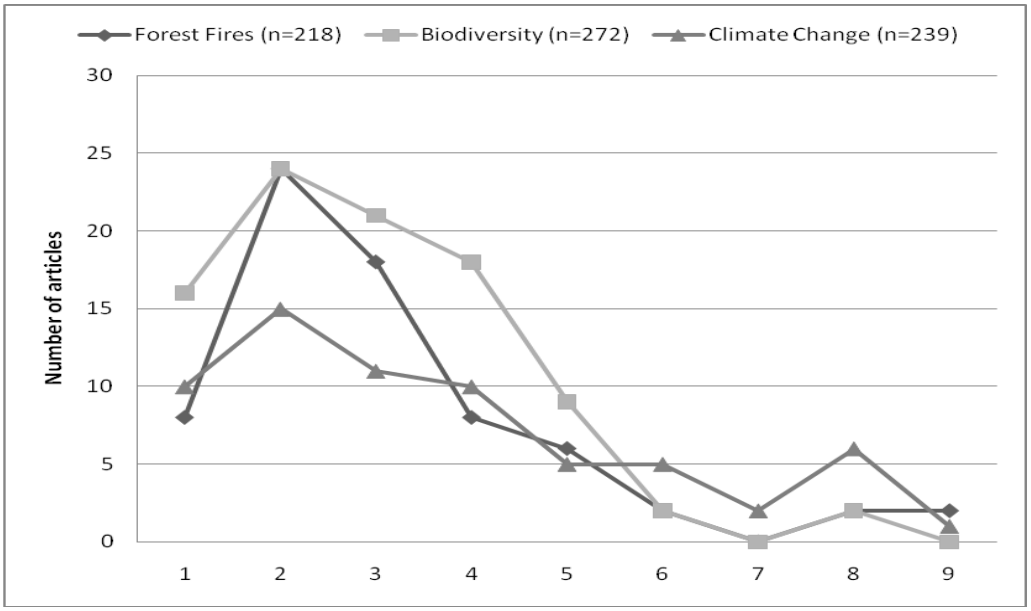

Figure 4.4. Number of authors per articles (Source: own calculations)

If the affiliation country of the authors is observed an interesting picture arises when examining this variable for the different journals analyzed. The journal which had the widest variety of countries as affiliation country of authors was *FEM*. This journal reflected 31 different countries, ranging from the United States of America, to Brazil and Bolivia, to the Central Republic of Africa and Ethiopia, to Germany and the United Kingdom. The distribution of countries according to journal source can be seen in table 4.3.

The journals *FS* and *JF* reflect a true "home-based" publishing behavior. Both these journals are published by the *Society of American Foresters* (United States) and mainly publish articles of authors from this country (90% and 100% respectively), with the small exception of a few authors from another English speaking country, namely the United Kingdom (10% of all authors in Forest Science were from this later country). *Forestry* is an England-based journal edited by the *Institute of Chartered Foresters* of the UK (a similar organ as the Society of American Foresters) and as such reflects as well a "home-based" publishing behavior, where 63,64% of its authors are affiliated to an organization within this country[50].

The *CJFR* includes a greater diversity of countries than the previous mentioned journals. However, more than 86% of the total authors published were affiliated to either a Canadian institution or a United States based one (46,34% and 40,98% respectively); here not a "home-based" but a "neighbor-based" behavior is the norm. Mainly industrialized countries such as Finland, Sweden, and the United Kingdom amongst others complete the list.

FEM published as a majority authors from the United States (37,15%). English speaking countries take up second and fourth place: tied for second are United Kingdom and Australia, and fourth place is taken by Canada. This journal can then be characterized as

[50] The affiliation country of the scientists participating in an article was derived from the correspondence address given in the article. Cases were found where more than one institutional (or affiliation) address was given, in those cases only the first address was considered. 32 countries made an appearance in all article.

one which favors English speaking countries throughout the globe. This journal, in spite of the English-speaking-country bias, is as well characterized by the presence of authors from European countries such as Finland and Sweden (two mayor forestry countries); Germany, Belgium, and France are as well considered. Brazil has also an important author presence with 24 authors (5,10%) being included in articles published by this journal. It is noteworthy that representatives from countries such as Argentina, Bolivia, Central Republic of Africa, Ethiopia, Panama, and Mexico –which are not industrialized countries-, amongst others, also find resonance in this journal making for the remaining 15,92% of all authors present.

Table 4.3. Affiliation country of authors according to journal source (Source: own calculations)

	Canadian Journal for Forest Research		Forest Ecology and Management		Forest Science		Forestry		Journal of Forestry	
	n	% of N	n	% of N	n	% of N	n	% of N	n	% of N
US	84	40,98	175	37,15	18	90	4	36,36	17	100
CA	95	46,34	29	6,16	2	10	0	-	0	-
UK	3	1,46	34	7,22	0	-	7	63,64	0	-
FI	11	5,37	24	5,10	0	-	0	-	0	-
SE	5	2,44	28	5,94	0	-	0	-	0	-
AU	2	0,98	34	7,22	0	-	0	-	0	-
FR	1	0,49	5	1,06	4	-	0	-	0	-
DE	0	-	19	4,03	0	-	0	-	0	-
NZ	0	-	12	2,55	0	-	0	-	0	-
BE	2	0,98	12	2,55	0	-	0	-	0	-
BR	0	-	24	5,10	0	-	0	-	0	-
Other Countries	2	0,98	75	15,92	1	-	0	-	0	-
TOTAL (N)	205	100	471	100	25	100	11	100	17	100

As the research object here is the scientific discourse on forest science, it would be expected that scientists affiliated to forest science dominate as authors and that, because of the interdisciplinary character of two of the three issues (climate change and biodiversity) participation of other scientists is also found but on a lower scale. The question to answer now becomes whether the scientific discourse on forest science is dominated by forest scientists or can participation of other fields be found? To answer this question, author's field was classified according to the institution to which they were affiliated[51], which serves as an approximation of the field of science that the author belongs to. A scientists affiliated to a forestry faculty was classified as belonging to forest science; on the contrary, a scientists affiliated to a biology faculty was classified as a natural scientists when dealing with life sciences and belonging to formal sciences when affiliated to institutions such as mathematic or statistics departments. Nature conservation was also a category as well as social sciences, where authors were classified if they belong to, for example, economic departments. Since there was the possibility that authors participating in the discourse were actors not associated with research institutions, the category others was used (actors were coded as other when they, for example, belong to

[51] Authors affiliated to two or more institutions were coded based on the first of the institutions named in the contact address. The names of the affiliation institutions reflected a wide variety of possible combinations between fields (ecology, biology, natural resources, and environmental management amongst others) which made difficult the classification of the authors into one field. To solve this, in those cases that presented this the first field mention was taken to be the field of the author. However this was only the case in at most three articles. Then, they do not have an impact on the results presented.

museums). Figure 4.5 summarizes for each topic analyzed the affiliation field of the authors.

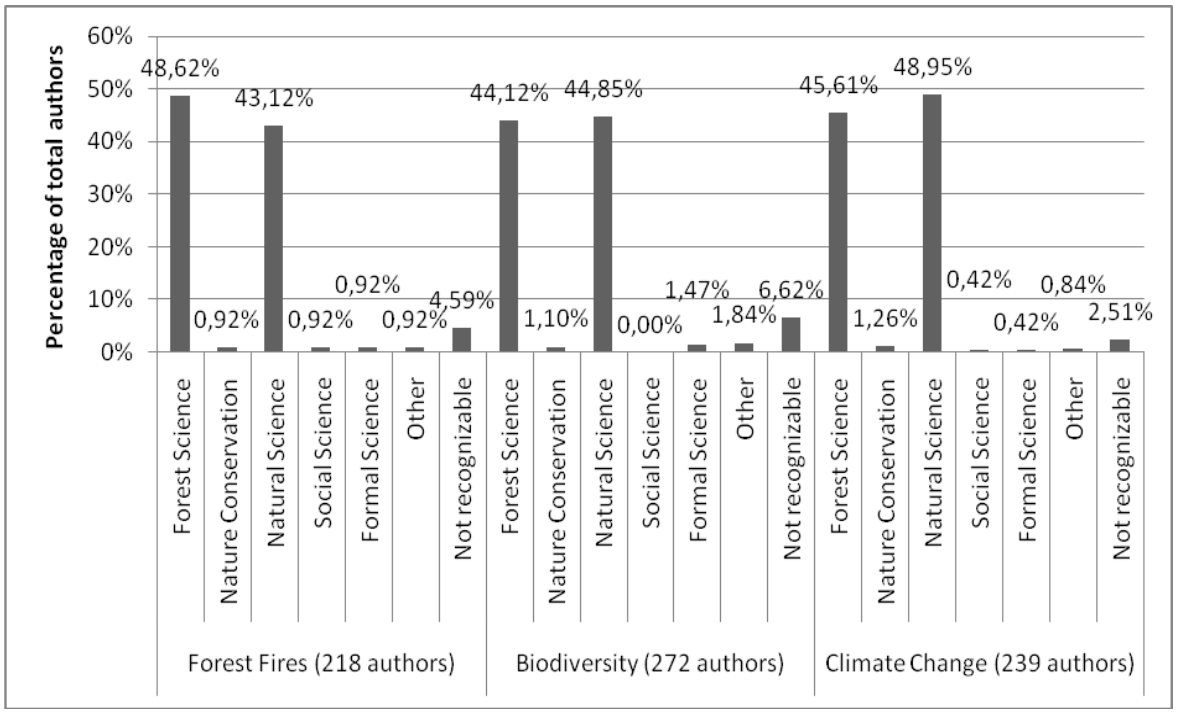

Figure 4.5. Affiliation field of authors of scientific articles (Source: own calculations)

In the issue of climate change the majority of the authors writing in global forest peer-reviewed journals were affiliated to the natural sciences. 48,95% of the total authors were classified as natural scientists versus 45,61% of forest affiliated authors. Biodiversity is also a topic where, even though not as noticeable as in climate change, this is as well the case: natural science affiliation reaches 44,85% of all authors where as forest science 44,12%. Forest fires, on the other hand is the issue where forest science marks its presence; of the 218 authors participating in discourse 48,62% were affiliated to a forest science institution where as 43,12% to the natural sciences in general. This result speaks of the limited interdisciplinary of the two issues, in the sense that only specific areas of natural science are incorporated into the discourse and not many other scientific disciplinary fields. The issues of climate change and biodiversity are not issues that are solely domain of forest scientists but accept the participation of other fields such as biology and ecology.

There are articles that are only written by natural scientists throughout the three issues. From the 33 articles that were written by only one author (figure 4.4), 20 of them (60,06%) were written by natural scientists and only 8 by forest scientists (24,24%). For each issue, the articles written by a single authors, five of forest fires (2,29%), seven of biodiversity (2,57%), and eight of climate change (3,34%) were written by authors affiliated to natural sciences. These articles reflect, for example in the forest fires issue, the use of software for modeling fire growth and behavior (Stephens, 1998) as well as literature reviews regarding the response of certain species to forest fires (Minshall, 2003). For the biodiversity issue, single authored articles associated with natural science include articles on, for example, the validity and use of the indicator species concept to the future direction of biological conservation in managed forests (Lindenmayer, 1999) or the effects and management considerations of natural disturbances on boreal forests and the

diversity of species found within them (Niemelä, 1999). For climate change, biomass energy in industrialized countries as a way to ameliorate CO2 emissions (Hallie, 1997) is one subject dealt with in singly authored articles; as well as estimating forest biomass through wood density in order to reduce uncertainties in emissions calculations (Fearnside, 1997). These are all subjects that can be the culmination of research undertaken by both natural as well as forest scientists, in other words it is not specific to any of these scientific fields.

The approximation through the affiliation institution gives some insight into the type of scientists working in the field, but it does not give exact information. Many scientists working in institutions with the name "Natural Resource Management" may both be natural or forest scientists. The fact that these institutions have names that are applicable to a wide field of sciences is a sign that they are not exclusively dealing with forest related issues and thus may extend their research field to different problems, not only forest-related ones.

There are other scientists incorporated into the global discourse on forest science, for example authors affiliated to statistical institutions as is the case of a forest fires article that deals with a statistical methodology for estimating historic forest fire frequency which has as first author a scientists from a department of mathematics and statistics (Reed et al., 1998). Social scientists are as well incorporated in the discourse on forest fire and climate change articles. In climate change the author affiliated to this science is incorporated in a ten author-written article set in the Brazilian Amazonia which examines the effects of governmental policy of road paving. However, the presence of these actors is minimal in comparison to presence of forest and natural scientists, which together account for almost 90% in all three issues.

4.1.2. NATIONAL SCIENTIFIC DISCOURSE ON FOREST SCIENCE

In the previous chapter, table 3.5 delivered a notable result for the national level. It seems that the scientific discourse in Chile differs greatly from the global scientific discussion. The number of articles that were found for the three selected topics amounted to a total of eight articles for the ten year time frame. Six articles dealt with the topic biodiversity; only one article dealt with climate change and one with forest fires. These numbers do not allow deep quantitative analysis regarding the existence of national Center-Periphery structures, of collaboration patterns and as well of medialization of forest science (only in the case of biodiversity can this be examined).

The scientific discourse on forest science in Chile, reflected through the selected medium, was centered on topics dealing with the impact of environmental variables (other than fire) on determined species, silviculture, modeling and management, genetics amongst other forest related issues. However, this cannot be taken to mean that no scientific discussion on climate change or forest fires has taken place within this time frame.

Forest fires are an important topic in Chile, where for the time period 1994-2003 an average number of 6000 forest fires occurred throughout the country, affecting on

average 52819 ha of forests (CONAF, 2008)[52]. The importance of this issue in the country is also reflected through the various policies and investments (for example regarding prevention) that both the government (through CONAF) and private enterprises have developed and carried out. As an example of such interests the government, through CONAF, invests every season approximately 7,5 million dollars on forest protection (including fire fighting and prevention); private enterprises on the other hand invest per season around 14 million dollars (CONAF[53]), having created different cooperation associations to prevent and fight fires. Projects that count with the participation of the scientific community in order to deal with the dangers of forest fires are being constantly carried out in the country. The locally based project "*Redes inalámbricas de sensores para la detección de incendios forestales y monitoreo de variables de estado de combustible para el recurso forestal de la Región de Valparaíso*[54]" for example, surged from a partnership between governmental actors, research organizations, and private enterprises. This project proposes the use of technological tools (satellite images and wireless sensors) to constantly monitor variables that favor the occurrence and propagation of forest fires. The scientific knowledge originated through this project was presented in different international scientific conferences as well as source of diploma theses.

Scientific articles published in national scientific peer-reviewed journals dealing with forest fires can also be found in journals associated with biology or geography, for example: "*Revista Chilena de Historia Natural*[55]" or "*Terra Australis*[56]". However, and because of the scares numbers of articles dealing with this issue even in the non-forestry journals, the publishing in scientific journals seems not to have been a priority of the researchers focused on forest fires.

The Chilean scientific community recognizes the opportunities and challenges that climate change presents for the country. Projects such as "*Bosques PROcarbono*" of the Austral University have since 1999 actively been playing a role in the diffusion and capacity formation of forestry projects that may contribute to the mitigation of climate change[57]. This particular project has produced scientific publications from its foundation which show that forest science has not been silent on this particular issue. They are however mostly presented in international conferences and in journals associated to wider audiences than those of forestry, for example natural resource or environmental journals.

The relationship between forest fires and climate change is an important and recognized one for Chile (INFOR, 2005) considering that when perturbations such as forest fires occur this has an influence on CO_2 emission (seen as important because of the interest Chile, and the private enterprises, have on being incorporated in Clean Develop Mechanisms projects under the Kyoto Protocol).

Thus, both these issues do have an impact on the scientific discussions of the country only that the place where these discussions have taken place was not through the only

[52] http://www.conaf.cl/??page=home/contents&seccion_id=322af25bd24d696f5abe1ed700dc5828&unidad=8&pagina= (last seen 20.09.08).
[53] http://www.conaf.cl/?seccion_id=cf3d17d66f71592d45efa932382c7c3f&unidad=0 (last seen 03.10.08).
[54] "Wireless sensor networks for the detection of forest fires and monitoring of combustion state variables for the forest resource in the Valparaíso Region" (Own translation) www.gisincendiosforestales.cl (last seen 03.10.2008).
[55] "Chilean Magazine of Natural History" (own translation) published by the Chilean Biology Society.
[56] Published by the Geographical Military Institute of Chile (http://www.igm.cl/productos.asp?id=39 last seen 03.10.08).
[57] http://www.uach.cl/procarbono/quienes_somos.html (last seen 20.09.2008).

regularly published forestry scientific peer-review journal selected. This result shows that the scientific discourse on the national level is diverse, or in other words, not contained within the limits of forest journals.

For the issue of biodiversity, a low number of articles were found (six). This can be used to analyze the hypotheses regarding medialization, as these are based on the number of statements as the unit of analysis rather than on the number of articles (which are needed for examining Center-Periphery structures as well as collaboration patterns).

Even though few amounts of data could be gathered regarding the scientific discourse on a national level, some characteristics of the discourse can be inferred by the data gathered.

The climate change article (1997) was authored by one scientist, a Chilean economist with no recognizable affiliation institution, who wrote about sustainable development and the environment emphasizing the presence of a new global strategy to combat environmental problems such as climate change. He analyzes the global tendencies to fight climate change and other environmental problems contrasting them to how Chile arrives at decision that affect economic, environment, and social sectors and what consequences these global strategies have on the country. The article focuses both on the global level and national level, especially how the global processes and policies present challenges and opportunities for a country such as Chile (Serrano, 1997).
The forest fire article, appearing in the year 2000, focused on the effects of fires on the wood of *Prosopis alba* Griseb. and *Prosopis nigra* (Griseb.) Hieron, *Mimosaceae* which grows in Dry Chaco, Argentina (Bravo et al., 2001). The authors, in an experimental type of article, examined how fires damaged the wood of these species lowering their commercial value. The article was co-authored by three scientists all from the same research institution in Argentina. The collaboration that took place in this article was at the department level since all scientists involved belong to the same department of silviculture and forest management. The three authors were female affiliated to a forestry faculty.

For biodiversity, a total of 14 authors wrote the six articles that were analyzed. 13 of them were affiliated to Chilean institutions, while one was affiliated to a Peruvian institution. More than half of the institutions, to which these scientists were affiliated, were forest research institutions, while the rest of the scientists were affiliated to natural sciences (six scientists). The disciplines that represented the natural sciences in these articles were ecology (four authors), entomology, and biology (each with represented through one author). Two authors belong to research institutions other than universities or colleges (twelve authors were affiliated to these institutions). No women were present as authors in the articles. All of the articles were either concerned with events happening on a national or local event in Chile. Regarding collaboration, all articles were written by more than one author. The average number of scientists per articles is 2,33 which is lower than the average number of authors for all issues on the global level. International collaboration in the biodiversity issues took place only in one of the six articles. Other collaboration was department collaboration (three articles), intra-organizational (one case) and inter-organizational (one case).

Through the analysis of the few articles that were gathered for the national discourse, some characteristics become apparent. There is participation of foreign scientists in the

discourse both having to do with events within other countries (Argentina) as well as with events in Chile. The scientists that participate in forest science discourse are mainly forestry-related; however there is a presence of scientists specializing in ecology, entomology, and biology. The national discourse is characterized by experimental articles; articles that deal with local problems and focus on practical knowledge.

4.1.3. SUMMARY OF DISCOURSE CHARACTERISTICS

Previously many different characteristics of the articles and journals analyzed have been described which helps clarify the global and national scientific discourse on forest science.

Through time there has been an increase in the amount of articles dedicated to each of the three issues.
The forest scientific community is not composed solely of forest science. The high participation of scientists affiliated with the natural sciences is evidence of this. Publication of results is mostly carried out through collaborative efforts, as there are both on the global and national level an average of more than two authors per article, but hardly any interdisciplinary can be found. The collaborative efforts, however, do not reflect interdisciplinary in the articles but a limited one in which forest scientists share their tribune of discourse with natural scientists.

Looking to the distribution of the countries, according to the different journals examined, it might seem that these journals favor authors from where the journals are published. On the global level this is the case for four of the five journals. The journal *FEM* favors as well authors from the United States, but incorporates in the discourse a wider variety of countries. Looking further into the distribution of authors, strong evidence has been found that point to favoring articles written by authors from neighbor countries or authors affiliated to countries that share the same native language (in the global level this language is English).

If Habermas' condition of participation is contrasted with the number of countries of affiliation of authors it is evident that, even though there is a wide variety of countries present (32 different countries), there is a dominance of two specific countries: the United States (298 authors) and Canada (128). Authors from other countries participate in a very unequal way in comparison to these two countries. The participation of non-English speaking countries is limited to industrialized countries and counted developing countries. This might be enforced, on the one hand by the publication decision of the journals and on the other, by the entire scientific community that has access to the articles published: since they are the ones who have decided (through citations) that these are the representatives of scientific knowledge with impact on their own work. And so the participation of interested parties is put in doubt when looking at these characteristics of the articles analyzed. As the free and equal participation in the discourse of all those parties interested is a fundamental condition of a deliberative discourse, the results found speak against the existence of a deliberative global scientific discourse on forest science.

In the following section a detail look into the participation of different countries will be given to gain further insight into the possibility of participation in discourse. This is done through the examination of Center and Peripheries in forest science.

4.2. CENTER AND PERIPHERIES IN FOREST SCIENCE

The theoretical background presented previously concluded that because of the existence of power structures that act on science communication, the discourse found within the forest science community is an empowered one, thus not fulfilling the conditions of a deliberative public sphere. In order to deliver evidence for this hypothesis (empowerment of discourse) the asymmetry of the communication process that forms the scientific discourse on forest science is here examined. In other words, and following the proposed theoretical model depicted in figure 2.6, power structures influence the scientific discourses with consequences for the free participation of actors within it. This s reconstructed through examination of the existence of Center and Periphery structures. Here, Galtung's characterization of Center-Periphery structures is followed, where the classification of a nation into either the Center or the Periphery will depend on either one or more of the following terms: an absolute property (a rank dimension), an interaction relation (productivity dimension), and/or an interaction structure (placement within a network; Galtung, 1971: p.103).

First, the absolute property of number of authors, their affiliation country, and its corresponding income classification[58] (found in annex III) is examined in order to discover which affiliation countries rank higher than others. A Center country would rank highest, meaning it has a higher absolute value, than Periphery countries.

Table 4.3 gave first insights on the participation of countries in the scientific discourse throughout the different journal sources analyzed. What could be seen through that table was that there was a clear domination, in all journals, of the English speaking countries United States, Canada, and the United Kingdom. A Center-Periphery ranking for each journal could be first –and not considering economic power- constructed in which for *CJFR*, *FEM*, and *F*, Center nations are clearly the United States and Canada, with the rest of the countries falling into the Periphery or a group between both Center and Periphery. For the *JF*, there is only a Center, as it published articles with authors solely from the United States. For Forest Science the Center is constituted by the United Kingdom and the Periphery by the United States, since there are only two countries represented in the institutional address of the authors. And so, the Centers nations are clearly identified, however the classification of Periphery nations is more difficult and varies according to each of the three journals examined. This analysis will later be complemented in that Center-Periphery structures will be analyzed according to their economic power. However, first a look at the frequency of occurrence of two variables will be examined.

[58] According to the World Bank Gross Domestic Product Per Capita country classification of 2004: this classifies countries into high, upper-middle, lower-middle, and low income countries. Here upper-middle and lower-middle will be aggregated into middle income countries.

Dividing the frequency of the countries of authors in percentiles (25, 50, and 75)[59] figure 4.6 emerges. Here a nation belongs to the Center of the scientific sphere when the total number of authors scores in the top 25% of all countries present; a nation will fall into the category of Periphery if, on the contrary, it belongs to the bottom 25% of the total authors. Two middle classification groups are formed: Semi-Center (larger than the 25% but smaller than 50%) and Semi-Periphery (larger than the 50% but smaller than the 75%). Two groups are constructed because empirical studies on scientific bibliometric indicators have expressed doubts on whether Center-Periphery structures are still a valid structure in the world of science today (Wagner, 2008; and Wagner and Leydesdorff, 2005). Thus, by considering the existence of intermediate groups such as the ones chosen here, the possibility of the non-existence of Centers and Peripheries in forest science is acknowledged in that if no great absolute difference in the frequency of the variable considered is found between the groups constructed, then it is hard to conclude that there are Centers and Peripheries. If on the other hand, the values of the variable considered is great -in absolute terms- between the different groups constructed then this would speak in favor of Center and Periphery structures present.

This definition of when a specific country is considered a Periphery and when one is considered a Center is of course based on the countries that are participating in the discourse. It ignores all those other countries that, even though carry out research related to forest science they do not appear in the global scientific discussion of the 25% most cited scientific publications. These countries that do not, or may not participate, build a Periphery on their own.

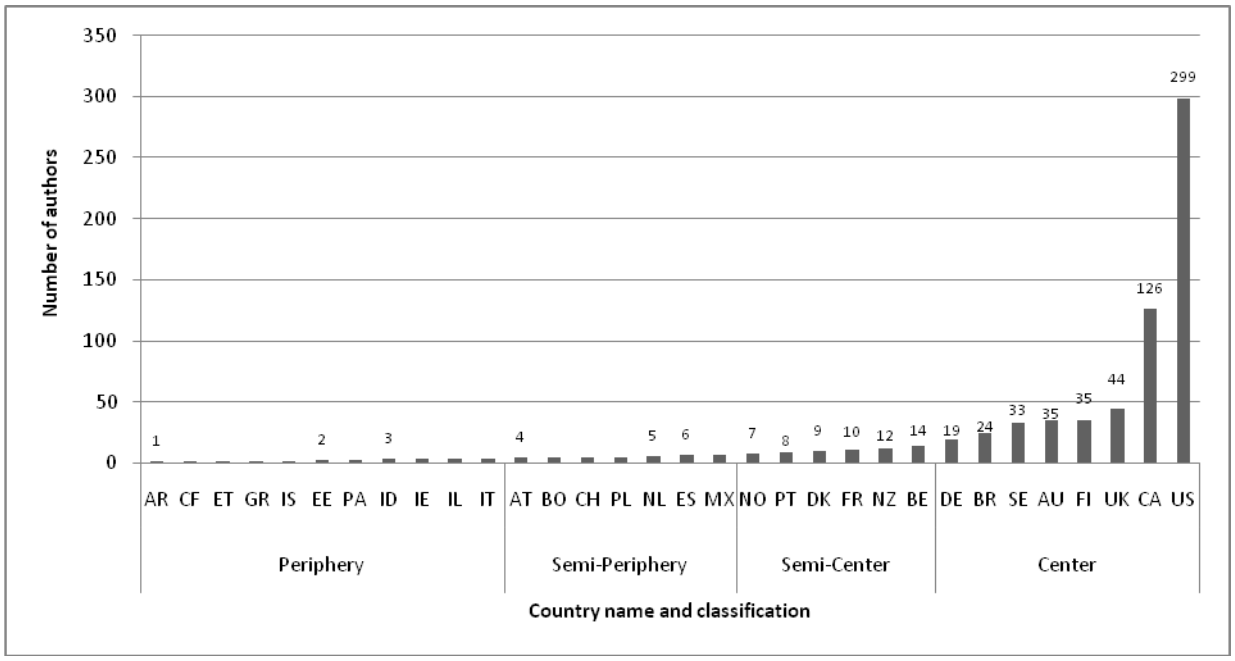

Figure 4.6. Center and Periphery structure according to author's affiliation country (N=729; source: own construction)

[59] This barrier was set following the consideration for the selection of the scientific publications that constructed the discourse. Since the discourse is here shaped by the 25% most cited publications, a continuation regarding the top 25% of countries that appear in the discourse are considered the Center –as a first approximation to the reveal these structures. Future research may concentrate on determining exactly the limits when a nation is considered a Periphery and when a Center. The objective here was not to exactly pinpoint this limit, but to prove that structures such as Center-Periphery do exist.

If all authors are considered (and thus their respective countries) and according to the distribution by percentiles, eight countries fall into the category of Center: United States (US), Canada (CA), United Kingdom (UK), Finland (FI), Australia (AU), Sweden (SE), Brazil (BR), and Germany (DE); eleven in the Periphery: Italy (IT), Israel (IL), Ireland (IE), Indonesia (ID), Panama (PA), Estonia (EE), Iceland (IS), Greece (GR), Ethiopia (ET), Central Republic of Africa (CF), and Argentina (AR); the rest create an intermediate area between the two. This intermediate area has as well been divided because of the notable differences between the countries present, and so these have been labeled on the one hand Semi-Periphery (because it is most near to the values of the country frequency of the Periphery), and on the other hand Semi-Center. Austria (AT), Bolivia (BO), Switzerland (CH), Poland (PL), the Netherlands (NL), Spain (ES), and Mexico (MX) are members of the Semi-Periphery; leaving Norway (NO), Portugal (PT), Denmark (DK), France (FR), New Zealand (NZ), and Belgium (BE) in the group of Semi-Center.

The participation of the United States as authors of articles, for all issues considered, is of course explained by the selection of the journals analyzed. Two of the journals were published by the American Society of Foresters (*FS* and *JF*); even though in its editorial board has members from all over the globe, *FEM* is as well based in the United States (see table 4.1). The high amount of Canadian authors is explained by the Canadian bias of the *CJFR*. The inclusion of both these nations is thus no great surprise, as is the inclusion of other industrialized countries such as Finland, Sweden, and Australia (to name some). However, the inclusion of Brazil as a Center nation is an unexpected result. The incorporation of Brazil in this category signifies that interpretation patterns other than those from industrialized countries did reach the core of global scientific discussions on forests and thus of the scientific discourse.

Looking at the countries which are near to the Center (the Semi-Center) no big surprises arise. All countries present are industrialized countries (high income countries) which do have enough resources invested in research and development that help scientists be part of the global discussion of the scientific community.

The Semi-Periphery is formed by four high income countries: Austria, Switzerland, the Netherlands, and Spain, and three middle income countries: Bolivia, Poland, and Mexico. Thus, it is relatively balanced in including countries (or authors) which possess different economic power and their interpretation patterns.

The Periphery shows as well this balanced behavior. It is formed by five countries which belong to the industrialized ones namely, Italy, Israel, Ireland, and Greece; four countries having middle income: Indonesia, Panama, Estonia, and Argentina; and finally two low income countries: Ethiopia and Central Republic of Africa. That these last two countries form part of this Periphery classification according to economic power is no surprise. Since economic resources have been linked to productivity in science (OECD, 1998; Wagner, 2008), countries that have few resources and which have difficulties in disseminating their research results which can compete on a global level are necessarily relegated to a last place in the scientific sphere. However, the economic power of countries such as Ireland and Italy (for example) had no positive influence in their access to the top actors of discourse. This might be an indicator that, even though countries have more financial resources invested in science than other countries, it does not

necessarily translate in the incorporation into the discourse. Thus, following the income classification of a country might not be the decisive factor for determining a Center or a Periphery.

To examine Center-Periphery structures based on the number of authors and their affiliation country is a near-sighted examination of these structures. In order to expand the analysis attention is given to the number of countries present in the total amount of articles published. This approach would decrease in some measure the bias towards articles in which many authors from the same country co-author, because it does not take into account the amount of authors but the amount of different countries being represented in the affiliation country. This will be named '*countries in articles*', to distinguish it from the author's country. The numbers analyzed here differ from the number of authors and their affiliation countries, in so far as a count of one is given to each different country appearing in the institutional addresses of the authors who publish. Thus, if an article was published by, for example, three authors -two from the United States and one from Canada- a count of one was given to both countries and, if an article was written by two authors from the same countries, a count of one was assigned to that specific country. This approach is what is known as the "integer counting" or "normal counting" which attributes the count of 'one' to each occurrence of authorship by a country created by the participation of researchers from that country (Wagner and Leydesdorff, 2005: p.190).

Consequently, the same classification in percentiles is carried out on the distribution of the number of countries present in all articles. Figure 4.7 shows the Center-Periphery structure of this new classification.

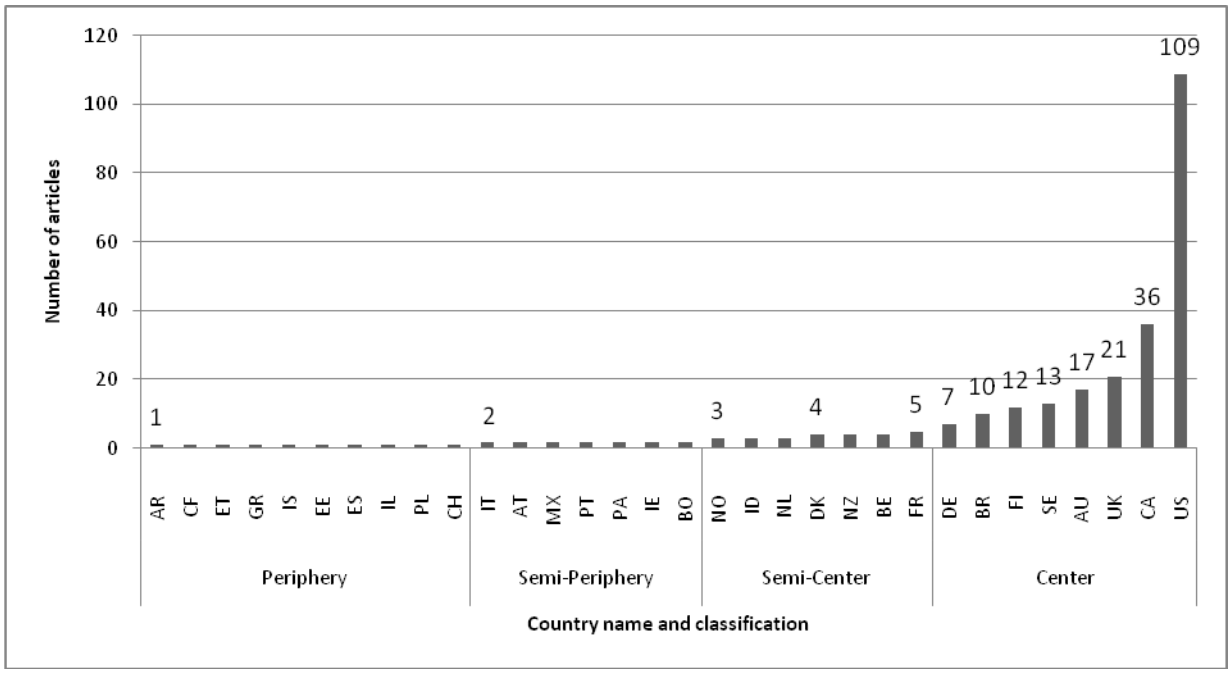

Figure 4.7. Center and Periphery structure according to countries in articles (N=274; source: own calculations)

No changes were found in the Center of forest science: the same countries that were classified as Center according to the total of authors and their affiliation country were

classified here as Center nations. The differences arise in the classification of the three remaining groups: Semi-Center, Semi-Periphery, and Periphery.

Previously, consideration has been given to all authors and all articles in order to examine whether Center-Periphery structures exists. The structures found, however, may vary according to which issue is analyzed. And so, authors and articles are separated into the three issues examined: forest fires, biodiversity, and climate change. First, the total number of authors and their affiliation countries on the one hand and *countries in articles* (amount of times a different country occurs in the affiliation country of the authors) on the other were considered. For each of these cases percentiles were built and countries were ranked either to the Center, Semi-Center, Semi-Periphery, and Periphery (value four, three, two, and one respectively in figure 4.8).

Figure 4.8 reveals that for all three issues the United States and Canada form the Center (value four in figure. 4.8) of forest science. Other countries acting as Centers are Australia -incorporated in the issue of forest fires-, Brazil in climate change, and Australia, Finland, Sweden, and the United Kingdom in biodiversity. The Semi-Center (value three in figure 4.8) is not clear for the issue of biodiversity because no single nation scored as a Semi-Periphery both according to author' country and country in article classification. Clear on the contrary is this group for the issues of climate change (Germany and the United Kingdom) and of forest fires (Brazil, Sweden, and the United Kingdom). The Semi-Periphery (value two in figure 4.8) is very clear in climate change where Poland, Austria, Sweden, and Denmark comprise it. Denmark is also a member of the Semi-Periphery of biodiversity where it is accompanied by Italy. For forest fires the Semi-Periphery does not have any nations clearly forming it. The Periphery can be seen as a clear group formation in all three issues. For forest fires it is comprised of Bolivia, Finland, and Indonesia; for climate change by Argentina, France, Ireland, Iceland, and The Netherlands; and finally for biodiversity by Ethiopia, Greece, Ireland and The Netherlands.

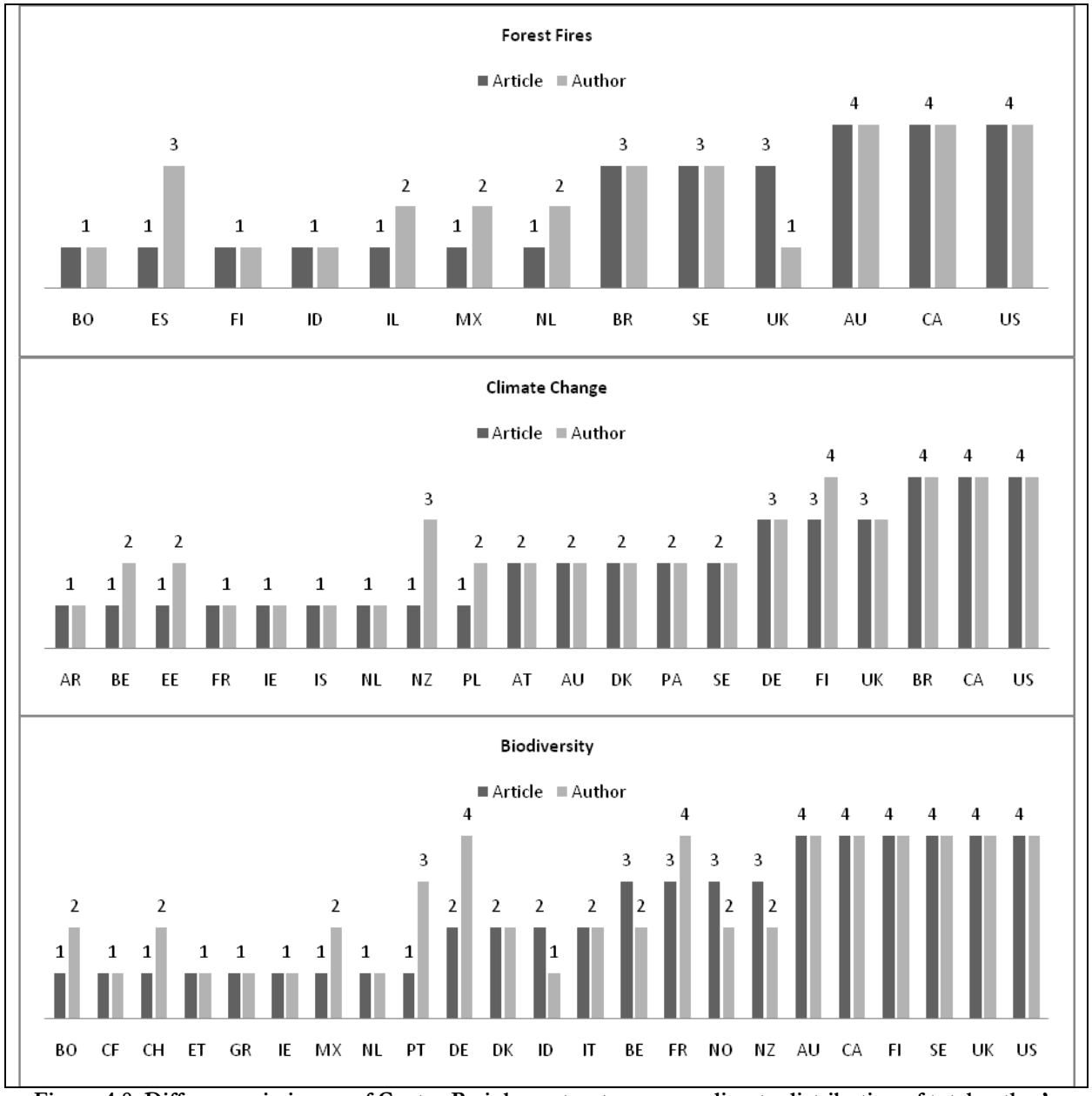

Figure 4.8. Differences in issues of Center-Periphery structures according to distribution of total author's countries and total article countries (Source: own calculations)

The absolute properties examined in the previous pages give a first idea on the structure of the forest scientific community and the determining actors (or countries) of the discourse. The discourse is dominated by the United States and Canada, both English speaking industrialized countries. Since the journals that have been selected are either from these two countries (or the United Kingdom) a bias to authors from these countries was expected. Competition for gaining access to these journals is harder on countries (and their scientists) which native language is not English. This translates in the existence of entrance barriers for scientists. If it is much harder for non-native English speaking scientists to access publication or discourse (as can be interpreted from the absolute values depicted before), the more will be the success if they do access them bringing their own interpretation patterns into the discourse.

Two different ways of measuring possible inequalities within the global community of forest science have been presented in order to examine the possible presence of Center-Peripheries structures that would reflect an empowered discourse (in opposition to a deliberative one). The two absolute measures (countries of authors/articles) deliver results that reflect the domination of the discourse of traditional Centers such as the United States, Canada, and the United Kingdom, confirming the hypothesis of empowerment of discourse.

A consideration should be here introduced regarding what it means for the scientific discourse on forest science to be a real deliberative discourse as Habermas describes, namely one with free participation (free entrance and non-coercion) where all those with interests in the issue participate. This implies for the scientific community, that the inequalities that have been discovered previously no longer exist and that a balance is found between the authors and countries participating in the discourse. If the forest related issues are more and more seen as global concerns, then global actors (scientists) should be able to participate in the discussion in order for science to gain in legitimacy. Here lies the difficulty. The subject of study here are scientific journals which are committed to publishing top quality research but are as well embedded in a market that competes for resources -be them scientific resources in the sense of publishing the work of top scientists or financial resources to be able to keep publishing. Therefore, if there is to be a more balanced form of scientific communication, or in other words a more deliberative one, then it is necessary that the structure of what and how scientific knowledge is published be revised. Wagner (2008) goes further into this point and gives detail recommendations for new science policies to be undertaken.

4.2.1. RESEARCH OUTSOURCING

With the previous analysis it has been made clear that inequalities exists in the world of forest science. Through this, Center and Periphery countries have been revealed. The attention now focuses on examining whether these Center-Periphery also translate in an '*research outsourcing*' in the sense that research based in one country –Periphery- is carried out by scientists from another –especially the Center. This is done by contrasting the countries of the authors of the articles and the place of occurrence of the event being reported on.

Arvanitis and Chatelin (1988), when analyzing the publication strategies of countries, used an indicator they have named the "fixation power of a country". This indicator, in their case, reflects the scientific autonomy of a country by calculating the proportion of studies (articles) published in a country by scientists of that country (Arvanitis and Chatelin, 1988: pp.121-22). A fixation power ration of 100% would indicate autarky (self-sufficiency or independence): where all the articles published in a country are published by researchers of that country.

Here this idea is borrowed and modified into the degree of research outsourcing in one country by other countries. The place where the event is taking place is considered in contrast to the countries of the authors carrying out the research. No *research outsourcing* takes place when all events reported on are reported on by scientists from that country.

Analysis focus on the economic power of the countries (measured through their classification into high, middle, or low income) since this is one of the most commonly recognized domination-relation between Center and Periphery. This, therefore, indicates whether the country-centered issue-dependent discourse is influenced (or dominated) by external powers: it is outsourced.

Figure 4.9 reproduces the places of the events being reported on according to the three issues analyzed. A global event is one that concerns the entire planet (research focuses on world-wide forestry issues); a regional event is one in which a group of countries or a specific geographical region is referred to; a national event deals with issues on a country level; and a local event deals with events on a specific place within a country.

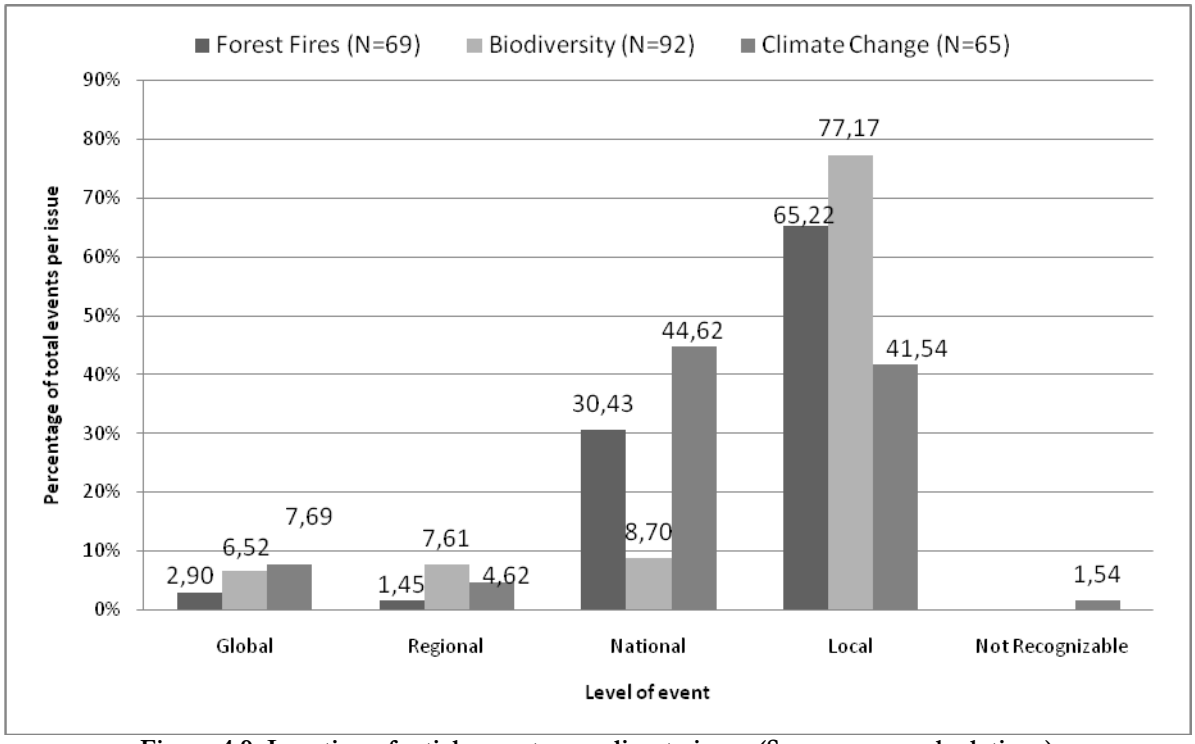

Figure 4.9. Location of article event according to issue (Source: own calculations)

The data show that one climate change article had no recognizable place of event: the authors gave neither indication of where the research was taking place nor to which countries or region the results were applicable to. The majority of the research published was concentrated on a national level (both affecting the entire country as well as localities within a country). A bit over 86% of the climate change articles reported on national level events, biodiversity articles did so in a total of 85,87%. Forest fires articles are the ones that mostly report on a local or national level, summing 95,65% of the total events reported on. Biodiversity is the issue which leaves the borders of a single country with most frequency: 14,13% of all articles reported on events on a global or regional level, but is also the issue which is most local in its reports (77,17% of all events happed or are concerned with local areas within a country). And so, even though it is the most 'global' of the issues, it is essentially a local topic. Global perspectives included in the issue of biodiversity include, for example, reviews on the knowledge needed and the management options necessary for conserving biological diversity (Ehrlich, 1996); or the role of science in the preservation of forest biological diversity (Simberloff, 1999).

Climate change followed suit in the discussion of global issues with a total of 12,31% of events transcending national borders (7,69% global and 4,62% regional). It has a slight difference in favor of national event reports than on local ones (44,62% vs. 41,54%). Regional events considered here include observing patterns of carbon storage, forest structure, and composition of Scots pine forest ecosystems throughout countries like Poland, Lithuania, Latvia, Estonia, and Finland (Vucetich et al., 2000) or identifying gaps in knowledge and prioritizing research needs of the forests of the temperate region in view of global challenges such as climate change (Hüttl et al., 2000).

Forest fires on the contrary reports in only 4,35% about events outside a single country and is as well most locally oriented, with 65,22% of its events haven happened on a local level (which is understandable since most forest fires occurred in specific places within a country and not throughout an entire country). Forest fire issues focusing on national level include reports from focus-groups interviews throughout different areas which reveal common factors that affect the acceptance of three fuel management strategies (Winter et al., 2002). Local level focus include reviews on fire regimes affecting Appalachian Mixed-Oak forests as basis to identify how to reintroduce fire to solve the oak replacement problem (mesophytic species replacing oaks because of a no-fire regime; Brose et al., 2001).

The previous figure shows that the discourse on forest science is mainly limited to national level events. Global focuses of topics or problems that affect larger areas than the nation state are not discussed. The discourse on forest science, when analyzing global forestry journals, reflect problems and issues that forests in specific single countries are faced with. It cannot be spoken of a global scientific discourse, in terms of the location of problems addressed. Which is surprising as the issues selected were precisely selected because of their global character: global interest – global problems. Rather, the discourse is a national one (reflects national problems and issues). However, changes through time might be observed which might as well be consequence of a globalization process in which problems of the forest become global. If this is true, then within the ten years analyzed an increase in the issues articles dealing with global issues should be found. It is then important to examine how the locations of the events being reported on by scientists have changed through time. Figure 4.10 mirrors the changes through time of the location of events for all issues.

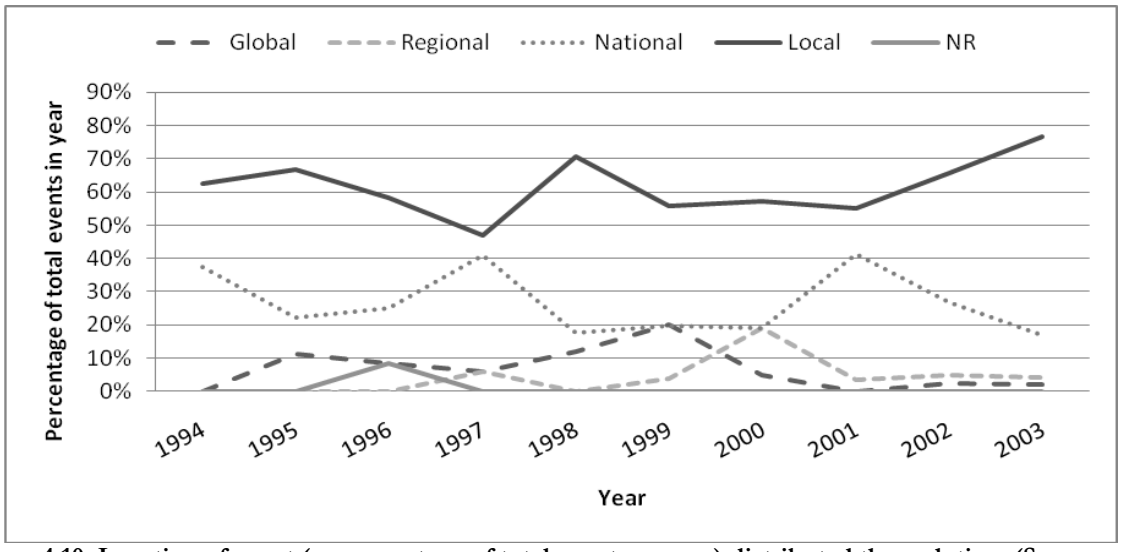

Figure 4.10. Location of event (as percentage of total event per year) distributed through time (Source: own calculations).

Figure 4.10 shows that the focus of the events that are portrayed, in terms of their level of analysis, has been maintained relatively constant through time. No conclusion can be reached in terms of an increment of global subjects; there is no globalization of issues. There is throughout the time frame analyzed a dominance of national issues, which can either concern an entire country or a specific location within a country.

To give the name of global to the discourse does not necessarily imply that the issues being dealt with are global. The problems the forest faces are local (or national) and thus the research that being carried out must focus on this level. This is something that might be expected of a science such as forest science. Werland and Morisse-Schilbach (2008, pp.15-16) and Wagner (2008, p.79) both argue that certain types of sciences (forestry in the case of Werland and Morisse-Schilbach and agriculture in the case of Wagner) unavoidably are focused on national levels, being this necessary in order to generate the data needed for a subsequent global analysis.

If national issues are being mostly presented in these journals, authors affiliated to the countries in which these national events are taking place would be expected to dominate the discourse. If on the contrary, global issues or events were being reported on, no statement could be made regarding the affiliation countries of the researchers participating in the articles, as scientists could belong to any given country. If the discourse is national, or in other words reflects national problems and issues, the domination or the presence of Center-Periphery structures would mean on the one hand, that Center scientists dominate on the reporting of the issues (absolute property already discussed) and/or on the other hand, that Center researchers (according to an interaction structure) participate in the discussion of events taking place in the Periphery (research outsourcing). If no domination occurs (according to this last characteristic) then the national events are presented by the national scientists affiliated to the country where the event is taking place. In order to examine whether this is happening, or in other words if research outsourcing (when an author affiliated to one country publishes on issues relating to another country) is taking place, a look to how authors are distributed through events will be examined (figure 4.11). Here specific countries will not be named but rather

their classification by income per capita will be used (World Bank 2004), as this is a measure of that approximates the economic power of a country.

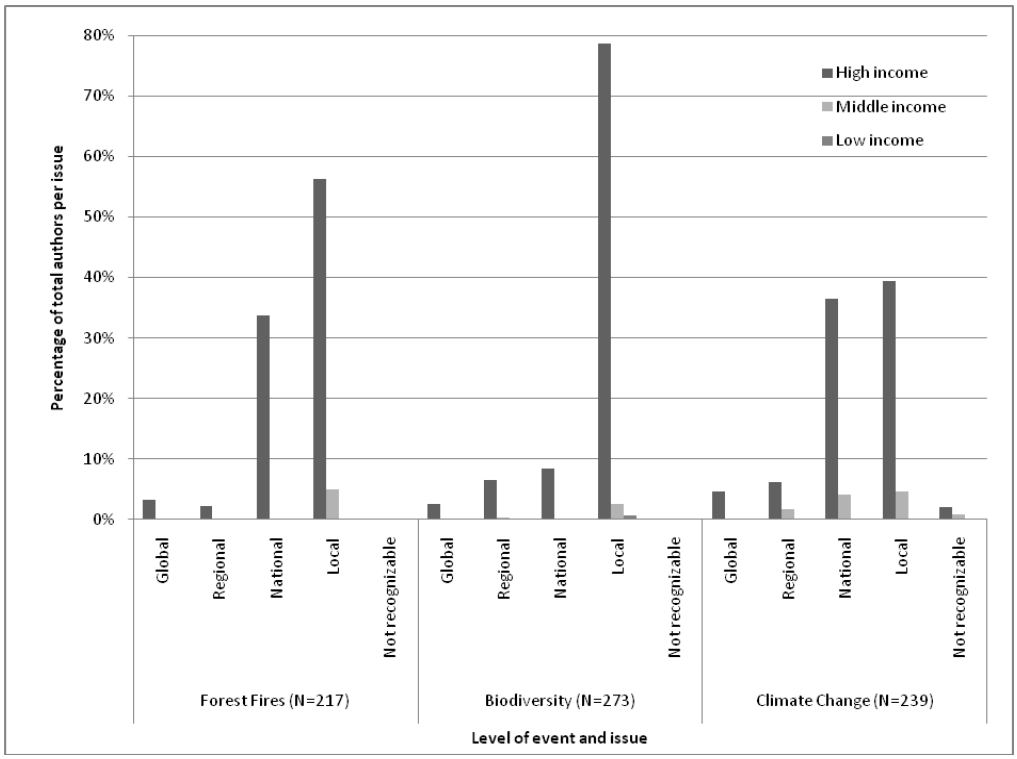

Figure 4.11. Affiliation country of authors (according to income classification) and location of issue event (Source: own calculations)

Figure 4.11 shows, for each issue, the distribution (as percentage of total authors per issue) of high, middle, and low income countries according to their level of event reporting. Firstly, authors affiliated to low income countries only make an appearance in the issue of biodiversity (two authors representing 0,74% of all authors participating in the issue). Scientific results pertaining global issues or events are presented only by authors affiliated to high income countries (such as the US and UK) on all three issues examined. Regional issues are as well dominated by authors from high income countries. The dominance of high income countries does not stop at these cross-border levels. National and local events are as well marked by the strong presence of scientists from countries with higher income. Only in climate change do middle income countries make an appearance in the discussion, having more diversity in its event location and author affiliation country than any of the other two issues: regional (1,67%), national (4,18%), and local (4,60%) events are reported on. Biodiversity, however, does include events reported on a regional level (0,37%).

This result only reflects that all types of event reports are dominated by the Center countries, but it does not give sufficient information on whether these Center countries are participating in national and local events in their own countries, or whether they are participating in the national and local events from other countries (research outsourcing). Therefore further analysis is needed.

In figure 4.12, the income classification of the countries appearing in articles in which events take place at a national or local level (total of 201 articles) and the countries of the

corresponding authors (total authors 654) are considered. In all three issues, high income countries dominate the discourse.

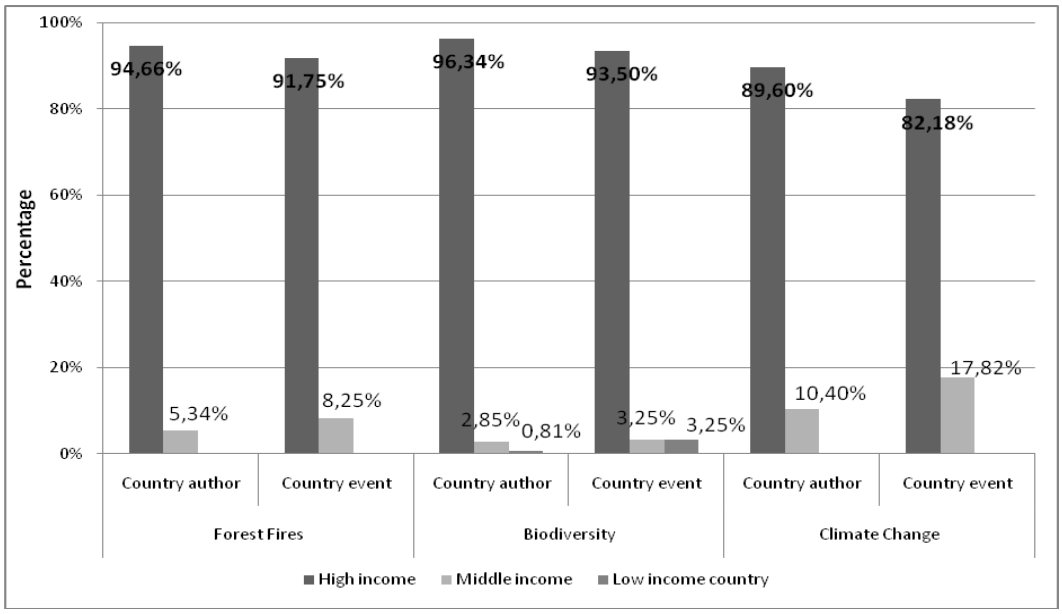

Figure 4.12. Affiliation country of author (as % of total authors) compared to country of event (considering only events on national or local level; source: own calculations)

Representatives of high income countries mostly talk about themselves. In all the issues, when considering national and local events, they dominate the country of author and the country of event. Nevertheless, what is interesting to note is that outsourcing is present. For the issue of biodiversity 3,25% of the events on which science is reporting on take place in some low income country, however the proportion of authors who are affiliated to countries of the low income class is much lower than this number (only 0,81% of the authors are affiliated to low income countries). The difference is not as strong when looking at events occurring in the Semi-Periphery (or middle income countries) where 3,25% of all events happen and 2,85% of all authors can be order to this income class. In both other issues this is as well the case: where events are happening in middle income countries but the share of authors who are affiliated to them is lower than that of event covered. For climate change, the percentage of country of event is 17,82% but the affiliation country of authors is only 10,40% of the total authors. The same when considering forest fires: 5,34% of authors are from middle income country but the events only in 8,25% of the cases are happening in the same income class. From this figure it can be ventured that there is some degree of research outsourcing because events are happening in specific places but not all the scientists involved are affiliated to the specific countries where events are taking place.

In order to further deconstruct the picture of research outsourcing, and with it the dominance of Center over Periphery, it is necessary to pay attention to exactly in which countries scientists are doing their research (or about which country they are reporting on) compared to the country they actually are affiliated to. Table 4.4 represents this information. Once again, not the names of the countries are being considered but the income class they fall into, as this approximates the economic supremacy of the Center countries over the Periphery. In this table the middle income class depicted before is disaggregated into Upper-middle income and Lower-middle income because of the

existence of considerable differences between the countries that integrate each of these classes.

Table 4.4 shows that research outsourcing in all the issues is carried out by high income countries (highlighted cases).

From the table it is clear that for climate change this phenomenon is mostly noticeable. High income countries intervene in both upper and lower middle income countries: 3,96% and 3.47% of all authors from high income countries are participants of events in upper-middle and lower-middle income respectively.

Table 4.4. Income classification of country of author and country of event (Source: own calculations)

	Income country event / Income country author	**High income (% of N)**	**Upper-middle income (% of N)**	**Lower-middle income (% of N)**	**Low income (% of N)**
Forest Fires (N=205)	High income	91,75%	-%	2,91%	-%
	Upper-middle income	-%	0,01%	-%	-%
	Lower-middle income	-%	-%	3,88%	-%
	Low income	-%	-%	-%	-%
Biodiversity (N=246)	High income	93,50%	-%	0,41%	2,44%
	Upper-middle income	-%	1,22%	-%	-%
	Lower-middle income	-%	-%	1,63%	-%
	Low income	-%	-%	-%	0,81%
Climate Change (N=202)	High income	82,18%	3,96%	3,47%	-%
	Upper-middle income	-%	0,99%	0,50%	-%
	Lower-middle income	-%	-%	8,91%	-%
	Low income	-%	-%	-%	-%

In the issue of forest fires, participation translates in 2,91% of authors from high income country participating in events occurring in low-middle income countries. This participation is specifically carried out by both the United Kingdom and the United States in Bolivia and Brazil. The case of United Kingdom is most noteworthy, from the two authors that participate in the discourse one is tied to events in Bolivia and the other in Brazil. Thus, their involvement in discourse is solely based on research outsourcing. The case of the United States is more balanced. The authors affiliated to this country as a majority participate in research in their own country (of 118 authors, 108 participate in the United States), few in the lower-middle income countries of Bolivia and Brazil (one and five respectively), and the rest participate in other high income country: Australia, Canada, Finland, Spain, Sweden, and Israel.

For biodiversity the intervention of high income countries in low income ones is carried out by Germany (which participates in events happening in Ethiopia), the United

Kingdom and the United States (both with participation in the Central Republic of Africa). Events happening in Bolivia (a lower-middle income country) are covered by one author from the United Kingdom. There is as well participation between high income countries such as Belgium in Denmark, Canada in Finland, and Norway in Sweden. There is no participation within countries of the upper-middle class, as Mexico is the only country participating (and its' event is reported on by scientists from the same country). Within the lower-middle class three authors from Bolivia participate in events in Bolivia, but Indonesia is also present with one author affiliated to this country who is participating in events in Bolivia. There are two authors from low income countries (one affiliated to Ethiopia and one to the Central Republic of Africa) which publish on research carried out in their own countries, so no research outsourcing could be observed.

For climate change the high income countries concentrate on events which are based in both upper and lower middle income. Such is the case of, for example, Canada (high income) in Panama (upper-middle income), and both the United States and Germany (both high income) in Costa Rica (upper-middle income). Here Brazil is the only lower income country which has participation in the reporting of an event by a high income one (the United States). There is, as well, participation between high income class countries, for example between Finland (author) and Germany (event), and The Netherlands (authors) and Germany (event). The only upper-middle income country that participates in events outside the author's own borders is Panama, which participates in Brazilian events. The other participating authors write about events in their own countries (Argentina and Panama). 8,91% of authors from lower income countries that participate are all Brazilian authors who describe research carried out in their own country.

The data analyzed previously show that it is mostly members of high income countries (industrialized countries) which participate in research from lower developed countries, or with lower economic power. There is not one case in which an author affiliated to a country in a lower class participates in research carried out in a higher economically-ranked country. In the scientific discourse on these three topics, it is the high income countries such –for example- as the United States, Germany, or the United Kingdom who are involved in issues that occur in less economically powerful countries such as Brazil, Bolivia, Ethiopia, and the Central Republic of Africa. Thus, in terms of the interaction structure of research outsourcing highly ranked actors (in this case authors form high income countries) are the Center dominating the Periphery. So clearly inequalities at this level exist.

4.2.2. SUMMARY OF CENTER-PERIPHERY RESULTS

Asymmetries in communication are one aspect that makes a discourse deviate from a deliberative discourse. The asymmetries may be caused by different power structures such as economic resources of countries. Resources available for a specific country determine their participation in the scientific discourse on forest science, as countries that allocate more resources to research and development may be more scientifically productive (in terms of scientific publications) and may access scientific knowledge more easily (through access to databases that contain scientific articles) and incorporate it into new scientific discussions. Additionally, pressures for publishing in scientific journals which bring about

visibility for the scientists regarding the evaluation measures of their organizations might only be an idea that is strongly enforced in high-income countries. However, the notion that these pressures are as well touching countries other than high-income or industrialized ones is not far from reality. As an example, Chilean research organizations are evermore incorporating in their research strategies incentives for those scientists who publish in internationally visible scientific journals –or those who belong to the ISI Web of Science (CONICYT, 2008)

Previous research on scientific productivity has shown that richer countries dominated the scientific sphere (OECD, 1998; Wagner and Leydesdorff, 2005; Wagner, 2008). For forest science this as well has been proven when considering three different indicators of Center-Periphery structures namely when considering absolute values of affiliation of authors, countries in articles and research outsourcing.

This result raises the question about what indicator should be used when considering whether inequalities exist in the access to the global discourse. Deciding on how to measure inequalities is a difficult process as this always implies settling for some indicators in detriment of others. However, the results have shown that based on two different indicators it is evident that inequalities exist, as there is no balanced participation of discourse within the actors who participate. On the one hand, some countries –and the scientists who represent them- integrating discourse are favored over others by the scientific community. On the other hand, there are those representatives of countries that do not even have the possibility to participate in discourse: those who because of language or peer-review considerations were eliminated from having the possibility of joining the discourse. Thus, it is not necessary to favor one indicator over the other to conclude that the scientific discourse, based on a global perspective or a global discourse on forest science is a clear example of an empowered discourse. Consequently, the prevailing knowledge that has been accepted by the forest scientific community as such is characterized by the presence of authors belonging to Centers reporting on events happening in the Center. These countries are as well present in the few cases where events have moved away from the Center to countries of the Periphery. Center countries participate in research being performed in Periphery (also in Semi-Periphery) countries bringing their own points of view on issues happening outside their borders. It must be made clear that this participation is not seen here as a negative characteristics. What forms the inequalities is that the Periphery (or even the Semi-Periphery) does not participate in research being conducted in the Center. That is what speaks of unequal opportunities to participate in the global discourse.

4.3. COLLABORATION

In the previous section focus has been on examining whether inequalities within the structure of science are present. These inequalities make it hard, if not impossible, for a deliberative process -following Habermas' ideal- to exist. The most visible interpretation patterns are those from the Center which violates the free participation principle of Habermas' communicative action. If science however is to gain in legitimation then it is necessary for new communication patterns to emerge within the scientific community in which the ignored points of view may be incorporated into the discourse. Collaboration

may be a path adopted that helps those who otherwise would not have had the chance to be integrated in the discourse to be so.

Scientific collaboration, as seen previously, may be carried out on different levels and because of many reasons. Collaborations range from participation on elaborated projects that require the participation of many scientists across many nations, or projects that can be carried out by two scientists within the same organizations. Consequently, there are collaborations on an international level, on inter-organizational level (different research institution within a same country), intra-organizational level (where researches from a same organization collaborate) and inter-departmental collaboration (scientists within a same department of an organization collaborate). In order to approach a deliberative global scientific discourse on forest science it is necessary that the collaboration exists across different countries. The next sections will investigate whether collaboration in forest science is taking place. If this is so, then the ground for a more participative way of performing science is being laid out.

4.3.1. ARTICLE LEVEL

Table 4.5 summarizes for all articles analyzed, the type of collaboration that has taken place. 85,4% of all articles were the result of some type of collaboration. National collaboration, comprising of inter-departmental collaboration, intra-organizational collaboration, and collaboration within a country (inter-organizational collaboration) is the most frequent sort of collaboration, with 69,91% of all articles. Interesting is, that scientists favor collaborating with other scientists from different organizations within a country rather than any other form of collaboration: 40,71% of all articles resulted from this form of collaboration. The least favored form of collaboration was between scientists from the same organization but belonging to different departments, for example between scientist working at the same university with some working in forestry departments and others in ecology departments (which can be taken as an indicator that there is no interdisciplinary research in the discourse on forest science analyzed here, thus an indicator that deliberative discourse is absent).

Table 4.5. Type of collaboration in all scientific articles analyzed (Source: own calculations)

Type of collaboration	Number of articles	Percentage of total articles
No collaboration	33	14,60%
Collaboration within a department	57	25,22%
Collaboration within an organization	9	3,98%
Collaboration within a country	92	40,71%
International Collaboration	35	15,49%
TOTAL	226	100%

Going further with the analysis, figure 4.13 shows the type of collaboration present for the three issues throughout the whole of the time period analyzed.

Figure 4.13 reinforces the results shown in table 4.5. Collaboration within a country is the predominant type of collaboration taking place for all issues. For forest fires this type of collaboration has a very strong presence: 55,07% of all its articles are a product of scientists collaborating between different organizations within a same country. The

second most frequent type of collaboration for two of the three issues -biodiversity and forest fires- is that which is being carried out by scientists who belong to the same department of an institution: for example, between scientists of a forestry department in a university. For biodiversity this is 29,35% of all the articles and for forest fires 18,84%. For climate change the second most frequent form of collaboration is the international one, which may be related to the more global approach that this issue has when reporting on events in comparison to the other issues (see figure 4.11). International collaboration however only takes third place (13,04%) within the types of collaboration of the biodiversity issues and the last place (7,25%, fourth place) for forest fires. The option of collaborating with scientists from the same organization but belonging to different departments (for example department of forestry and department of biology) does not seem to be favored by the scientists participating in all three issues. For biodiversity and climate change this type of collaboration ranks last (2,17% and 1,54% respectively); for forest fires it ranks second to last (8,70%).

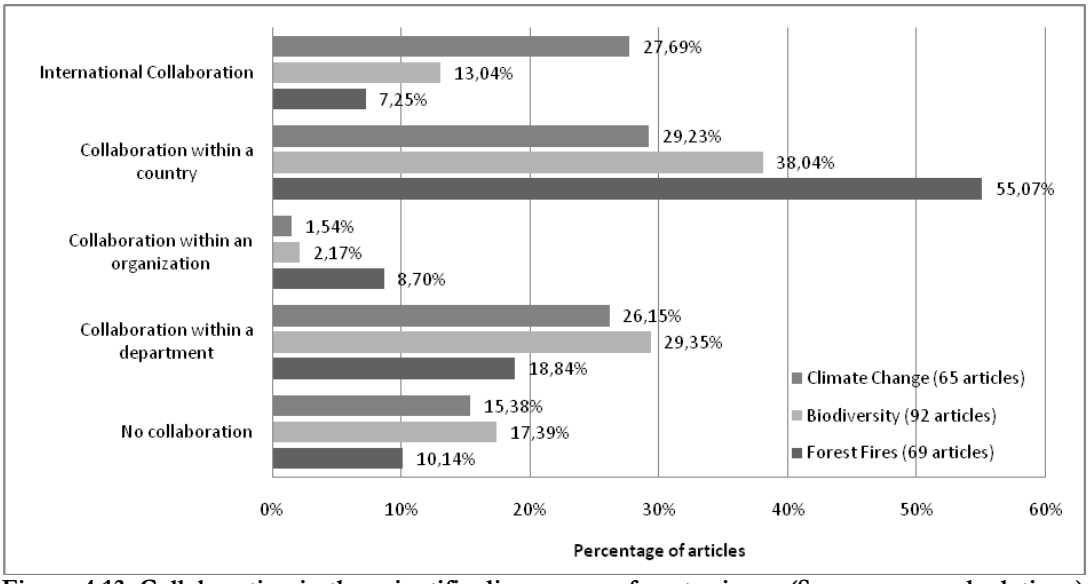

Figure 4.13. Collaboration in the scientific discourse on forest science (Source: own calculations)

From the data shown above it is clear that the issue of forest fires is the most closed-off to international collaboration (as it is the issue with proportionally less international collaboration) while climate change is the most open to international collaboration (proportionally compared to the other two). There is however a presence of international collaboration in the issue of forest fires, as table 4.6 shows. This is a noteworthy case, because the international collaboration that was carried out reported on local level research, in other words, events that happened at specific localities within a specific country. Additionally, the global events that were covered are not a product of international collaboration but of national collaboration, specifically between scientists from different organizations within a country. Thus, the local discourse is influenced in some degree by foreign scientists (global influencing local) and the global discourse incorporated the views of specific single countries.

International collaboration that deals with biodiversity issues, concentrates as well on a local level: 11,80% of all articles are a product of international collaboration on issues dealing on the local level. This once again comes to verify the 'locality' of the issue of biodiversity, or in other words it is not seen as a global topic. There is some international

collaboration that deals with issues that transcends nations (regional): 3,90% of all biodiversity articles. This is an example of how deliberation, following Habermas' idea, should work: in those issues that touch upon interests of different actors (in this case different countries or specific regions) then, it should be expected that the interests of all those who are affected are represented in the discussion (here the publishing of the research). If regional topics are dealt with, then the articles produced should be expected to be a product of international collaboration, where those actors belonging to the place where the event takes place are represented. This is seen in a somewhat greater measure through the climate change articles. There, both global and regional events do have some degree of international collaboration. However, international collaboration is aimed at either covering national or local events; once again external interests joining in the discussion of internal affairs. This is once again what can be seen as the dominance of the Center over the Periphery –or following Galtung's concepts imperialism, as the Center is carrying out and publishing research regarding the Periphery. Therefore clear evidence for the domination of Center over the Periphery is found, as the Center actors publish research regarding national events of the Periphery.

Table 4.6. Type of collaboration compared to location of event of articles for three issues (Source: own calculations)

Issue		Global (n, % of N)	Regional (n, % of N)	National (n, % of N)	Local (n, % of N)	Not recognizable (n,% of N)
Forest Fires N=62 articles	Collaboration within a department	-	-	5 8,10%	8 12,90%	-
	Collaboration within an organization	-	-	2 3,20%	4 6,50%	-
	Collaboration within a country	2 3,20%	1 1,60%	11 17,70%	24 38,70%	-
	International collaboration	-	-	-	5 8,10%	-
Biodiversity N=76 articles	Collaboration within a department	-	2 2,60%	3 3,90%	22 28,90%	-
	Collaboration within an organization	1 1,30%	-	-	1 1,30%	-
	Collaboration within a country	-	-	4 5,30%	31 40,80%	-
	International collaboration	-	3 3,90%	-	9 11,80%	-
Climate Change N=55 articles	Collaboration within a department	1 1,80%	-	7 12,70%	9 16,40%	-
	Collaboration within an organization	-	-	1 1,80%	-	-
	Collaboration within a country	-	-	9 16,40%	10 18,20%	-
	International collaboration	2 3,60%	3 5,50%	7 12,70%	5 9,10%	1 1,80%

The picture that is depicted from the data above, where national topics are predominantly researched by national scientists is what might be labeled 'scientific nationalism' (Wagner, 2008: p.2), which was the traditional way of carrying out science during the twentieth

century. Wagner (2008, p. 25) argues that since the 1990s the role of national policies in directing scientific research has diminished significantly and that the influence of global networks has grown; being the rise of social networks between scientists one of the main reasons of this growth. Inequalities are still present but the rise of networks has allowed the structure of science to open up. If this opening up of the structures of science means, as Wagner notes, that opportunities are being created to incorporate other actors (scientists) who previously did not have a chance to participate then, it should be expected that this is reflected through the presence of a high percentage of articles resulting from international (or also in this case regional) collaboration. From the result above this is not the case, making it clear that within forest science the structures that allow participating in the scientific process are still very much in place (inequalities do exist).

It is true that for forest science the norm is to carry out science at a local level and report on it, at most collaborating at a national level. However, international collaboration is making a breakthrough. Figure 4.14 shows how international collaboration for every issue has been gaining ground throughout the years analyzed.

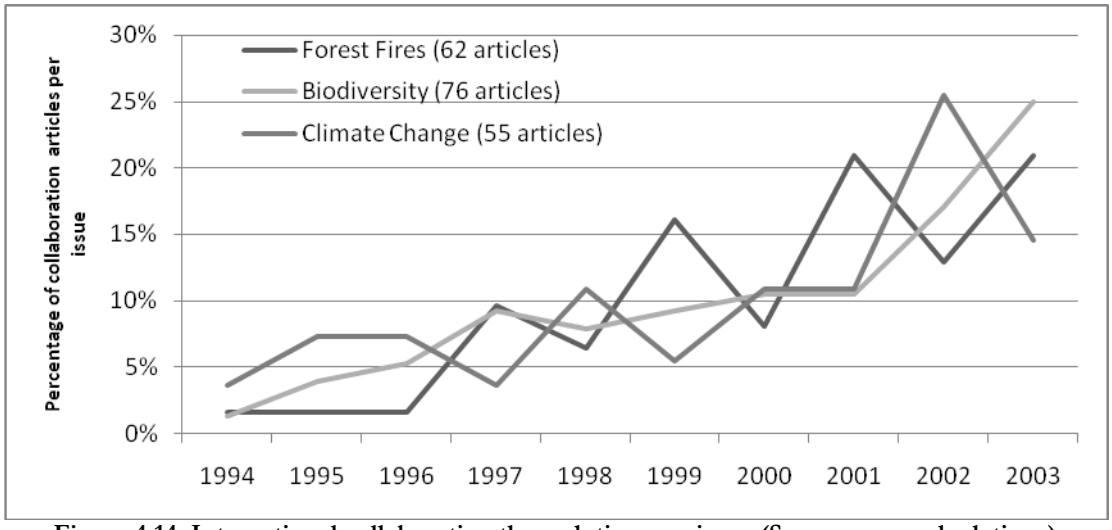

Figure 4.14. International collaboration through time per issue (Source: own calculations)

When mapping the world of science through co-authored articles, Wagner and Leydorf (2005, p.203) in a comparative study of the world scientific ties between 1990 and 2000, concluded that the global network of science has expanded in the year 2000 to include other nations that were not included in 1990. They as well found that ties were constructed, measured through the co-authorship of articles, which evidences the growth of international collaboration. In further research Wagner (2008) also notes the rise of international collaboration as a path that leads away from a traditional scientific nationalism. With the result from figure 4.15, the increase in international collaboration in forest science can be ratified. However, it is far from the percentages representing national collaboration. Forest science is thus slowly following tendencies of the entire scientific community.

4.3.2. DEGREE OF INTERNATIONALIZATION

International collaboration has been described previously as a strategy that can help the integration in discourse. This form of collaboration is evermore becoming a norm as communication tools grow that allow for geographical distances to be reduced. The Internet and many technological advances have allowed scientists to be able to contact colleagues with similar or complementary research interests for cooperation purposes. After cooperation has been carried out, collaboration may arise in that the scientists decide to publish their cooperative efforts in international scientific journals.

The results previously exposed, have shown that for forest science issues, collaboration is a most popular form of publishing where national collaboration is privileged. However, international collaboration has been carried out through the time frame analyzed and has as well been increasing through time. In order to examine which countries are putting more emphasis in international collaboration an index has been used which reflects the *degree of internationalization* of each country participating in the discourse. This index, as the OECD (1998) explains and Wagner et al., 2001) deepen, compares for countries the share of all its internationally co-authored articles published to the share of all its articles published. The more articles have been published as a result of international collaboration, the higher the index will be. If international collaboration is seen as a path for science to become more legitimate and more participative, countries should then strive for a higher index. Of course collaboration measured only through co-authored articles may not reflect the entire collaborative efforts on the part of the countries, as it focuses on one product of scientific productivity leaving many other important products out. However, it does measure the formal collaboration efforts of the countries. Figure 4.15 shows the internationalization index for all countries appearing in each of the issue studied with the data gathered.

Climate change was one the issue in which international collaboration was most frequently seen. For this issue, as figure 4.15a shows, publishing scientists represented 20 different countries. Of these, four countries published results that were not a product of international collaboration: Argentina (AR), Denmark (DK), New Zealand (NZ) and Belgium (BE). Scientists from all other countries published at least one article together with scientists from another country. The United States is the country which, in proportion to all its published articles, has had the least international collaboration, followed by the United Kingdom and Canada. Nine countries score the highest in their degree of internationalization; six are high income countries (DE, IE, FR, AU, NL, IS) and two upper middle income countries (EE and PL). Brazil is the only low middle income country which collaborates internationally.

For the issue of forest fires, 13 were the countries found throughout the articles. Only six of them collaborated internationally, as figure 4.15b shows. The United States is once again the least collaborative country in relative terms, followed by Canada and then by Brazil. The United Kingdom, Bolivia, and Indonesia are the countries which mostly collaborate.

Within the countries that internationally collaborate in the issue of biodiversity an opposite picture is found for the United States. As figure 4.15c shows, this country is the second most collaborative losing to the United Kingdom. There is then a strong drop in the degree of internationalization for seven countries: one of them being Indonesia (lower-middle income) and all the rest high income countries. Finally a third group of countries face a low internationalization degree: Belgium, Bolivia, Canada, Central Republic of Africa, Germany, Denmark, Ethiopia, Greece, and the Netherlands.

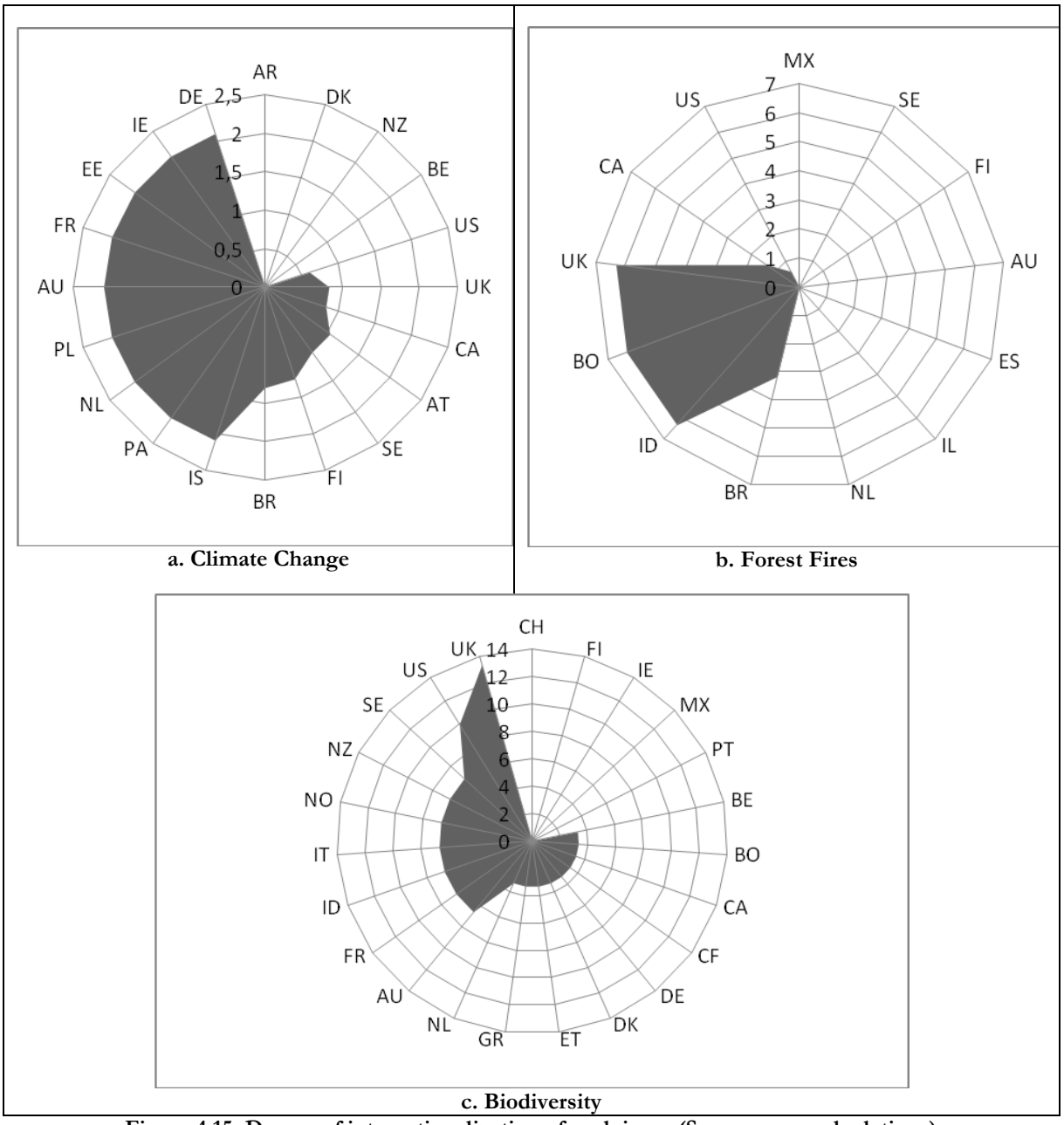

Figure 4.15. Degree of internationalization of each issue (Source: own calculations)

From the previous figure it is clear that there are countries which -independently from the issue- always collaborate internationally, even though their level of collaboration may be ranked lower in some issues compared to other countries. This is the case of the United States, the United Kingdom, and Canada. One country which is present through international collaboration is Indonesia. Indonesia was present three times, in all of them (all three articles) it collaborated internationally. The authors that participated in these

articles belong to CIFOR (Center for International Forestry Research), an organization which is orientated to international collaboration.

Countries with fewer resources than those of high income have the tendency to collaborate internationally. Such is the case of the Central Republic of Africa, Ethiopia, Brazil, Bolivia, Panama, Indonesia, Estonia, and Poland. Mexico and Argentina are the exception. These countries, when appearing in the global scientific discourse on forest science, do so at their own accord, not making use of collaboration networks to be integrated. But as a consequence are cutoff from the benefits of being incorporated to the global scientific network, as they here have no collaborative ties that may make them beneficiaries of scientific exchange.

The degree of international collaboration serves to measure how specific countries are integrated into the global world of science; measured through a higher degree of internationalization. However, not only is it important to examine to which degree a country is integrated in but also important is to examine the ties it has formed when collaborating. A country that has several international ties may have a better chance to position themselves in the global discourse than others who also collaborate internationally but do so with fewer countries. Thus, not only is the amount of internationally co-authored articles important but the networks the countries have formed when collaborating.

4.3.3. NETWORKS OF INTERNATIONAL COLLABORATION

Wagner (2008) writes that in the recent history of global science a 'new' invisible college has formed whose base is international collaboration (pp.23-26). It differs from the 'old' invisible college insofar that research is in the twenty first century seen not any more as a nation-state enterprise but a global one. Knowledge and development cannot be contained within the borders of a single nation and so countries must learn to take advantage of the opportunities that international collaboration present. A most important opportunity is that of gaining access to discourse and with it, the possibility to participate in disseminating knowledge that can serve policy makers and society in the solving of problems like environmental ones. But the benefits are not only found at societal level. Benefits for individual scientists who choose to internationally collaborate include tapping into resources, complementary of integrative capabilities, well connected people, and last but not least, funding (p.37)

To say that international collaboration carries with it benefits for those who choose to participate is not new. Many studies have emphasis the benefits of international collaboration. Many studies have also mapped different scientific fields in order to uncover Center-Periphery structures that are present in science, as well as to reveal the increase in international collaboration throughout disciplines, between disciplines, and in the global scientific community. For forest science empirical evidence of the presence of international collaboration has not been examined. Many efforts have been made to bring about international collaboration, the most prominent that of organizations such as IUFRO (International Union of Forest Research Organizations) which are ground on the principle of international collaboration. It is thus important to examine the structure of

international collaboration in forest science in order to see how internalized international collaboration is on the part of the forest scientific community, which will be seen as an opportunity to integrate discourse for those actors who do not count with as much resources as others that dominate the global scientific discourse on forest science.

For the three issues studied, networks of collaboration were built using co-authored articles as a means of formal international collaboration. Partitions[60] were built using the income class of the countries. Figures 4.16, 4.17, and 4.18 were constructed using PAJEK software for network visualization and analysis (de Nooy et al., 2005). In figures 4.16 to 4.18 networks were analyzed to identify Center countries within the network. The position that is analyzed here refers to the access of scientific information. A central actor, or in this case country, is one that either has quick access to information (scientific knowledge) circulating in the network or who may control the circulation of information (scientific knowledge). As the networks here are information networks it is important to identify the countries which have a key role in distributing and gaining scientific knowledge. If these countries are identified, actors (scientists and countries) who enter the network can more effectively focus their strategies of incorporation in the global discourse.

Certain measures of network analysis are used to examine how scientific knowledge can be gained and transmitted through the network (de Nooy et al., 2005: p.123 et seq.). These concepts are: (1) closeness centrality which indicates how near or far a country is to all others; this measure is linked to the idea of how accessible information is to the actors in a network. The closer a country is to all others, the faster information can be acquired by it. The closeness centrality is higher if the total distance to all other countries is shorter[61]. And (2) the betweenness centrality of a country indicates the importance of a country. In this sense, a country is more central if it is a link in more information chains between other countries in the network. A high betweenness centrality indicates that that country is an important intermediary in the communication network[62]. Additionally, figures have been drawn through automated procedures for finding optimal layouts; only in some minor cases were the figures modify so as to gain clearer sight of the vertices and connections.

Figure 4.16 maps the international collaboration network for the issue of climate change. Through visual inspection it is clear, and as the degree of internationalization (figure 4.15a) showed, that four countries have no international ties and are thus portrayed as loose vertices within the network: Denmark (DK), Belgium (BE), New Zealand (NZ) and Argentina (AR). The other countries did have some degree of international collaboration. Twenty countries have some participation in the global science discourse on forest and climate change.

From figure 4.16, climate change can be seen as a research area that interests countries with higher economic resources: it is only integrated by actors from countries with either high income (yellow vertices) or upper-middle income (green vertices); no lower income

[60] A partition of a network is a classification or clustering of the vertices in the network such that each node or vertex is assigned to exactly one class or cluster. Country classification based on the GDP per capita was used, classifying a country as high, upper-middle, lower-middle, or low income countries (World Bank 2004).
[61] Closeness centrality: large distances between vertices will yield lower centrality scores.
[62] Betweenness centrality: the more an actor is a go-between, the more central his/her position in the network.

countries are present. The international links formed are mainly those between high income countries. Brazil, Panama, Poland, and Estonia (all upper-middle income countries) are involved in international collaboration but they are dependent on the United States to connect with the rests of the countries.

The country that has the most access to scientific knowledge within this network is the United States, which has a closeness centrality of 0,43. Thus the United States has the shortest distance to all other countries in the network and can so tap more effortlessly to the scientific information circulating within the network.

The United States is as well the one which mostly controls the scientific knowledge circulating in this network: its betweenness centrality is the highest of all countries (0,45). Without the presence of this county the network would be broken into two sub-networks, and additionally three countries would lose opportunities to integrate the global discourse and form other collaboration ties: Estonia (EE), Austria (AT), and Poland (PL).

One of the sub-networks is composed by northern European countries such as Germany (DE), Ireland (IE), Netherlands (NL), Finland (FI), Sweden (SE), and Iceland (IS). Germany and Finland act as central countries. Germany connects the entire sub-network with the rest of the participating countries and Finland connects Iceland and Sweden with Ireland, Germany, and the Netherlands, as well as with the entire international community. It is thus comprehensible that Germany is the second highest ranked country in the access of information and in the control (closeness centrality is 0,38 and betweenness centrality is 0,32).

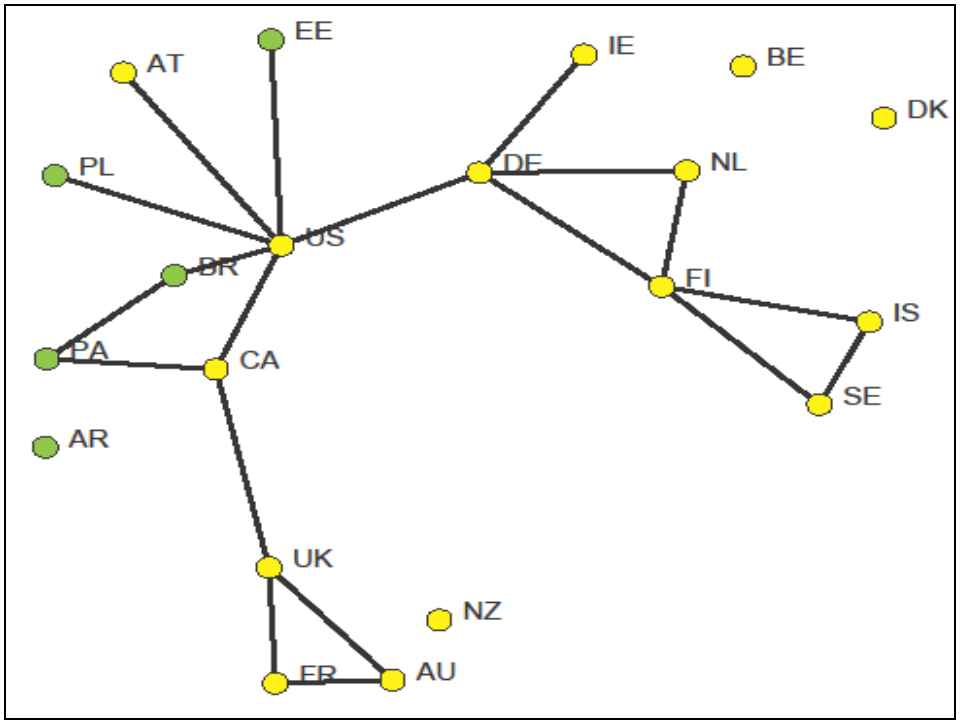

Figure 4.16. International collaboration network for climate change. Yellow nodes depict high income countries, whereas green upper-middle income countries (Source: own calculations)

On the other side of the international collaboration network, another sub-network may be observed. One that is connected to all other countries by the United States and where

Canada and the United Kingdom act as connection points between various countries. Canada, however, is in a higher position to access and control the scientific knowledge circulating in the network. This country ranks third both on closeness centrality (0,35) and betweenness centrality (0,24).

The result for this particular issue mirrors that there is really no global community of forest science, but one divided into Anglo-America / European one (with special presence of Scandinavian countries).

A different picture is seen when analyzing the issue of forest fires. Figure 4.17 illustrates the international collaboration ties that form the global discourse network. This issue is, in comparison to climate change, one in which international collaboration is not the main strategy for integrating discourse. From the 13 countries that are present in the issue, seven of them have gained access to discourse without any international collaboration backing them up. Those countries that do collaborate are joined together by the United Kingdom. Scientific knowledge travels from one point to another within this network always through this country (closeness centrality 0,38); the United States follows with a closeness centrality of 0,33. Brazil is in a third position in terms of accessing information (closeness centrality of 0,29) as it can reach all other countries through shorter paths than the other lower-middle income countries Indonesia and Bolivia.

The fundamental countries in the network, in other words those countries that control the information, are the United Kingdom (0,09) and the United States (0,06). All other connected countries are replaceable (betweenness centrality is 0).

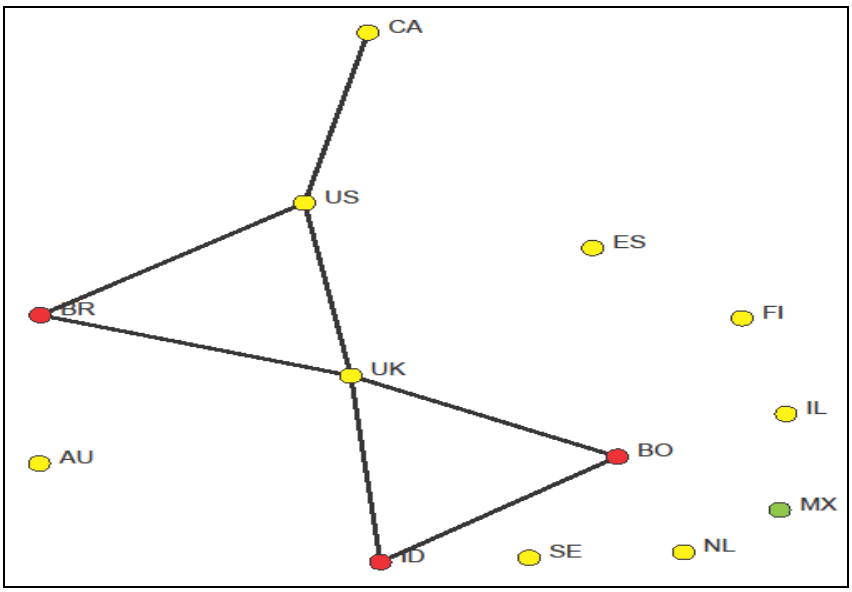

Figure 4.17. International collaboration network for forest fires. Yellow nodes represent high income countries, green represent upper-middle income countries, and red lower-middle income countries (Source: own calculations)

Finally the network of biodiversity is illustrated through figure 4.18. This is a much more complex network that the previous two. On the one hand more countries are involved in the discourse, 23 countries, and on the other more international links have been created. In this network there is a presence of countries with less economic resources: both lower-middle income (Indonesia and Bolivia) and low income (Ethiopia and Central Republic of

Africa) countries participate. These countries are not isolated regarding collaboration but are present in the global discourse through their collaboration ties. Unlike Finland, Ireland, Portugal (all high income countries) and Mexico (upper-middle income country) who participate in the global discourse but do so isolated from the rest.

In this network more countries have access to the scientific knowledge circulating. But those with the highest accessibility are once again the United Kingdom in first place (closeness centrality is 0,35), Denmark in second place (closeness centrality 0,33), and tying for third place Belgium and The Netherlands (each with a closeness centrality of 0,28). The positions of other countries within the network leave many of them with a relatively high closeness centrality, seven other countries have a closeness centrality between 0,27 and 0,23 (Norway, the United States, New Zealand, Central Republic of Africa, Indonesia, Bolivia, and Sweden), which means that they are all in good position to access the scientific knowledge flowing in the network, but as well to rapidly share knowledge with all other countries.

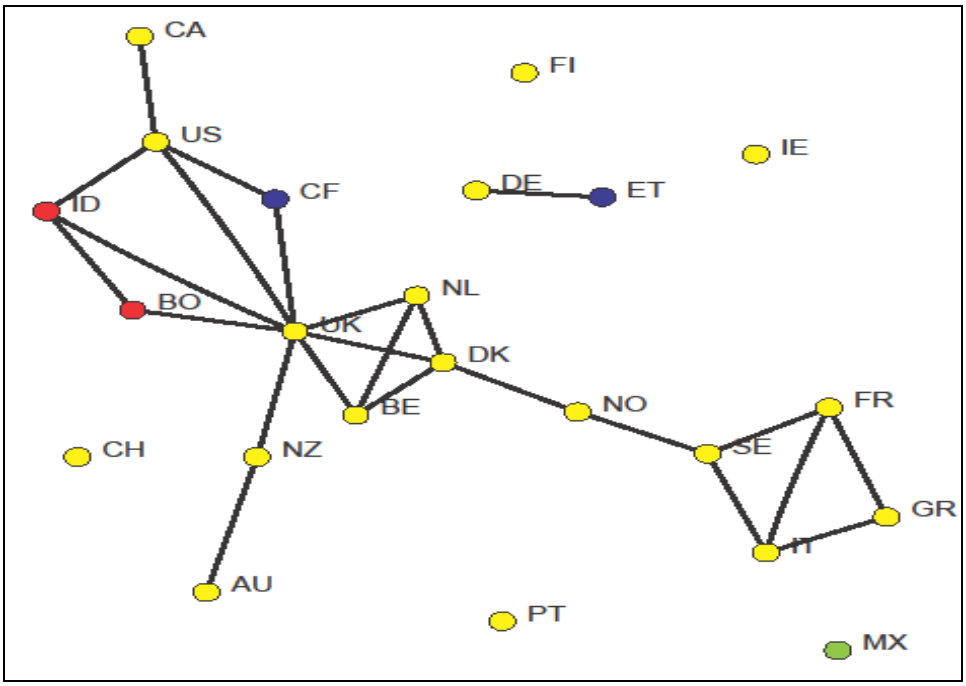

Figure 4.18: International collaboration network for biodiversity. Yellow nodes depict high income countries, green ones upper-middle income countries, red low-middle income, and blue low income countries (Source: own calculations)

The control of information, however, is not as equally distributed in this network as the access to the scientific knowledge. The highest control can be exercised by the United Kingdom (betweenness centrality of 0,30), followed by Denmark (0,22), Norway (0,19), and Sweden (0,16). All other countries either have low betweenness centrality (between 0,06 and 0,03) or do not score at all in this indicator, for example countries like Germany, Greece, and Bolivia which either connect with a single other country (in the case of Germany with Ethiopia) or they connect with countries that are in turn connected with others through more direct links: as is the case of Greece connecting with France and Italy (these last two being connected on their own). So if United Kingdom, Denmark, Norway, or Sweden each or all decide to leave the network negative effects will be appreciated by all other countries in that their ties to all other countries are severed.

Interesting is that countries such as Denmark, Norway, and Sweden act directly connecting high income countries, but the United Kingdom connects the wider variety of countries (lower-middle and low income countries as well).

Here, as well there is the presence of the Scandinavian country section (Norway, Sweden, and Denmark) in collaboration. As in climate change, this reflects the non-existence of a global community.

4.3.4. COLLABORATION IN NATIONAL SCIENTIFIC DISCOURSE

For the national level, results on scientific collaboration cannot be applied to the dominating discourse on forest because the number of articles analyzed is low. However collaboration is the norm in the articles that were analyzed. For biodiversity all articles were published as a consequence of some type of collaboration. This was mainly inter-organizational collaboration (between scientists from the same department). There was however presence of scientists from outside the country. More precisely, for biodiversity a Peruvian scientist was found to be collaborating with a Chilean one in an issue regarding the characterization of the vegetation found in a native forest located in Concepción, Chile, which can be an indicator of participation of foreign actors in national issues. The only article that was found regarding forest science and forest fires dealt with an issue placed in Argentina. For climate change only one article was found authored by one Chilean scientist (no collaboration took place).
Even though international collaboration is not present in the issues that have been here analyzed, and according to the National Commission of Scientific Information and Technology (CONICYT, 2008[63]), collaboration is an issue in which the scientific community of Chile has become increasingly interested in. Scientific articles appearing in the *Web of Science* in the period from 1994 to 2005 in which Chile has had a presence (measured through the institutional addresses of the scientists), have increasingly been the product of international collaboration. Since 1990 articles resulting from no collaboration have been decreasing whereas articles which are products of domestic collaboration have maintained or marginally increased their numbers finally, articles fruit of international collaboration have noticeably increased.

International collaboration may be increasing overall within the Chilean scientific community however how the discipline of forest science has been participating on this is still an uncovered area. Speculation can be done regarding issues as forest fires where, according to the different web-sites of scientific and governmental institutions involved in this issue, international partnerships have been formed and joint projects have been carried out. However, the formal product of collaboration that is the scientific article is difficult to find.

4.3.5. SUMMARY OF COLLABORATION

The previous results have shown that within forest science collaboration is being carried out. The type of research that is carried out in this field can explain for the collaborative

[63] http://www.conicyt.cl/573/article-28133.html (last seen 21.08.08).

efforts made by scientists. Research in forestry generally implies field observation through extensive areas which can be more effectively carried out if various actors participate.

The collaboration that mostly takes place is national. Scientists choose to collaborate mainly with colleagues from different organizations than with colleagues from their own departments or organizations. This might be an indicator of the necessity to tap into resources that are not found within the same organization or the tendency to form various links that can help develop future research plans. It reflects that national discourses are a consequence of national collaboration.

The results have also shown that scientific collaboration has been increasing on an international level throughout the years studied, going in the same direction that the global scientific community is moving in. However it is doing so at a very slow pace, if one considers the amount of international collaboration in comparison to other types of collaboration. Using Wagner's (2008) terms, forest science is still a scientific field where 'scientific nationalism' is strong.

Additionally the international collaboration that is taking place is dominated by high income countries. The hegemony of the rich over the poorer countries continues when considering international collaboration. The control and access to the scientific information circulating within the networks of all issues are dominated, once again, by high income countries such as the United States. However, and so the importance of countries such as the United Sates is revealed, through international collaboration countries (usually those without the same economic resources than high income ones) that may not have been able to participate in discourse are doing so through the collaborative links established. However those who are mostly linked –or linked the closest- are revealed to be those who share the common language of English or those coming from Scandinavian or Northern-European countries.

Some countries have entered the discourse without the need of international collaboration; as is the case of Argentina in climate change and Mexico in forest fires and biodiversity. These countries appeared as part of the 25% mostly cited publications that formed the discourse. However, these countries cannot tap into the benefits that the involvement in the scientific global network carries with it, as their involvement in the discourse is not done through international collaboration. Thus, they lose chances to benefit from the knowledge links created in the network as well as chances to secure even further their participation in the global discourse.

4.4. MEDIALIZATION OF SCIENCE

The previous sections have dealt with characteristics of the scientific discourse on forest science and distortions that are found which causes a deviation of the discourse from the deliberative ideal. The mayor distortion that was previously considered, provoking the dominance of Center over Periphery was the economic resources of countries. Countries with higher resources were found to dominate in discourse over countries with lower resources. This distortion of the condition of free and equal participation in discourse is not the only distortion that can be expected when examining the discourse on forest

science. It is, however, difficult to determine why the distortions in communication occur. Possible explanations could relate to a higher quality and more frequent communication processes of high income countries, a higher amount research occurring in these countries, a higher interest to communicate on a global level of these countries, or might be a consequence of the selection process within science. All reasonable explanations for distortions of the communication process which in future research might be examined in more detail.

Medialization is as well a distortion that occurs in a communicative process that aims to be deliberative. Science and scientists face restrictions regarding financial resources and pressures from society -and from within the scientific community- which have consequences for the type of communication that is carried out regarding forest science. These consequences can be seen in the sphere of science as well as in the universal public sphere. As described in the theoretical background section, science wishes to appear and participate in the mass media, which is seen as the approximation of the universal public sphere, in order to gain legitimacy, participate in the agenda setting of problems relating to the forest, and eventually be noticed by those in charge of the resources that will be assigned to science. To be successful in this, the traditional model of science communication with the media must be dropped and scientists must adapt themselves to the rules set by the media. This is done by science and its scientists through the adaptation of media rules that may help position themselves in the public discourse. To be oriented to the media has as well consequences for science and the internal communication process (Weingart 2002). With this in mind, the medialization of science is then the term used to describe the orientation of science to the rules of the media. If medialization is happening in forest science, if forest science is seeking public legitimation or success regarding resources, then evidence of its occurrence will be found both in the public as well as in the scientific discourse on forest science.

In order to study whether medialization is taking place in both spheres several factors have been named that provide evidence of its occurrence. These factors will help verify or falsify the three hypotheses created earlier regarding the medialization phenomenon namely:

1. The scientific discourse on forest science is medialized
2. The public discourse on forest science is medialized
3. Scientists working in the field of forest science recognize the medialization of science

Global and national levels of analysis will be considered to further give answers to the hypotheses. These levels of analysis are chosen in order to examine whether there are differences in the media-related tools that scientists use when communicating either on the local or global level.
The factors that will be considered in order to prove the medialization phenomenon follow different theoretical and empirical works mainly that of Schäfer (2007), Weingart (2001), and Nelkin (1987). These factors are:

- Extensiveness of the issues (Schäfer, 2007)
- Pluralization (Schäfer, 2007)

- Controversy (Schäfer, 2007)
- Communication tools (Weingart, 2001; Nelkin 1987)
- Politization (Weingart, 2001)
- Individual scientists' communication behavior and organization characteristics

Firstly the medialization of the scientific discourse on forest science is examined on the basis of the first five factors (extensiveness, pluralization, controversy, communication tools, and politization). Following this, the public sphere of the media is revised on the basis of the same factors. Finally, survey results of individual scientists and their communication patterns and organization characteristics are revealed.

4.4.1. MEDIALIZATION OF SCIENCE DISCOURSE

Here the factors mentioned earlier will be exposed for the scientific discourse on forest science on both the global as well as the national level. On the national level however, only the issue of biodiversity will be included in the analysis because for the other two issues only one article was found, from which no quantitative analysis of the medialization factors can be carried out.

4.4.1.1.EXTENSIVENESS

Schäfer (2007) has noted for the mass media that as science becomes medialize it is expected that the articles dealing with the specific issue increase in number through time. This factor can be as well applied to the scientific discourse on forest science by examining the change in time of the number of scientific articles published on a global level. The extensiveness of the issue, examined through the distribution through time of the number of articles that form the global discourse, has already been exposed in previous sections (see figure 4.3). For medialization to occur, the extensiveness of an issue needs for an increase through time in the number of articles of each issue to occur. As figure 4.3 showed, and table 4.7 describes, for all issues the total number of articles increased through time. In 1994 a total of eight articles were published (once again the top 25% published) for all three issues. The increment (or at least the continuity) in the number of article is seen all throughout the time frame except in the year 2000, where a small set back from the previous year is observed.

The biggest growth in the number of articles on the global level is seen by the issue of biodiversity. From only two articles published in 1994 a total of 23 articles were published in 2003. The greatest leaps in the number of articles published are seen in 1999 and 2003, going from six articles in 1998 to twelve in 1999 and from 17 in 2002 to 23 in 2003. The large increase of articles might be due to the internalization of the relevance of researching this topic.

Table 4.7. Extensiveness of issues in scientific discourse on forest science (Source: own calculations)

	Forest Fires	Global Biodiversity	Climate Change	TOTAL Global	Biodiversity National
1994	3	2	3	8	2
1995	1	3	5	9	0
1996	2	5	5	12	1
1997	6	7	4	17	1
1998	5	6	6	17	0
1999	10	12	3	25	1
2000	5	8	8	21	1
2001	13	9	7	29	0
2002	10	17	14	41	0
2003	14	23	10	47	0
TOTAL	**69**	**92**	**65**	**226**	**6**

In the year 1992 the Convention on Biological Diversity was opened for signature by the countries of the world (ratification). Three years past until the number of articles published on this issue started to increase more pronouncedly (in 1996, five articles published). At the end of 1996, in the 3rd Convention of the Parties in Argentina, forest biodiversity was brought to the agenda when requests were made to develop a focused work program for this issue. Three years into this decision (in 1999) a great increase in the number of articles can be found. A work program was endorsed in 1998 (which has since then been retired); the possible reaction of the forest scientific community can be seen through the increase in articles starting in 2002. Scientific research and the publication of results in peer-review journals cannot be as reactive to events that happen as, for example, reports in the mass media. An amount of time must elapse before the first reactions of the scientific community to the events can be seen, as time is needed for research to be carried out, results written, and finally published. For biodiversity this might be the case.

For climate change an increase in the number of articles can be as well seen, however, not as pronounced as in biodiversity. Two mayor events have further served as incentive of the research carried out regarding forest and climate change. First, the United Nations Convention on Climate Change which sets an overall framework for intergovernmental efforts to deal with the challenge posed by climate change, recognizing that the climate system is a shared resource which's stability can be affected by industrial and other emissions of carbon dioxide and greenhouse gases. A second important push in the issue was the adoption of the Kyoto Protocol in 1997, which set binding targets for reducing greenhouse gases emissions for 37 industrialized countries and the European Union. The scientific community working in forest science (or at least publishing in the journals of forest science) however, reacted slowly to these mayor events. Increments in the total of articles published started in the year 2000 (increasing from three articles in 1999 to eight articles in 2000) but gave clear indications of an increase starting in 2002 (from seven articles in 2001 to 14 in 2002).

The issue of forest fire greatly increased its numbers starting in 1999 (with a small decline in the year 2000). Forest fire is not an issue which has global political events providing a background basis which could justify the increase in the number of articles published, at least not a direct one. However, forest fires have consequences on the emissions of carbon dioxide which may be altering the climate. As such, research in this issue is then

important as it can help decrease the information uncertainties that countries face when estimating their emission rates. Consequently, the same global processes that influence the issue of climate change can either directly or indirectly influence the research on forest fires. Starting in the year 2001 a great increased is seen in the number of articles published.

The increase in the number of articles for all issues could be due to the overall increase in articles published by the selected journals. All journals, except *FEM* maintained through the years their publishing numbers. Since the mayor number of articles analyzed for all issues comes from *FEM* it is the tendency of this journal that must be paid special attention to. The increase of total articles published in this journal from 1994 to 2003 was more than 300% (total number of articles published in the time frame for each journal can be found in annex V). The increase of the three issues for the same time period did not even reach 18% of articles (sum of articles of the three issues which were published in *FEM*). Consequently, some of the increase in the published articles may be explained by the overall increase in the total articles published by the journal, but that increase does not explain the whole of the increase for the three issues analyzed. Consideration must also be given that the analyzed articles represent the 25% most cited articles for every year analyzed. It is, therefore, not only the increase in articles published by the journal, but as well the recognized importance of the articles by the scientific community which is a further factor that might explain the increase in the number of articles considered. This is the reason why extensiveness can be confirmed for the scientific discourse on forest science.

In the national discourse, biological diversity is not a regular topic in the journal selected. Only a total of six articles were published throughout the ten years analyzed, and are unevenly distributed. No conclusion can be reached about the extensiveness of the issue here.

4.4.1.1.1. SUMMARY EXTENSIVENESS

The previous results show dissimilar results for the global and national scientific discourse on forest science. While on the global level an increment in the amount of articles forming the discourse is seen through time, on the national level –the only issue which could be considered- was not often published throughout the time frame studied here.
On the global level this implies that the medialization of science gains points in existence because, and following the operationalization of Schäfer (2007), as topics increase in attention their numbers increase in time.

4.4.1.2.PLURALIZATION

With pluralization Schäfer (2007) refers to the possibility that discourses open themselves up to other actors who then contribute to the discussion of specific issues, since the information or points of views regarding the issue are not the sole domain of one specific group of actors. Discourses are then diversified by the participation of different actors in it. This participation is not limited to the pure mentioning of the actors within the issue,

but they must represent their own points of views -give their own interpretation patterns- in the discourse (Ferree et al., 2002: p.86). In the media this is justified because scientists and scientific arguments do not any more monopolize the discourse on scientific topics but that "contra-experts" also have a say in the discussions (Schäfer 2007, p.30). For pluralization in the scientific discourse on forest science to occur, actors other than forest scientists, and for that matter, other than scientists would have to participate in the discourse. This would mean that scientists writing the articles recognize that scientific knowledge (or knowledge in general) is as well created by actors outside the scientific sphere, and that this knowledge is recognized by the scientific community. Recognition of course does not necessarily mean acceptance: for example, the knowledge created by actors other than scientists may be used as basis for criticism.

In order to examine which actors participate in the discourse, the speaking actors within the articles are considered. First, the inclusion of scientists other than forest scientists is investigated in order to see if the scientific discourse on forest science is effectively a domain of forest science or if other scientific disciplines are as well considered (this has been partly answered when looking at the characteristics of discourse, see figure 4.5). Afterwards, results on speakers which have appeared speaking directly or indirectly in the articles are put forward. In scientific articles it is difficult to find other actors as direct speakers than the scientists who wrote the articles. The majority of the other speakers participating do so by the citations given to them by the authors (indirect participation). The classification of the speakers into either scientists or other types of actors is done by considering the bibliographic references given by the authors.

As previously seen in figure 4.5 the global scientific discourse on forest science -when considering the authors of the articles- is a balanced product of both natural and forest scientists. For all three issues the number of both these types of scientists reached at least 43% of all scientists participating as authors in the discourse. This number is an approximation of the field an author represents, as it has been collected through the affiliation institution of the scientists. The equal participation of both types of scientists found, and the near exclusion of any other type of scientists, speaks for the limited natural-science interdisciplinary that is found throughout the issues selected. Climate change, biodiversity, and forest fires are not the domain of forest science but require the views of scientists representing other natural sciences such as biology or ecology, in other words sciences dealing with the environment of nature. For certain specific issues scientists from other fields such as economics, informatics, or statistics were incorporated as authors of the issues. In most of these cases the articles were a collaborative product between natural or forest scientists and representatives of social or formal sciences and so the inclusion of these other sciences would be more probable to occur.

The national scientific discourse on forest science (issue biodiversity) paints a similar picture. In the six articles analyzed the total amount of 14 authors were found. Of these eight (57,14%) were affiliated to a forestry-related institution, and thus coded as forest scientists, and six (42,85%) were affiliated to a natural science-related institution (thus natural scientists). No participation of scientists belonging to the social or formal sciences was found, favoring with this the participation of forest scientists as more than half of all authors represent this field. The participation of natural scientists amounted to a percentage similar to those found for the global discourse.

If consideration is now given to the total of speakers appearing in the articles on both the global and national level then table 4.8 can be explained. For this analysis the authors of the articles have been considered as one speaker since, when more than one author co-write an article, they act as a group making statements in the article.

As expected a clear domination of scientists is seen in all issues on both levels (global and national). In every single issue scientists scored more than 85% of all speakers, making the discourse almost impenetrable for other type of actors who also create or transmit scientific knowledge. Climate change is the issue which mostly allows incorporation of other actors in the discourse. Politicians (both government –officials elected by popular vote- and non-government), administration actors, international organization such as FAO, OECD, and UN, other organizations such as NGOs or enterprises are as well present in the discourse. There is also a presence of actors that are not organizations and must be grouped as different actors (for example Kyoto Negotiators, or Round Tables). The Intergovernmental Panel on Climate Change (IPCC) was the second most important actor incorporated in the discussions, which is understandable since this international organization delivers, as well as calls for much input that is responded to and required by the scientific community.

Table 4.8. Speakers in the scientific discourse of forest science (Source: own calculations)

SPEAKERS	Global			National
	Biodiversity (% of Total)	Climate Change (% of Total)	Forest Fires (% of Total)	Biodiversity (% of Total)
Scientists	664 (96,65%)	411 (85,98%)	580 (85,55%)	44 (89,80%)
Politicians	-	5 (1,05%)	-	-
Administration	19 (2,77%)	17 (3,56%)	85 (12,54%)	3 (6,12%)
Media	-	-	1 (0,15%)	-
International organizations	-	14 (2,93%)	-	1 (2,04%)
IPCC	-	18 (3,77%)	6 (0,88%)	-
Other organizations	-	6 (1,26%)	6 (0,88%)	1 (2,04%)
Other	2 (0,29%)	7 (1,46%)	-	-
NR	2 (0,29%)	-	-	-
TOTAL	***687***	***478***	***678***	***49***

The IPCC makes as well an appearance in the forest fires issues, even though not as pronounced as in climate change (0,88% of speakers). The second most participative actor in this issue belongs to the administration sector: 12,54% of all speakers come from this sector. This is explained as much information on damages, prevention strategies, or management options regarding forest fires is originated and gathered by the administrative sector. The media as a speaker was incorporated once in the issue of forest fire. In this case, the Associated Press delivered information regarding the damages of drought associated with the current El Niño which resulted in record levels of burning

with nearly five million ha of forest and shrubland in Indonesia and Brazil (Neary et al., 1999: p.52). It is interesting to note the participation of the media as a speaker in delivering facts on damages left by different natural phenomena; which might give indication that a role the media might have as speakers in the scientific discourse on forest science, and may be recognized by scientists, is the input of certain information that cannot be elsewhere so rapidly obtained.

On the biodiversity issue, for both levels there is a clear domination of scientists (even more so than in the other issues). It is the issue with least diversification of actors on a global level. The administration sector is stronger in the national discourse, even though in both level is has a low presence, 6,12% of all speakers compared to the 2,77% on the global level. On a national level the one international organization present in the discourse is the FAO and the other organization that is present is a national university (which is not classified as scientists because no mention of individual or groups of scientists was made, only of the organization as such).

A closer look at the scientists that participate as speakers shows a similar picture as when analyzing the authors of the scientific articles. Table 4.9 shows how scientists as speakers are distributed through the different sciences.

On the global level in the issues of biodiversity and forest fires, forest scientists were slightly in the lead when compared to natural scientists. As with the articles' authors in climate change, more natural science affiliated scientists were incorporated in discourse than forest science affiliated ones. On the national level, however, an interesting result arises. The natural scientists are the majority of the scientists speaking in the articles (61,36%). If consideration is given that periodic forest science journals in Chile are a scarce good, then this result can be understood. The information relating to the forest or the issues such as biodiversity are not published in the almost non-existence forest science journals but are then published in journals with natural science orientation. Since the audience for such journals is much wider than a forestry-related journal, there is a need for the titles of the articles to be more natural science oriented. Given that speakers were classified in one or another science according to the titles of their publications and the journals in which these were published, both these reasons allow for a natural science classification of the scientists appearing in the discourse, even though they could be forest scientists which have decided to publish in other science oriented journals.

Table 4.9. Affiliation field of scientists speaking in discourse (Source: own calculations)

Scientists	Global			National
	Biodiversity (% of Total)	Climate Change (% of Total)	Forest Fires (% of Total)	Biodiversity (% of Total)
Forest Science	266 (51,45%)	196 (47,69%)	289 (49,83%)	13 (29,55%)
Nature Conservation	1 (0,19%)	0	2 (0,34%)	3 (6,82%)
Natural Science	232 (44,87%)	213 (51,82%)	263 (45,34%)	27 (61,36%)
Social Science	1 (0,19%)	1 (0,24%)	16 (2,76%)	0
Not recognizable	17 (3,29%)	1 (0,24%)	10 (1,72%)	1 (2,27%)
TOTAL	***517***	***411***	***580***	***44***

Nature conservation makes an appearance on both levels, however it is on the national level where its presence is higher. 6,82% of all scientists were associated with this scientific area but in comparison to the other sciences present it is the least important.

4.4.1.2.1. SUMMARY PLURALIZATION

In order for a discourse to be considered deliberative, the participation of all those with interest in the issue should be equal and free, providing through this different forms of knowledge (different view points). This means that it should be reflected not only in the diversity of actors other than scientists participating in the discourse, but as well in a diversity of scientists affiliated to different fields of science. The participation of scientists should be transdisciplinary. The results shown here imply that the existence of pluralization within the scientific discourse on forest cannot be proclaimed. Scientists, on the one hand, do not give opportunities to other actors which might have scientific or any relevant information on the issues in their articles. The clear majority of scientists as speakers (at least 85% in al issues) and the lack of participation of other actors is proof of this. And on the other hand, no room is given to scientists from other disciplines, especially not for social sciences. This then is as well an indicator that there is no open deliberative discourse.

4.4.1.3.CONTROVERSY

To prove the existence of medialization, Schäfer (considering the work of many other authors) has further operationalized the concept. In the context of pluralization, scientists have had to confront society in order to give evermore justification of the usefulness of their work. It is through this that, in the media, reports on science are increasingly being controversially discussed (because of the increasing importance of science and research in the lives of the population). With this, the role of scientists and experts has constantly come under attack deriving in the existence of more and more controversy in the public reports regarding science and scientists (Schäfer 2007, p.30). This is understandable if the incorporation of a wider diversity of actors in the discourse is seen which represent their own interests and points of views which can be in opposition to those represented by scientists.

Previously, the speakers appearing in the scientific discourse have been analyzed and the conclusion has been reached that scientists are closed off to the participation of other actors within the discourse. This could imply, since no wider variety of actors are present, that the interpretation patterns on the issues are not at all controversial but represent a agreement amongst scientists on how they discuss and view the issues. In order to examine this, consideration is first given to the assessment of the event as portrayed in the articles; second, the authors' statement assessments are considered, finally giving way to the assessment of all other statements of speakers in the articles.

Figure 4.19 gives details for the assessment of the event for all issues on both levels of analysis.

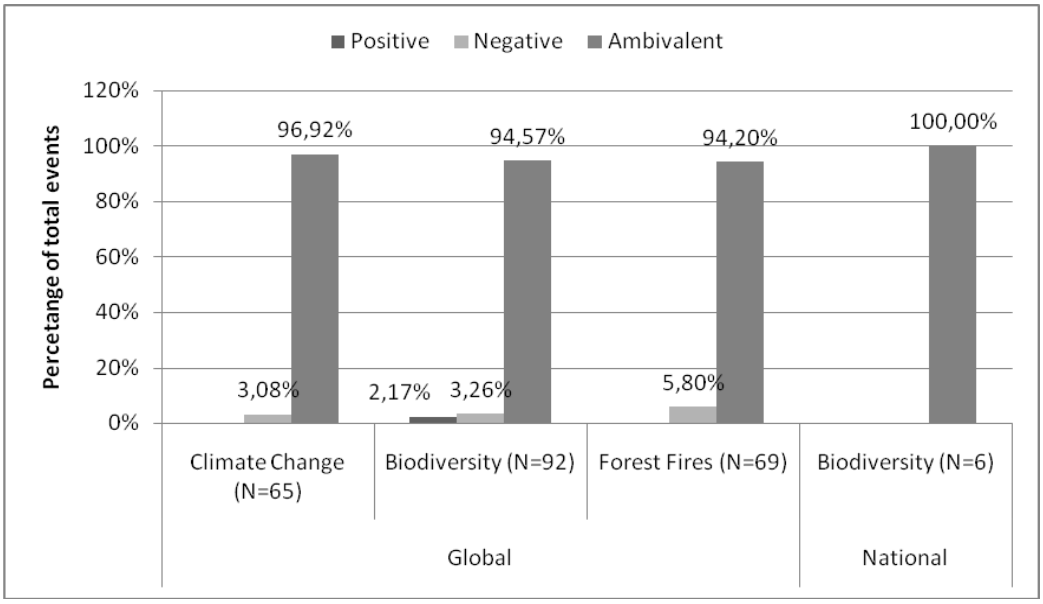

Figure 4.19. Assessment of event in scientific articles (Source: own calculations)

In the previous figure there is a clear domination of the ambivalent assessment of the events for all issues. The events reported on and described by the scientific community are generally discussed in a way in which no judgment or normative assessment is assigned to them. On the national level this is even clearer as all articles are represented in an ambivalent way. Therefore from this, controversy cannot be confirmed.

The following step is to examine whether controversy is present in the authors' statements. Figure 4.20 gives insight into the speaker statements. As with the overall assessment of the event, the authors express themselves making no judgment on the issues they report on. On both levels, on all issues authors' maintained their 'scientific objectivity' and described and reported their research results in a value-free way. There are some authors who made statements that can be classified as expression of certain values when evaluating the issues. The positive statements have been made when authors introduce a new technique which allows an improvement on relevant measurements required to eliminate scientific uncertainty regarding, for example, carbon dioxide emissions. In these cases the authors are advocating their own research, and thus their statements are not as objective or value-free as is normally the case. However, this situation does not even reach 2% of all authors' statements. The negative statements from authors in the biodiversity issue are cases where the authors criticize policies that have been put forward by governments. However, this is as well a minor share of all authors' statements (only 2,17%).

Consequently it is clear that when considering the authors' statements no controversy regarding how the issues are dealt with can be confirmed.

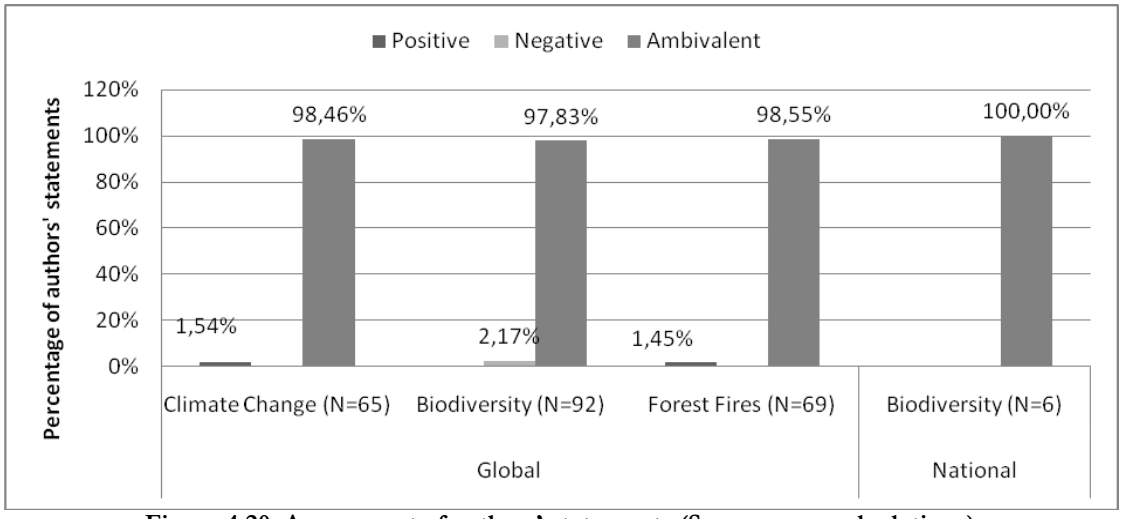

Figure 4.20. Assessment of authors' statements (Source: own calculations)

The next step is to examine if the value-free perspective of the authors' statements is maintained by all other speakers in the articles. Figure 4.21 shows a similar picture from the results above. In all three issues on the global level the speakers represent their points of view in a value-free form. This is in conformity with the type of speakers that is participating in the scientific discourse: mainly scientists. Therefore scientists do not make use of the platform of the scientific articles to express opinions on what is being discussed; no judgment is being made regarding the issues at hand. This of course is not possible for speakers to do since in most cases what is being cited are other scientific articles analyzed and selected by the authors of the scientific article. The authors take and interpret the relevant information that they need from other sources in support of their own scientific objectives (complementing their own research) or sometimes information which contradicts their own results or scientific standpoint (giving way to new scientific discussions). Whichever the reason authors have for incorporating other relevant actors in the discourse, the appearance of other speakers in the discourse is determined by the authors of the articles; there is no direct participation, but speakers are always indirectly making a statement which depends on the interpretation patterns of the authors; therefore not allowing positive or negative statements to be made.

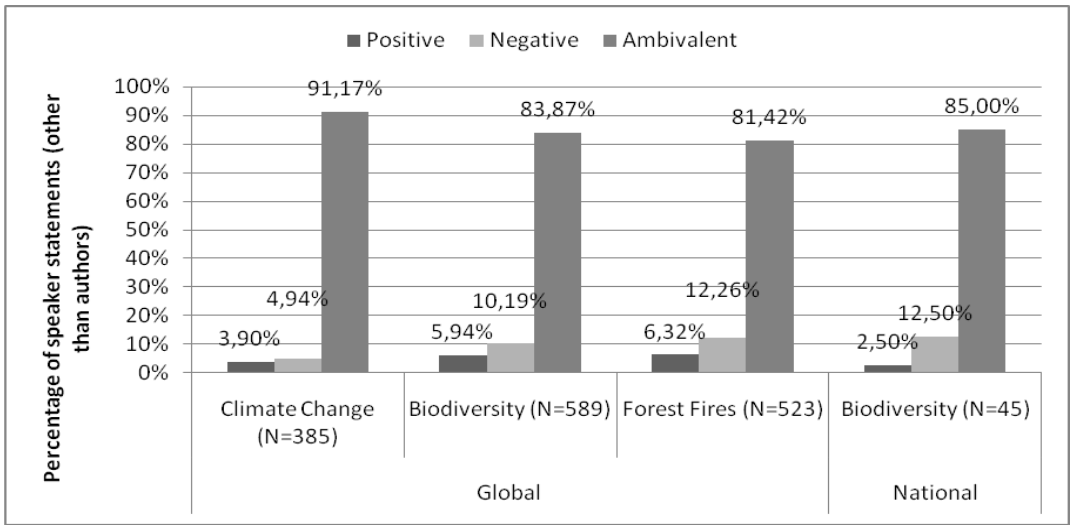

Figure 4.21. Assessment of speaker statements (other than authors'; source: own calculations)

On the national level controversy is as well absent: 85% of all speakers contribute with statements that have no judgment attached to it.

On both levels there are statements that have a normative quality to them, specifically a negative assessment attached to them. For each issue this was mostly the case where speakers talked about 'dangers' or 'risks' of events occurring that might have negative effects on, for example, the biological diversity. Positive assessments or judgments included shedding positive light on possible solutions for the danger faced by the forest: for example suggesting new polices or management options, as well as developing new tools that might decrease the risks of uncertainty on information needed. However, the share of both these types of judgments is small in comparison to the judgment-free statements of most of the speakers.

4.4.1.3.1. SUMMARY CONTROVERSY

Consequently, the previous results are conclusive regarding controversy being absent from the scientific discourse on forests. There is room within the discourse for value-charged events or statements (either positive or negative) but these are always far less than the value-free events or statements, as could be expected from scientific objectivity.

4.4.1.4.COMMUNICATION TOOLS

Media studies have pointed out the importance of communication strategies or collective symbols in gaining attention of and simplifying information for the lay public (Nelkin, 1995; Weingart, 2001; Krumland, 2003). The use of these media tools by actors other than the media, in this case specifically by science-related actors, has been proposed as a sign of the medialization of science. If scientists incorporate these media tools in their interactions with the media and in their scientific publications then this is an indication that this factor of the medialization of science is taking place.

In order to examine whether the incorporation of media strategies is a tool used by scientists it is necessary to compare specific tools favored by the media to other communication tools that are found in the scientific publications. Therefore, different tools will be examined and compared in order to see if they are incorporated into the scientific discourse and if so, how they measure in comparison to other commonly used communication tools in the discourse. Table 4.10 shows the number and percentage of statements using each communication tool for all speakers and all authors of the scientific publications on the one hand, for all speakers present in the scientific discourse of forest science (seen through scientific publications) and on the other hand particularly for the authors of the scientific publications.

Table 4.10 shows that communication tools were a strategy adopted by speakers participating in the discourse, on both levels, in their statements. In at least 60% of the statements, speakers made use of at least one type of communication tool, as the percentage of statements in which no communication tool was found (or was not recognizable = NR) never surpassed 40% of the total statements found.

From the table 4.10 it is also clear that descriptions based on empirically gathered facts are most frequently used in statements of the speakers in the discourse. This is an expected result as scientists need to use descriptions to present their facts and research results. In all issues, on both levels, the percentage of statements in which descriptions where used reached more than 55% of all the statements. Looking at the authors –or publishing scientists- of the articles the prominence of this communication tool is further confirmed. Table 4.10 shows that in all of the author statements–for all three issues- descriptions were used (100%).

Table 4.10. Number and percentage of statements using each communication tool found for all speakers and authors of the scientific publications for the global and national level (Source: own calculations)

	Global						**National**	
	Climate change		**Forest fires**		**Biodiversity**		**Biodiversity**	
	All speakers (% of N)	Authors (% of N)	All speakers (% of N)	Authors (% of N)	All speakers (% of N)	Authors (% of N)	All speakers (% of N)	Authors (% of N)
History	20 (4,44)	15 (23.08)	108 (18,24)	27 (39,13)	67 (9,83)	39 (42,39)	8 (15,68)	3 (50)
Technology	54 (12)	29 (44,61)	20 (3,38)	10 (14,50)	4 (0,59)	2 (2,17)	-	-
Metaphor	-	-	4 (0,68)	3 (4,35)	3 (0,44)	3 (3,26)	-	-
Symbol	-	-	20 (3,38)	7 (10,14)	22 (3,23)	17 (18,48)	-	-
Description	249 (55,33)	65 (100)	502 (84,79)	69 (100)	451 (66,22)	92 (100)	31 (60,78)	6 (100)
Other	36 (8)	6 (9,23)	2 (0,34)	2 (2,90)	42 (6,17)	19 (20,65)	2 (3,92)	2 (33,33)
Total Statements (N)	***450***	***65***	***592***	***69***	***681***	***92***	***51 (25,49)***	***6***
NR (% of N)	166 (36,89)	-	39 (6,58)	-	170 (24,96)	0	13	-

Forest fires as an issue is the one in which the use of communication tools in the statements was more relatively more frequent, as percentage of statements in which no communication tool was found (or was not recognized) was the lowest of all three issues on both levels (no more than 7%). This was mainly due to the use of descriptions in the statements found: more than 84% of the statements found made use of this particular tool). Additionally, history as a communication tool was often used to refer to fire events occurring in the past as a way to compare to present fire events, as well as in reference to the behavior over time of specific tree species after fire events. This type of tool was found in a little less than 20% of all the statements.

The least frequent communication tool found in the statements was a tool associated with the media, namely metaphors. In four statements (0,68% of statements) was this tool found and was mainly used by the authors of the articles in their statements (3 of the four statements corresponded to the authors statements).

> "*Eucalyptus is not only the Universal Australian, it is the ideal Australian – versatile, tough, sardonic, contrary, self-mocking, with a deceptive complexity amid the appearance of massive homogeneity; an occupier of disturbed environments; a fire creature*" (Pyne 1992 in Attiwell, 1994)

The previous is an example not only of the use of metaphors in the scientific articles (comparing *Eucalyptus* to an Australian with specific Australian characteristics) but also of symbols (using the species as a means of exemplifying the characteristics of the Australian bush, as well as a fire creature). This is the one example of a metaphoric citation used by the authors of the scientific papers. All other metaphoric references are specifically made by the authors of the papers.

The use of symbols is much more intense than that of metaphors. In total symbols were used in little over 3% of the total statements. On the contrary to metaphors, symbols were mostly used by speakers other than the authors of the scientific papers, as 7 of the 20 statements where this communication tool was found corresponded to the authors. This could mirror the preference of authors to use statements of other speakers as a means of exemplifying their issues without having to incorporate themselves symbolic references in their statements.

For biodiversity the percentage of statements where metaphors where found is slightly lower than in forest fires (0,44%) but all contributed by the authors of the scientific articles. It is as well a rare tool used by scientists. Metaphors are here used, for example, by authors wishing to explain methods of analysis used to reveal interactions that might exist between species in a biological community: Martin and Eadie (1999, p.254) refer to how species are connected by

> "…*ecological 'rubber bands', the strength of which is dictated by the value of the correlation coefficient*".

Symbols are here as well found in a similar proportion of the statements than in forest fires: in over 3% of the total statements. But unlike in forest fires, the use of symbols in the statements of the authors of the biodiversity scientific papers is proportionally higher. The spotted owl (*Strix occidentalis caurina*) is used by Noss (1999) as a symbolic example of how indices to determine population declines, to specify the critical amount of habitat needed for persistence, or to monitor and assess programs especially for forests have been used either successfully or unsuccessfully. To emphasis results that they have presented, many speakers select a particular species and describe how the results they have shown can be seen through the characteristics of that particular species.

In climate change the use of metaphors is not at all practiced by scientists. This result requires some explanation. In all articles the authors made references to concepts such as 'greenhouse gases' or 'greenhouse effect' which might be considered as metaphors since these expressions are figures of speech which make reference to seemingly unrelated objects (greenhouses and gases). However, these are concepts that have long been incorporated in the scientific discussion regarding global warming or climate change and are thus not used as a particular mean to make it easier for the reader to understand certain concepts. Consequently, the decision has been made in this work not to code these cases as metaphors; this then being one reason why no metaphors were found in the scientific articles. Symbols, which were the second media tool examined, as well have no presence in the discourse on climate change. Climate change is then the issue which is least medialized of all three issues as there is no incorporation of the communication tools that are frequently used by the media in the statements of all speakers participating.

Most of the scientific articles in which this analysis is based on have been written with the objective to contribute to the information gaps that are present in the topic climate change and the role forests play in mitigating it. Authors present facts and results in order to contribute to discussions were scientific data is lacking or insufficient. They do so by describing their research results to extensive detail and, by doing this, they seem not to need specific metaphors or symbols that would help illustrate their results to the target audience of scientific literature.

On the national level the results show that speakers in the discourse do not make use in their statements of any of the two media-related communication tools. Authors prefer to use detailed descriptions of their concepts and historical references rather than exemplify concepts and situations through metaphors or symbols. One author makes use of paradigm ('Ecosphere') and educational references (environmental education as solution to problems) to illustrate how a social change led by man can determine the configuration of the environment and thus the different biological diversities present in it (Rozzi et al., 1994). Consequently, when in need of tools to clarify their points, authors make use of other types than those that can be considered purely medialized communication tools.

4.4.1.4.1. SUMMARY COMMUNICATION TOOLS

From the results of the use of communication tools in the scientific articles it is clear that the speakers in the scientific discourse on forests are not making massive use in their statements of tools which literature identifies as the ones which are preferred by the mass media in their reports (Weingart 2001; Nelkin 1985). In the issues of biodiversity and forest fires symbols are the most used tool of the two. These symbols are used to exemplify a specific situation that is being described in the article or as example of a specific issue authors of the articles wish to highlight therefore selecting citations which can be considered symbolic for the point at hand. As a result, if speakers are not making use of any of the two media-related communication tools then it can be concluded that medialization -measured through the use of these tools in the statements- cannot be confirmed for the articles here analyzed neither on the global level nor the national one.

4.4.1.5.POLITIZATION

As introduced in the theoretical section, politization speaks about how scientists become political actors in issues by naming -in their statements- responsible parties who are to blame for the problems faced. Medialization of science concerning this factor (politization) means that scientists in their statements have named responsible parties for the troubles faced by the forest. In the scientific discourse on forest science, the statements speakers have made regarding the issues are examined in order to identify if actors, specifically scientists, have politicize the issues in that they specifically name other parties as being the cause of the environmental problems –specifically forest-related problems- depicted in the discourse.

The results will be analyzed regarding the politization of all actors present in the discourse versus the politization of the authors of the scientific articles. When possible, examples regarding other actors will be incorporated to illustrate how different speakers name

different responsible parties (if they name them at all) as guilty for the problems faced by the forest.
Table 4.11 shows the results regarding the responsible parties that have been named as causers of the problems discussed in the scientific articles, classified according to the different issues and the different levels.

Table 4.11. Causers of problems named by speakers in global and national scientific articles (Source: own calculations)

Level / Issue / Causer	GLOBAL				NATIONAL			
	Climate Change (Total speakers 478)		Forest Fires (Total speakers 678)		Biodiversity (Total speakers 687)		Biodiversity (Total speakers 49)	
	All speakers (% of N)	Authors (% of N)	All speakers (% of N)	Authors (% of N)	All speakers (% of N)	Authors (% of N)	All speakers (% of N)	Authors (% of N)
Scientists	3 (0,98)	1 (1,37)	-	-	-	-	-	-
Administration	-	-	-	-	3 (2,14)	3 (9,67)	-	-
Government	1 (0,33)	1 (1,37)	-	-	-	-	-	-
Enterprises	1 (0,33)	-	-	-	2 (1,43)	2 (6,45)	-	-
Nature	205 (67,21)	45 (61,64)	386 (75,10)	56 (66,67)	96 (68,57)	18 (58,06)	11 (64,71)	1 (33,33)
Society	24 (7,87)	8 (10,96)	122 (23,74)	27 (32,14)	6 (4,29)	4 (12,9)	2 (11,76)	1 (33,33)
Single persons or communities	3 (0,98)	1 (1,37)	-	-	-	-	-	-
Other	68 (22,30)	17 (23,28)	6 (1,17)	1 (1,19)	33 (23,57)	4 (12,9)	4 (23,53)	1 (33,33)
TOTAL CAUSERS (N)	***305***	***73***	***514***	***84***	***140***	***31***	***17***	***3***
Speakers naming causers	*273*	*55*	*461*	*57*	*128*	*22*	*20*	*3*
None	205	10	217	12	559	70	29	3

Table 4.11 shows how many speakers were found who named causers and how many speakers did not make at all any reference to causers (rows 'Speakers naming causers' and 'None' respectively).

From the 687 speakers in biodiversity (table 4.8) only 128 of them named responsible parties for problems. Speakers in climate change mentioned in more than half of their statements responsible actors (273 of the 478 speakers blamed some sort of party). In the issue of forest fires over two third of the speakers present named for the forest-related problems some sort of responsible party (461). On the national level, from the 49 speakers appearing in discourse 20 of them named responsible parties. Consequently, it is in the issue of biodiversity which speakers compromise themselves the least in naming specific actors as causers of the problems, as this is the issue in which the proportion of speakers participating in the discourse less frequently name a guilty party.

Nature is the party mostly named by all speakers in their statements for all three issues on the global level and in biodiversity on the national level. For all speakers, nature is blamed more than 67% of the times speaker name any other responsible party of problems. Variations on the actors blamed after nature are found within the topics.

In climate change the second most named responsible party is the category 'others' which groups both different activities (which are not identified with a particular actor by the speakers) and a low percentage of actors that have not been coded through all other categories. As an example of responsible parties named, forest management or forest activities (forest fertilization, fire management, amongst others) which alter the capacity of forests to uptake carbon dioxide and thus make difficult the contribution of forest in tackling the problems of climate change (Murray et al. 2000) or tropical deforestation which is a source of greenhouse gas emission (Fearnside 1997) are both examples of how speakers (in this case the authors of the articles) put the blame of contributing to climate change on activities which relate to practices carries out in the forest. The practice of identifying activities as inciting problems related to climate change is something that is done mostly by the scientists which either authored or were cited in the scientific articles analyzed. The participation of other actors, such as speakers belonging to the administration, mainly concentrates on blaming nature as the responsible party of problems. As a reminder, speakers belonging to the administration participated 17 times in this issue. From these 17 speakers nine of them assigned blame to either nature or an activity. They seem not to compromise themselves in naming specific parties as causers of the problems. The same is true for international organizations, were 14 speakers participate and only five of them mentioned some sort of nature or some other sort of responsible party as the cause of certain problems.
Interesting to note is that scientists appear as causers of certain problems in climate change. This is the only issue in which this happens. Actors who name scientists as causers of certain problems include scientists themselves, the Intergovernmental Panel on Climate Change and other actors. For example 'academic research' (which is undergone by scientists) is named as a restrictive factor to foster integrative work which integrates different disciplines in order to improve models which can help diagnose present climatic conditions so as to deliver sound data to the discussion on climate change (Waring, 2000). Another example blames the scientific community (scientists) for not being able to reach agreement on whether forest clearing leads to a significant soil carbon loss in tropical forests and thus hindering solutions steps that could be taken to mitigate the possible loss of carbon (Fearnside, 1998) .
From table 4.14 speakers in the scientific discourse on forest science relating to climate change do not politicize the issue by naming specific responsible parties as causers or contributors to certain problems. Three fourths of the times causers were named, 'nature' or 'society' were pointed as guilty parties. That speakers name 'nature' or 'society' as causers does not speak of a politization of the issue, as these parties are not as tangible entities as politicians or enterprises, in the sense of being able to respond to such accusations. Both these parties cannot react to being singled out as guilty parties for the problems faced by the forest: these actors have no way of 'speaking back'.

For forest fires this is even more the case. The low differentiation of actors (number of different speakers) which participate in the discourse naming responsible parties can be appreciated in table 4.8. The few different types of speakers that participate in the discourse assign blame to parties which cannot participate in discourse themselves, namely nature and society. There are few cases in which other parties for example, logging activities which provide ignition source for forest fires (Long et al. 1998) or increased fuel material which allows ignition of fires and the faster propagation of fires

(Brown and Hebda, 2002). The media is included as a speaker in one article. It would be expected that the media politicize the issue by naming a specific party; as, if this was done in, for example, newspapers it would have more news value than topics in which no politization is present. The media here is an almost irrelevant actor (only one speaker) and their statement assigns blame to nature. Specifically, the media blamed 'El Niño' for the record burnings with nearly 5 million ha of forest and shrubland in Indonesia and Brazil in 1997. Consequently, even the media here is not politicizing its statement. Considering these results, this issue is as well not politicized by the actors that take part in discourse.

Table 4.14 also illustrates speakers and the statements they make in the global scientific articles on biodiversity. Remembering table 4.8, there were a total of 687 speakers in the discourse distributed through a low variety of different actors (issue with the least variety in actor participation). From these, a total of 128 raised their voice to assign blame to certain party, not even one fourth of all speakers. Scientists, administration, and other actors (one non-governmental organization and some speakers which were not recognizable: from table 4.8) were amongst those who participated in the discourse (no speakers from the political sector or enterprises participated). From the participating speakers, it is mostly scientists who utter statements which assign blame to a specific party. However, from the total scientists participating (664) only 127 of them did mention some responsible party (almost one fifth of the total scientists participating). This speaks of the lack of politization that scientists charge their statements with. Those scientists who do assign blame most frequently name 'nature' and 'other' parties.
The administration is the only other speaker that assigns blame. However, from the 19 actors belonging to this sector, 18 of them remain silent about the responsible of biodiversity-related problems. The other speakers found in the discourse (other and not recognizable categories of table 4.8) are silent regarding who is to blame on, for example, the extinction faced by the different biological species. In this case the speaker representing forest administration concluded that the management practices which are adopted are responsible for 'profound' effects on the biodiversity of a habitat (Kerr, 1999). These results as well speak fervently of the non-existence of politization of the issue of biodiversity on the global level.

On the national level table 4.14 showed that almost half of the speakers present did not utter statements where different parties were named as causing biodiversity-related problems. Of the 20 speakers who uttered statements where problems were assigned responsible parties, 'nature' and 'society' were the ones with the most utterances.

4.4.1.5.1. SUMMARY POLITIZATION

. Politization as a factor which gives evidence for the medialization of science (introduced in the previous theoretical chapter) sustains that -in view of the societal conditions faced by scientists (lack of financial resources, need for legitimation)- scientists choose to become more involved in political discussions, or to become more political, in that they assign blame for the problems faced by the environment (in this case the forest) in order for their statements to gain in 'news values'. If scientists assign blame, more attention is suppose to be shed on what they are stating and perhaps by this they gain necessary attention. If they do not politicize their statements it might be a sign that they are being

careful because they specifically do not want to damage the relations or contacts that they have with those that can be of relevance for future support –in the case that these were really responsible parties. With the results presented in this section, it is clear that the speakers in the scientific discourse on forest science do not use this medium as a way of becoming 'political' by naming parties as responsible for the problems discussed by the scientific community in their formal channel of communication. From the data shown previously the conclusion is reached that no politization occurs in the scientific discourse on forest science, and thus no evidence to further ratify medialization can be found.

4.4.2. MEDIALIZATION IN GLOBAL MASS MEDIA DISCOURSE

Scientific discourse on forest present in the mass media can be examined for both levels of analysis, namely, for the both the global as the local or national level. The results for each of the medialization factors will be here on presented for the global level. National level will be treated afterwards.

4.4.2.1.EXTENSIVENESS

As in the scientific discourse on forest in the scientific sphere, the extension of the three issues will be examined through the variation in time of the number of articles published in the media for each of the issues selected. The existence of extensiveness will be indicated by the increase in the number of articles published by the global media on each issue.

If the total number of articles is considered for the time frame (summing articles for all issues) a slight increase in the number of articles published from the beginning of the period analyzed related to forests can be observed. Table 4.12 shows this result. From two articles covering the issues in 1994 the media attention increased to 15 articles in 2003. The first mayor increase in the media attention was found in 1997; mostly due to the increment in forest fires articles provoked by the fires occurring in Indonesia that year (19 articles can be found this year). The following year the media attention dropped slightly, to 17 articles, but was once again marked by the consequences of the fires occurring in Indonesia.

Table 4.12.Total number of global media articles from 1994-2003 (material source "EQMGW"; own calculations)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	*TOTAL*
N	2	8	1	19	17	8	13	18	18	15	***119***

After the year 1997, the number of articles found dealing with forest science, or science dealing with forest-related issues, was maintained relatively stable. A drop in the attention of the media was found in 1999, but otherwise, from 1997 onward, more than 13 articles per year were found. Following this result, the extensiveness assumption cannot be either confirmed or denied because the total number of articles for these issues is low. When comparing these number to, for example, the total number of articles dealing with "climate change" (not restricted to news related to forest issues) the low importance that

the media gives forest related topics can be seen. For both the global media analyzed (Time Magazine and the International Herald Tribune) 625 articles were found for the same time period[64]. Consequently, for the sole issue of climate change over 19% more articles were found than all three analyzed forest-related issues together. This is then evidence for the low media attention to the subject forest, and the science related to it, as a news issue. As a whole, the extensiveness of the issues cannot be confirmed. However, differences may arise when examining the issues separately.

Figure 4.22 shows the distribution of the articles for each issue in the global media. The contribution of the forest fires articles and climate change to the total amount of articles found for the period analyzed can be seen. The figure confirms that extensiveness for any issue cannot be confirmed. The media attention goes back and forth on both climate change and forest fires and is less attentive to biodiversity.
The peaks regarding the forest fires issues are a consequence of the fires starting in Indonesia in September of 1997, which carried grave consequences not only for that particular country and its' population, but for neighboring countries and the global environment as well. The occurrence of the fires prolonged into 1998 and with them the discussion of the consequences of the fires. The fires occurring in 1998 are then the reason for the prolonged media attention to the issues related with forest fires. The increase of reports in the years 2002 and 2003 are consequences of attention paid by the media to fires occurring in the United States and Canada and their far reaching consequences such as, necessity of local legislation or the ecological damages caused.

For climate change, there seems to be an increase in the total number of reports, this issue having three distinct peaks. First in 1995 an increment on the attention of forest and climate change was due to the first major conference on global warming since the Earth Summit in Rio de Janeiro in 1992 taking place in Berlin, as well as a report published by the United Nations claiming evidence of the occurrence of global warming and the consequences of it for, amongst others, forests. A second peak is observed in 1998 which is due to reports that relate the forest fires occurring in the Asian region, their consequences to the emission of carbon dioxide and its' contribution to global warming. These reports speak of the intertwinement of the two issues and their relevance for the global environment. The highest peak is observed in 2001 year in which debates occur on the possibilities to off-set carbon emissions –especially through forests as carbon sinks; advances of countries to reduce carbon emissions; the negative of the United States to ratify the Kyoto Protocol; as well as reports on evidence of global warming throughout the Earth. The focus of these articles is presenting solutions to global warming, and especially on the role of the forests in helping mitigate climate change. As time has advance this topics has become more present in the media debates, thus giving slight evidence of the extensiveness factor of the medialization phenomenon.

[64] Searched was done using LexisNexis and search function in www.time.com.

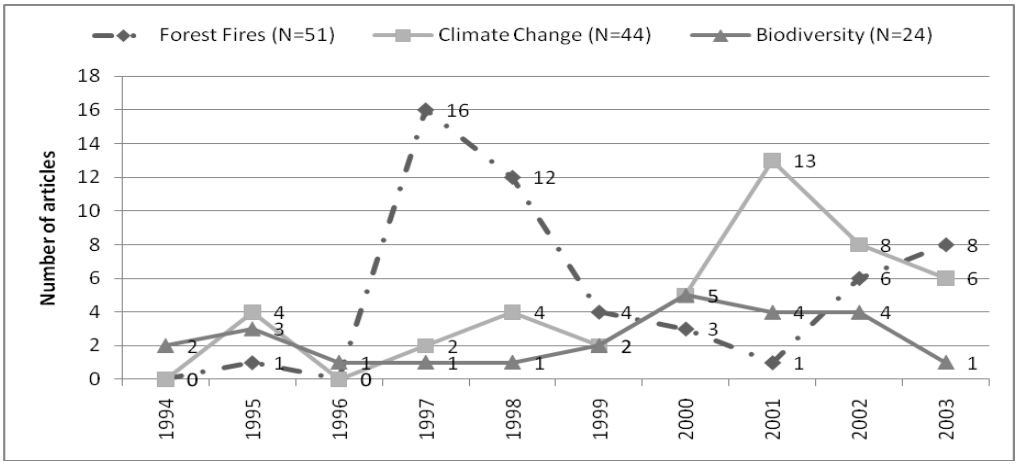

Figure 4.22. Number of articles throughout 1994-2003 for the three global issues (material source "EQMGW"; own calculations)

Biodiversity, on the other hand, is the one subject in which media attention seems not to vary much. Aside from one notable peak in the year 2000, no great variation as with the other two issues is observed. This is noticeable since biological diversity is an issue which, in comparison to climate change, has been longer on the agenda (especially since the Earth Summit in Rio de Janeiro in 1992). It seems that, even though biological diversity is an issue which is every single year present in the media, it is not one that is easily related to forest science, or science in the forestry field. Specifically, the issues of biodiversity that opens the door for news featuring science related to forests, report on the loss of species that are found in a forest habitat and what can be done to avoid this (this is especially the case for the year 2000). This result might be caused by a strategy of the media to report on biodiversity from other perspectives (other than scientific perspectives) or that when reporting on biological diversity no mention to forest or forest related science is made. However, the results leave open the door for interpretation. Thus, for this issue extensiveness must be denied.

Comparing these results to those found for the global scientific discourse on forest science differences arise. While in the scientific discourse all issues evidenced extensiveness in that the number of publications grew through time, in the global media discourse on forest science the extensiveness could only be slightly verified for the issue of climate change, especially starting in the year 2000.

For the issue of forest fires, the extensiveness of the media discourse could not be denied nor confirm, as the media coverage grew a great deal when a catastrophic event took place, but drop sharply when no such event took place. The difference between the two discourses, in this case might be explained if the topics discussed in each of these spheres are considered. While the scientific discourse on forest fires centered its articles on fires as a management option, or as events which influenced the present composition of forest ecosystems, the media discourse centered its coverage on studies regarding causes, damages, and the impact on climate change; topics of discussions that do not have many similarities without which it might be understandable that no coincidence of their evolution through time, in terms of more coverage, might be found.

Finally, for the issue of biodiversity where in the global scientific level a clear increase in the article publication was seen, on the global level of the media no increase in coverage can be found, thus denying the extensiveness for this issue.

For specific coincidences or dissimilarities of the issues between these two specific spheres a frame analysis, different points of views presented in the articles, of the issues is a relevant topic of research that might be in future pursued.

4.4.2.1.1. SUMMARY EXTENSIVENESS

For the global media discourse on forest science the previous results have shown that depending on the issue, evidence for the medialization of science may or may not be found. While medialization was found for the issue of climate change, it could not be confirmed or denied for forest fires, and it was denied for the issue of biodiversity. Compared to the global scientific discourse coincidence on the existence of extensiveness was only found for climate change.

4.4.2.2.PLURALIZATION

Turning the attention to the second medialization factor to be examined, table 4.13 was constructed. This table shows that the global media discourse on forest science, or science relating to forests, is characterized by the presence of a variety of speakers. Eleven different classifications were found which describe who speaks in the mass media. Amongst the actors incorporating their interpretation patterns in the discourse are scientists, politicians, administration, enterprises, non-governmental organizations (NGOs), international organizations such as the United Nations, the World Bank, Food and Agricultural Organization, other organizations for example museums, single persons or communities, as well as experts. The media is as well a speaker in the discourse. As Krumland (2003, p.93) has noted, the role of the media is not as producer of news or reports but comes to be a speaker as a consequence of introducing the news or reports, as well as the groups of actors speaking and their interpretation patterns. The media brings their interpretation patterns in the discourse not only through these introductions but as well in sections like editorial or opinion pieces.

The results of table 4.13 show that no one group of actors clearly dominates the discourse. Scientists are the speakers that appear most frequently in two of the three issues namely, climate change (on third of all speakers) and biodiversity (one fourth of all speakers). In the articles on forest fires, scientists are the third most important group after the administration sector and the media. This result might reflect that when forest science -or science relating to forests- is included in the reports of the media, scientists and their interpretation patterns are given priority as speakers by the media or that this is a topic which more frequently appears in the media when scientists have something to say about it. There is also an important presence of administrative actors in the discourse on forest fires and climate change, more so than politicians. For forest fires this is an understandable result as the administration sector of a country is usually the actor who is in charge of giving status reports on the extent of fires and on the damages caused by them. This might also indicate that politicians do not see these specific topics as 'political' enough in the sense that they have a big resonance with the public or are the center of important societal discussion (as for example the topic of stem cell research has been) and so their involvement is kept in range.

Table 4.13. Distribution of speakers in the global mass media discourse (material source "EQMGW"; own calculations)

Speakers	Forest Fires		Biodiversity		Climate Change	
	n	% of N	n	% of N	n	% of N
Scientists	41	15,13%	28	25,45%	83	33,60%
Politicians	7	2,58%	1	0,91%	10	4,05%
Administration	51	18,82%	7	6,36%	26	10,53%
Media	49	18,08%	17	15,45%	32	12,96%
Enterprises	4	1,48%	3	2,73%	16	6,48%
NGOs	4	1,48%	24	21,82%	13	5,26%
International Organizations	7	2,58%	7	6,36%	23	9,31%
Other Organizations	35	12,92%	4	3,64%	16	6,48%
Single persons or communities	36	13,28%	10	9,09%	11	4,45%
Experts	21	7,75%	5	4,55%	7	2,83%
Other	16	5,90%	4	3,64%	8	3,24%
Not Recognizable	0		0		2	0,81%
TOTAL (N)	***271***		***110***		***247***	

For biodiversity, the second most frequent actor is non-governmental organizations: a little more than one out of every five speaker belongs to this group. The participation of NGOs in the discourse is mainly as advocates for biological species that are in danger of becoming extinct; raising their voices to proclaim preservation efforts in order to save the species and the forests they live in. The larger participation of NGOs in the issue of biodiversity might have something to do with the type of issue being considered and the instrumentalization of it on behalf of the interests of non-governmental organizations, such as ones oriented to the protection of species. Generally, the public relations activities of these organizations are much more experienced than, for example, scientists- in dealing with the media and the public in order to get their points of view or messages across.
For both forest fires and biodiversity the presence of different actor groups other than scientists indicates a pluralized discussion of the issues. The participation of administration, NGOs and other actor-groups assure that the issues incorporate different points of view.

For climate change the existence of pluralization is not as clear. The presence of scientists in this later issue is most noticeable in comparison to other actors (one out of every three speakers). The second and third most frequent actors participating in discourse are the media with 12,96% and administration 10,53%, a difference of more than 20% with scientists. In the previous two issues, the difference in participation between the leading actor group and the following groups was not as pronounced as the difference observed in the climate change issue. For example, for forest fires the difference between the top three participating actors amounted to little more than a three percent difference, which is as well the difference for biodiversity between scientists and the following more participative actor NGOs .This could be due to the fact that the media still see climate change, and its' relation to the forest, as a more or less 'pure' scientific issue, and thus

when reporting about it they seek the participation of those with scientific knowledge, namely scientists.
Forest fires on the other hand may not be seen as 'scientific' as climate change; as the proportion of scientists participating in this issue is less than half the proportion of scientists participating in climate change. The media coverage on forest fires as an issue which is not as 'scientific' as climate change may also be confirmed by the higher participation of actors such as single persons or communities which give details on the damages and consequences they have suffered because of these negative events. The coverage of forest fires might be seen as more personalized in the sense that it focuses on the effects the events have on individual persons and their everyday lives or the opinions of these persons. While the issue climate change may be seen as one in which not the individual effect of the events is 'news worthy' but the scientific information relevant for the discussions.

Another relevant result is the participation of international organizations such as the United Nations and the World Bank. Their participation is highest in climate change and lowest in forest fires. This result speaks of the political relevance on the global level of the issue climate change and the local perspective of an issue such as forest fires. For climate change, on the one hand, the relevance of international organizations such as, and especially like, the United Nations is reflected as these organizations try to provide framework for international processes regarding combative measure on global warming. The participation of single persons and communities well indicates, on the other hand, the locality of the issue of forest fires and the global political relevance of the issue climate change; being the participation of this actor group the highest in the forest fires issue (13,48%) and the lowest in climate change (4,45%).

The participation of enterprises is more related to the issue climate change than the other two. 6,48% of the speakers are representatives of enterprises. Amongst actors belonging to this group are representatives of insurance companies who see the consequences of global warming in the evermore higher occurrence of extreme events:

> *"[T]here have been strong, strong catastrophes in all ages, what we see clearly is that changing in global climate warming would change the velocity of events. Extremes get more extreme and the frequency changes. An extreme we used to see once every 10 years, we now see every six years or eight years.*" (IHT 2001)

Other representatives of enterprises see that the reduction of emissions as a business strategy that must be internalized by the enterprises:

> *"This isn't an act of altruism," … "It's a fundamental strategic issue for our business.*", (IHT 2001)

Additionally, there are those enterprises that favor the planting of trees as mitigation of carbon dioxide emission that are released because of flights, as one representative of an enterprise illustrates when paying others to plant trees for every 1,500 'passenger miles' its employees fly:

> "*It's part of our program to minimize our impact on the environment … The cost is minimal, and we create enormous good will*" (IHT 2003)

From all speakers enterprises along -and to a lesser extent- international organizations are the only speakers in the issue of climate change that somewhat increase their participation through time. For example speakers from enterprises participate in three of the 10 years examined. Their participation is shy in the years 2000 and 2001-only one participant in each of the years- and explodes to seven participants in the year 2003. This is mostly related to the discussion of forests as carbon sink and the opportunity this presents for them. International organizations participated in the earlier years analyzed (1995, 1997, and 1998), were silent until 2001 where seven participants spoke, and drop a bit in the year 2002 (with five speakers). Their participation was associated with the Kyoto Protocol and the mechanisms it established for mitigating greenhouse gases emissions.

For the other issues, only in forest fires a particular increment in the number of scientists participating in discourse can be observed. Particular, because their participation increases in the years 1997-1998 and 2001-2003; which are the years in which specific catastrophic fires in Asia and Brazil were occurring.

4.4.2.2.1. SUMMARY PLURALIZATION

From the previous results and discussion it is clear that the pluralization of issues regarding forest science –or science relating to the field of forestry- is taking place. This is specially the case for both biodiversity and forest fire issue but a bit less evident for the climate change issue.

4.4.2.3.CONTROVERSY

In the previous section it is clear that the media discourse is more open to the participation of different types of actors when dealing with the issues relating to the forest than the scientific discourse on forest science was. According to Schäfer, this wider participation implies that the scientific topics will be discussed in a controversial way since the inclusion of many actors and their interpretation patterns assures that the issues will be dealt with in different, and sometimes contradicting, ways. Controversy will be here said to be present when a balance between the different assessments –either of the event or of speaker's statements- is seen. Particularly controversy is present when none of the three different assessments (positive, negative, or ambivalent) reach over one third of the total assessments. Thus, controversy will be absent when a majority of one assessment is observed, and the sum of the other two types of assessment does not reach over one third of the total assessments.

The starting point of the analysis of whether controversy is present in the media discourse is to examine how the events that are being reported on are portrayed in the media. For this, figure 4.23 has been constructed.

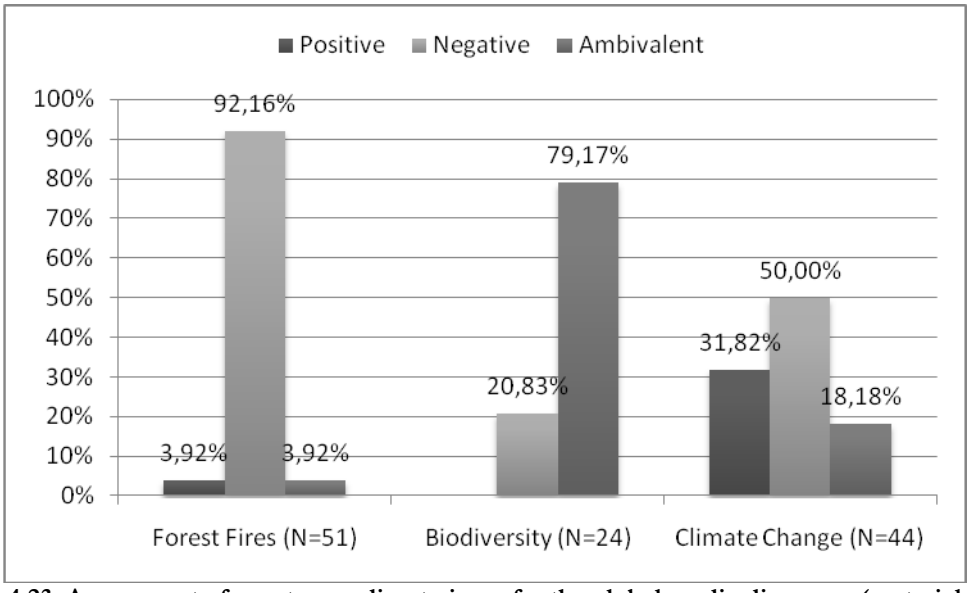

Figure 4.23. Assessment of event according to issue for the global media discourse (material source "EQMGW"; own calculations)

From the figure, differences between the issues can be observed. For forest fires, it is very clear that negative assessments of events were in place: 92,16% of all events were negative, with a very small proportion of events being reported on either positive or in an ambivalent form. Example of a negative event are reports on forest fires occurring in Indonesia in the year 1997 which brought on negative consequences not only for the country but for its neighbors as well. Therefore this issue is not controversial, as there is one dominating type of assessments (and the sum of the other two types does not reach over one third of all assessments).

Biodiversity is as well an issue where controversy is absent. Almost 80% of the events are presented in an ambivalent way. Negative events are as well present, however in a small proportion of 20% of all events covered; proportionally more so than the forest fire issue. The small proportion of the negative events covered does not reach the limit set from controversy to be present, namely the one third of all assessments, the lack of events associated with positive assessments further confirms this. Therefore, in this issue events are portrayed mostly free from value-related judgment (or in a scientific objectively manner), which derives in controversy not being present.
An example of an event assessed as ambivalent, is the report on the Galapagos Islands and its richness of species which has been the object of conservation efforts throughout the years. The article portrays the information observing a balance between negative and positive statements, but mostly it portrays information in a value-free manner; which might be considered similar to how scientists in their scientific publications deal with the description of biological species present in a specific area.

> *"The archipelago's 15 main and 106 smaller islands are dotted with the volcanoes that gave birth to the Galapagos more than 3 million years ago; some are still active. Opuntia cactus, spiny acacias and palo santo trees have taken root amid the hardened lava of the lowlands. On some of the largest islands, the higher elevations have patches of dense, moist forests dominated by Scalesia trees, which are giant relatives of sunflowers, and by giant ferns."* (Referring to the Galapagos as a unique ecosystem were biology

> and geology have gone to bizarre and instructive extremes, TIME 30.10.1997)

There is, however, a presence of events which highlight dangers for biodiversity. Example of how an event is negatively covered is the inclusion of statements found below which in this particular article is part of the dominating negative statements that were found describing the event:

> *"Already the Nagarahole tigress is not free. If she hunts during the day, she may run into a carload of tourists, cameras clicking. At night, it may be poachers, guns blazing. Once the rulers of their forest home, she and the park's 50 other tigers are now prisoners of human intruders."* (28.03.1994, TIME)

For climate change some controversy can be observed. Even though 50% of all events are negative, the presence of positive events reaches more than 30% of all events. Leaving the ambivalent assessment with 18,18%. The joint presence of ambivalent and positive events surpasses the limit set for denying controversy, which is then the reason why controversy in the event assessments for this issue can be confirmed.
Negative events include reports on evidence found that human activities are responsible for the increase in greenhouse gases emissions and which has consequences for the environment:

> *"A change in temperature might have serious consequences. Global warming could cause a rise in sea level that would flood coastal lowlands, an increase in weather extremes and damage to forests and croplands. Forestalling truly severe damage might well warrant action to slow the emission of greenhouse gases by reducing the world's reliance on fossil fuels. But that would be a wrenching, costly process that few political leaders are eager to undertake absent compelling evidence that human activities really are driving world temperatures toward dangerous levels." (IHT, 19.09.1995)*

The previous extract names 'serious consequences', 'damage to forests and croplands', and 'wrenching, costly' process which do not find acceptability in political leaders, all examples of negative connotations on how an event is being covered.

The previous result has shown that whether an issue is controversy or not depends on which issue is being presented. For forest fires and biodiversity no controversy in the media reports are found. For climate change further result must be taken into consideration before any conclusion can be reached on the controversy of the issue. This first view into controversy delivered evidence of controversy only in the issue of climate change. A deeper analysis would give further evidence of whether controversy is or is not present. For this purpose the statements of the speakers, for each issue, will be examined in order to make more clear whether there is controversy in the global media discourse surrounding each of these issues.

Figure 4.24 shows the distribution of the assessment of the all the statements found in the articles for all issues. Controversy regarding the assessment of the statements speaker make will be said to be absent when there is a clear domination of one type of assessment and the sum of the other two do not reach over a third of all assessments. From figure 4.24, and according to the definition set of when controversy is absent or present, there is no one issue which is free from controversy in the statements of the speakers. In each one of them there is a majority of one statement assessment, but the sum of the other two reaches levels of over one third of all statement assessments.

Forest fires seem to be an issue in which statements are controversial. In over 57% of the statements, speakers address the issue in a negative way. However there is an important participation of actors uttering their points of view or information in an ambivalent way: every third speaker assesses the issue in an ambivalent way, in comparison to every second speaker assessing the issue negatively. This is a different result than the one found when examining the event assessment. The event assessment was in more than 92% of the cases negative; which gave evidence of the absence of controversy,; but the speaker statements is only negative in 57,56% of the cases and is accompanied by both ambivalent (over 30%) and positive (over 10%) assessments.

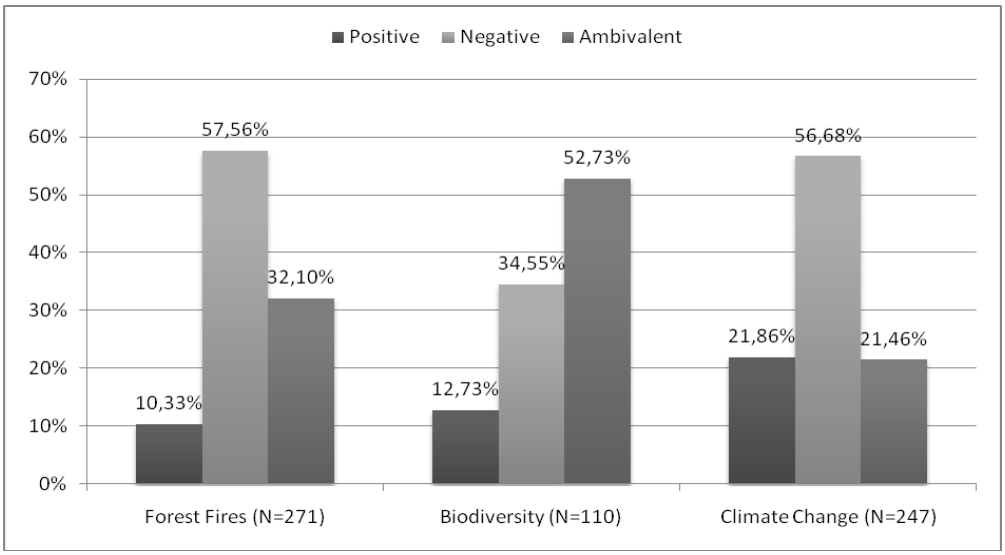

Figure 4.24. Assessment of all speaker statements for each global media issue (material source "EQMGW"; own calculations)

By taking a closer look at the speakers participating in the discourse and their particular statement assessment it is clear that all actor groups, except the media and international organizations, assessed the forest fires issues being discussed in a negative way (table 4.14). The media and international organizations favored an ambivalent way of discussing. The media here fulfills a role of information transmitter without judging what is being discussed which is as well done by international organizations (61,22% and 57,14% respectively). Two of the most frequent speakers, administration and scientists, give their statements mostly negative connotations. For each of these actors the presence of ambivalent statements is not an insignificant amount which, added to the positive statements that are uttered, give base for concluding that the issue is as well controversially discussed within a same group (as the sum of the two remaining assessments is more than one third of all assessments). For scientists, controversy is then present as the negative assessments are majority but there is an important participation of

the ambivalent statements (over 41%). This represents a change when considering the global scientific discourse on forest science. As figure 4.19 and 4.20 showed for this particular issue over 98% of all author's statements were ambivalent as was the case in over 80% of the statements of the remaining speakers, clearly giving evidence of the lack of controversy in the statements. This change from ambivalent way of uttering statements to a possible controversy of statements might be a consequence attributed to the medialization of this particular issue.

For biodiversity, where the assessment of the events were mostly negative, ambivalent statements were the majority: over half of the statements found were uttered ambivalent. Every third speakers, however, uttered a negative statement and the remaining 12% of the statements were considered positive. The presence of these two other type of assessment –which surpass the limit here set as to when controversy is absent- make it clear that controversy is present in the statements. That ambivalent statements are the dominating majority, is mostly due to the dominance of this type of assessment in the statements of groups like: politicians, administration, enterprises, international organizations, and other organizations (see table 4.14). For these groups controversy was absent in their statements, as the presence of both positive and negative statements never represent more than a third of all the groups' statements. The statements of experts and 'other' speakers in this issue, as well lack controversy; they participate mostly with negative statements (80% of the experts' statements and 75% of the other statements, from table 4.14).
Controversy is explained in this issue particularly by the statements of scientists and the media. Scientists included in the issue biodiversity do not only choose to utter ambivalent statements that can be considered in touch with their 'scientific objectivity'; as in almost two thirds of their statements no assessments were found, or their statements were marked by a balance of both positive and negative aspects. But they also utter positive and negative statements that summed equal to more than a third of all statements. Therefore, compared to their participation in the scientific global discourse they do not remain objective. Careful consideration must be given to this result, as it would seem to emphasize that medialization as seen through the assessment of the statements of scientists would exist. Even though scientific objectivity, as seen in the scientific sphere, may be question, the heterogeneity of the articles analyzed give basis for not concluding that this result reflects the medialization of the statements of scientists in the media arena. The media as well contribute to the existence of controversy, as its statements reflect a balance between on the one hand ambivalent statements, and on the other negative and positive statements.

From figure 4.23 controversy in the event was confirmed for climate change, since negative events were 50% of all events but positive and negative events were present reaching together over one third of all event assessments. Figure 4.24 shows that negative assessment of the speakers' statements were the majority with 56% of all statements. However, there is a balanced participation of both positive and ambivalent assessments which give evidence of controversy (since added together they represent more than one third of all statements). Table 4.14, regards the distribution of the speakers and their statement assessments and shows that different groups of actors have different appraisals of the issue, which then further speaks in favor of controversy. The only group in which the combination of the two assessments -that are not the majority- does not surpass one third of all statements is scientists. They utter their statements mostly charged with

negative judgments. Negative statements on the part of scientists focus on the risks predictions that will come true if climate change is not stopped:

> "*Entire ecosystems could vanish as rainfall and temperature patterns shift. Droughts, floods and storms could become more severe*" (TIME 02.10.1995)

Ambivalent statements that scientists make are characterized by the delivering of scientific information or beliefs on climate change, without attaching any values to it:

> "…(scientist) *believes that rising concentrations of greenhouse gases are already beginning to have an impact on another important cycle, known as the North Atlantic or Arctic Oscillation.*" (TIME 10.04.2000)

Looking at the participation of the other actor-groups (table 4.14) it is clear that the controversy of this issue is explained because of the controversy within particular groups. Noticeable is that representatives of enterprises discuss the issue mostly in a positive way. This is because they highlight climate change and the mitigation strategies as business opportunities and as strategies that favor the image of the companies. However, there are representatives of this group which find that their worries and efforts lie and should be focused elsewhere and not on mitigating carbon dioxide emission, translating in an ambivalent statement:

> "*We are extremely focused on financial survival, … CO 3/4 emissions are not something we have time for to think about*" (IHT 28.02.2003)

For this issue, coincidences between how scientists uttered their statements in the global scientific discourse and in the global media discourse are found. In the scientific sphere, scientists behaved objectively in their statements in that they presented facts and results without attaching judgments to them. In the media discourse, even though controversy was found for the event level and the general statement level, scientist still uttered statements without controversy. However, they changed from ambivalent utterances to negative ones, mostly associated with the transmission of risks associated with climate change.

Table 4.14. Assessment of speakers' statement in the global media discourse for each issue (material source "EQMGW"; own calculations)

		Positive		Negative		Ambivalent		N
		n	% of N	n	% of N	n	% of N	
FOREST FIRES	Scientists	3	7,32%	21	51,22%	17	41,46%	*41*
	Politicians	1	14,29%	4	57,14%	2	28,57%	*7*
	Administration	13	25,49%	30	58,82%	8	15,69%	*51*
	Media	-	-	19	38,78%	30	61,22%	*49*
	Enterprises	-	-	4	100%	-	-	*4*
	NGOs	-	-	3	75%	1	25%	*4*
	International Organizations	2	28,57%	1	14,29%	4	57,14%	*7*
	Other organizations	2	5,71%	25	71,43%	8	22,86%	*35*
	Single persons or communities	2	5,56%	24	66,67%	10	27,78%	*36*
	Experts	4	19,05%	12	57,14%	5	23,81%	*21*
	Other	1	6,25%	13	81,25%	2	12,50%	*16*
	TOTAL	***28***		***156***		***87***		***271***

		Positive		Negative		Ambivalent		N
		n	% of N	n	% of N	n	% of N	
BIODIVERSITY	Scientists	3	10,71%	7	25%	18	64,29%	*28*
	Politicians	-	-	-	-	1	100%	*1*
	Administration	-	-	2	28,57%	5	71,43%	*7*
	Media	5	29,41%	5	29,41%	7	41,18%	*17*
	NGOs	4	16,67%	14	58,33%	6	25%	*24*
	Enterprises	1	33,33%	-	-	2	66,67%	*3*
	International organizations	-	-	1	14,29%	6	85,71%	*7*
	Other organizations	-	-	1	25%	3	75%	*4*
	Single persons or communities	3	30%	1	10%	6	60%	*10*
	Experts	1	20%	4	80%	-	-	*5*
	Others	0	-	3	75%	1	25%	*4*
	TOTAL	***17***		***38***		***55***		***110***

		Positive		Negative		Ambivalent		N
		n	% of N	n	% of N	n	% of N	
CLIMATE CHANGE	Scientists	7	8,43%	56	67,47%	20	24,10%	*83*
	Politicians	1	10%	6	60%	3	30%	*10*
	Administration	6	23,08%	14	53,85%	6	23,08%	*26*
	Media	8	25%	15	46,88%	9	28,13%	*32*
	Enterprises	9	56,25%	*6*	37,50%	1	6,25%	*16*
	NGOs	3	23,08%	8	61,54%	2	15,38%	*13*
	International organizations	6	26,09%	13	56,52%	4	17,39%	*23*
	Other organizations	7	43,75%	7	43,75%	2	12,50%	*16*
	Single persons or communities	2	18,18%	5	45,45%	4	36,36%	*11*
	Experts	4	57,14%	2	28,57%	1	14,29%	*7*
	Other	1	10%	8	80%	1	10%	*10*
	TOTAL	***54***		***140***		***53***		***247***

4.4.2.3.1. SUMMARY CONTROVERSY

The results presented in this section spoke of events where in two cases no controversy could be confirmed (forest fires and biodiversity) and one in which it was (climate change). The assessment of the speakers' statements showed that for all issues controversy was present. When considering only the statements of scientists, differences were found between forest fires –where controversy was present within the group of participating scientists- and biodiversity and climate change –were no controversy was present.
In the issue of biodiversity, scientists maintained their scientific objectivity so characteristic of their statements in the global scientific arena, but traded their 'objectivity' for a role as scientists warning of negative risks in the media articles dealing with climate change.

The results presented here are very much dependent on the limit set for when an issue is considered controversial in its event and in the statements that constituted it. The barrier of a third of all events or statements defined here as the limit to when controversy is or is not present can be contested and in future improved upon. However, for the results here it is sufficient to state that when there is a clear majority –for example of 98% as was the case in the scientific sphere- of one of the assessment types than no controversy is present. In all other cases such a strong result cannot be confirmed. Therefore ground is given to question the absence of controversy.

4.4.2.4.COMMUNICATION TOOLS

Extensiveness, pluralization, and controversy are not, however, the only factors that might determine whether a particular field of science is or is not medialized. Weingart and Nelkin have both gone further to explain that for an issue to be medialized strategies of the media must be incorporated into the communication strategies of the actors, in this case scientists, who are participating in the discourse. The most frequent media strategies used, and as explained earlier, are communication tools such as metaphors and symbols. If actors such as scientists make use of these particular tools in their statements -in comparison to the use of other communication tools and also in comparison to other actors- then further evidence of medialization can be found. Therefore, the communication tools used by speakers, and particularly by scientists and the media, are here examined.

Firstly, the number and percentage of statements where the different communication tools were used, is examined. This is shown in table 4.15. For forest fires, for a total of 271 statements, only 26 statements did not make use of any communication tools (9,5%), for biodiversity in 29 of the 110 statements no communication tool was found or recognized (26,36%), and finally for climate change, in 116 of the 247 statements found did not contain any communication tools (46,96%). The use of communication tools in the speaker's statements is variable, being climate change the one issue in which speakers in their statements made less use of communication tools, as this was the issue with the most statements not using any communication tool.

As a way for the media to transmit information to the public they make use of certain communication tools that appeal to the understanding of the general public. By using metaphors and symbols, the media simplifies complex information into more understandable concepts which can help laypersons better interpret what is being presented. If medialization of science is a reality, scientists in their statements would make use of these tools as they adapt their communication behavior to the rules and criteria of the media. This is why the number of statements using each communication tools found for all speakers (table 4.15), and particularly in the statements of scientists are examined (table 4.16).

From table 4.15, speaker statements using descriptions are the most frequent comparing to other communication tools for all issues: in all cases in more than 40% of the number of statements was this communication tool present. This is not a rare occurrence as situation and facts must be described in the articles for people to understand what is being reported (Nelkin, 1987).

Table 4.15. Number and percentage of statements using each communication tool found for all speakers in each issues (material source "EQMGW"; own calculations)

	Forest Fires		**Biodiversity**		**Climate Change**	
	Number of statements	% of N	Number of Statements	% of N	Number of statements	% of N
History	48	17,71%	11	10%	30	12,15%
Technology	39	14,39%	4	3,64%	13	5,26%
Metaphor	6	2,21%	12	10,91%	31	12,55%
Symbol	46	16,97%	5	4,55%	24	9,72%
Description	212	78,23%	75	68,18%	111	44,94%
Other	39	14,39%	19	17,27%	10	4,05%
Total Statements (N)	***271***		***110***		***247***	
Not Recognizable	26		29		116	

The use of metaphors by any actor is keep to a minimum in forest fires. Here, this particular communication tool was the least used in the statements (over 2%). For climate change the use of metaphors in the statements is in second place (12,55%) with a minimal distance to historical references which regarding the number of statements in the third most frequent communication tool used (12,15%), losing both to descriptions. In climate change, metaphors used by the media include for example:

"*rattling the sword of global sanctions*" (TIME 2001)

This illustrates that there would be political implications for the USA for not ratifying the Kyoto Protocol. For biodiversity statements using metaphors are as well the second frequent (10,91%, not considering the 'other' category which is an aggregation of tools such as myths, education, and paradigms). For biodiversity an example of metaphors used as communication tools can be found in the following statement:

> "*which is why, when I see a rain forest being bulldozed to make a few dollars for a logging company, I feel like I'm watching Notre Dame or the Louvre being hit with a wrecking ball"* (TIME, 1998).

These numbers then reflect that for the scientific issues regarding forests, metaphors are favored by actor in their statements when transmitting their information in both climate change and biodiversity.

Symbols -as references in the statements- are favored over metaphors in forest fires (16,97% over 2,21% respectively). Here, symbols are used to express the failure and frustration of actors regarding scarce resources to fight fires:

> "*This smoke ... is a reflection of my impotence.*" (TIME 1995)

or as a means of comparing the lack of interest in helping to combat fires and mitigate their damages:

> "*When there is an earthquake in Los Angeles or in Kobe, the whole world comes to the rescue and most of the people are already dead … But after weeks of haze -and people will die - where are the United Nations?"(IHT 1997*)

Metaphors are not as frequently used as symbols or history in the statements, but they do have a presence in the discourse.

> "*When … is in barker mode, he makes the brashest p.r. rep seem shy*" (TIME 1998)

The previous is an example of a metaphor used by the media to refer to how aggressive an individual representative of a non-governmental conservation organization can be when he needs to push the interests of his organization in climate change.

Historical references are preferred over metaphors and symbols in the statements of the speakers only in forest fires. For forest fires it is understandable since many of the speakers make references to how, over the years, forest fires have affected different geographical regions of the world, as well as comparing fire frequencies from different periods in time. A particular example is a report on forest fires brought about as a consequence of the 'El Niño' phenomenon and how scientists have been trying to construct a model that helps to predict weather conditions caused by this climate phenomenon:

> "*In trying to improve their power of prediction, researchers are building on a scientific investigation that began in the 1920s*" (TIME, 1998).

For climate change, reports on causes of the greenhouse effects find historical evidence because:

> "*In three decades the continent has lost half its forests. A third of its farmland has been eroded, salinized or otherwise made less fit for agriculture*" (TIME, 1997).

For biodiversity, the historical reference relate to how in previous times species were more abundant and to how in comparison, the species now a days are in danger of disappearing.

Technological references (mentions to technology or processes, for example how machines have altered the environment) are preferred to the media-related tool of metaphor only in the case of forest fires. Technological references used include, for example, references to geographical information systems that help keep track of the trajectory of forest fires and/or the damages produced by them.

When comparing the number of statements using the communication tools found in the global mass media discourse (table 4.15) to the number of statements of the communication tools found in the global scientific discourse (table 4.10) it is clear that the speakers in the mass media more frequently use in their statements the media-related communication tools of metaphors and symbols. This is especially the case in climate change where in the mass media discourse both metaphors and symbols were used in the statements where as on the global level they were absent. In biodiversity and forest fires, the number of statements found making use of these communication tools is as well proportionally larger than the number of statements found in the scientific arena which made use of both these tools. This of course may be mainly caused by the mass media as speaker in the mass media discourse, but might also be due to the participation of other actors in the media discourse, including scientists.

Table 4.16 shows the number and percentage of scientists, media, and non-governmental organizations' statements that made use of the different communication tools examined. If the proportion of scientists' statements which use media-related tools is similar to that of the media, this might be a first indication that scientists are adapting their statements to the criteria of the media. However, as media is supposed to make use of these tools in an extra-ordinary way (more than any other speaker-group) it also makes sense to compare the proportion of scientists' statements using these tools to that of other actor-groups which might be more experienced in dealing with the media, and thus might be more adapted to their criteria. This is why non-governmental organizations are chosen as a comparison group.

On the one hand, the communication tool most frequent to the statements of scientists is descriptions. In the issue of forest fires scientists in their statements make no reference to metaphors but they do to symbols, which were manifested in the same proportion of statements. There was also mention of technological references such the use of satellite images to improve weather forecasts and track the development of forest fires (IHT, 21.08.2003).
The metaphors found in the statements were mostly found in those statements which were made by the mass media, from the six statements where metaphors were used in this issue (table 4.15), five were media statements (table 4.16). Even though statements making use of metaphors and symbols by the media were found –they favored symbols to

metaphors-, proportionally to the other communication tools used in the statements, these were the lowest for this group of speakers.

The statements of non-governmental organizations show a different picture. As a proportion of the statements where communication tools were found, descriptions were the most frequent tool used, followed by a tie between technological references and symbols.

Comparing these three results, it would seem that scientists do adapt themselves to the use of media-related tools, specifically to symbols in the issue of forest fires. However, in order to state this, additional consideration must be given to the statements scientists uttered in the scientific arena. In the statements found in the global scientific discourse, a proportion of over four and ten percent of the statements of the authors of the articles (table 4.10) were found to be making use of metaphors and symbols respectively. Symbols were in this case favored over metaphors. In the case of symbols, this proportion of statements is slightly lower than the proportion of statements using the same communication tool in their statements in the media discourse (from table 4.16: 12,20%). In the mass media scientists only made use of symbols and did not use metaphors while in the scientific discourse they made use of both. Therefore, if the proportions are ignored, and only the presence or absence of both these tools in the statements of scientists is considered, then there can be no confirmation of the adaption of the statements of scientists to the criteria of the media, therefore no confirmation of whether medialization is or is not present can be given.

For biodiversity a slightly different picture is seen. In their statements, scientists use both metaphors and symbols. In comparison to the times their statements were charged with descriptions, however, these media-related tools were in disadvantage, being the statements of scientists in over 80% of the times statements were made by this actor group, charged with descriptions.
Metaphors are preferred by scientists over symbols in this issue. In the statements of the mass media, statements using metaphors and symbols are proportionally more frequent than scientists' statements using the same tools. Finally, in the statements of NGOs, the statements using these tools were proportionately less frequent: in only one statement metaphors were used. This comparison shows that, and considering the proportion of statements in which these tools were found for the three actor-groups, scientists adapt themselves to the criteria of the media but use them in a smaller proportion than the media does (as percentage of the total statements made by that particular actor-group). This would then give evidence that confirming medialization.

Looking at the statements of scientists in the global scientific discourse of forest fires (table 4.10) -particularly the authors of the scientific publications analyzed (scientists)- they incorporated both metaphors and symbols in their statements. This is different from what is seen in the statements of scientists in the media discourse. While symbols were used in both the discourses, metaphors were only used in the statements found in the scientific discourse. This could imply that scientists are making use of media strategies in their scientific papers however the evidence of this is still weak, therefore, scientists cannot be said to be adapting their statements to the criteria of the media. This as well would imply that their statements in the mass media are not contributing to the

medialization of science, as metaphors were not a tool used in their statements in the media discourse. However, the medialization of science also states that the effect of science adapting to the criteria of the media will be reflected not only in the media sphere but as well in science sphere. Thus the use of metaphors and symbols in the science arena could be an indicator of medialization, but as these tools were found in proportionally the lowest number of statements this effect cannot be confirmed.

Table 4.16. Number and percentage of scientists, media, and non-governmental organization statements using each communication tool (material source: "EQMGW"; own calculations)

SCIENTISTS	**Forest Fires**		**Biodiversity**		**Climate Change**	
	n	% of N	n	% of N	n	% of N
History	5	12,20%	3	10,71%	8	9,64%
Technology	4	9,76%	2	7,14%	1	1,20%
Metaphor	0	-	3	10,71%	4	4,82%
Symbol	5	12,20%	2	7,14%	6	7,23%
Description	34	82,93%	23	82,14%	40	48,19%
Other	5	12,20%	7	25%	2	2,41%
Total Statements (N)	***41***	***100%***	***28***	***100%***	***83***	***100%***
None	3		4		35	

MEDIA	**Forest Fires**		**Biodiversity**		**Climate Change**	
	n	% of N	n	% of N	n	% of N
History	25	51,02%	6	35,29%	15	46,88%
Technology	21	42,86%	1	5,88%	9	28,13%
Metaphor	5	10,20%	6	35,29%	21	65,63%
Symbol	11	22,45%	2	11,76%	12	37,5%
Description	48	97,96%	17	100%	28	87,5%
Other	26	53,06%	9	52,94%	5	15,63%
Total Statements (N)	***49***	***100%***	***17***	***100%***	***32***	***100%***
None	0		0		3	

NGOs	**Forest Fires**		**Biodiversity**		**Climate Change**	
	n	% of N	n	% of N	n	% of N
History	0	-	2	8,33%	1	7,69%
Technology	1	25%	1	4,17%	1	7,69%
Metaphor	0	-	1	4,17%	1	7,69%
Symbol	1	25%	0	-	2	15,38%
Description	3	75%	14	58,33%	4	30,77%
Other	0	-	2	8,33%	0	-
Total Statements (N)	***4***	***100%***	***24***	***100%***	***13***	***100%***
None	0		8		6	

Finally for climate change, once again statements were found in which scientists made use of metaphors and symbols; but once again –and in comparison with the proportion of statements making use of other communication tools- they are the lowest (except for technological references found in over 1% of the scientists statements). The media and non-governmental organizations, proportionally make more statements using these two media-related tools than scientists, especially the media. The proportion of media statements that made use of metaphors is almost two thirds of all the media statements, while the proportion of statements using symbols amount to over one third of all media statements. Thus, measured to these other two media-oriented actors, scientists would seem to be medializing their statements much less. But, considering the results of the use by scientists in their statements of the media-related communication tools in the scientific arena -where no statements were found where metaphors and symbols were used by the authors of the publication (table 4.10)- scientists and their statements in the media can be said to be oriented to the criteria of the media, and so give evidence for the medialization of science in this particular sphere.

4.4.2.4.1. SUMMARY COMMUNICATION TOOLS

From the results presented in this section, and considering the number of statements where the use of communication tools by scientists in the scientific arena was found, the adaptation of scientists to the criteria of the media can only be confirmed for climate change: where no media-related tools were used by scientists in the science sphere but were used in the mass media sphere. For the issue of forest fires, that scientists adapt themselves to the criteria of the media cannot be neither confirmed nor denied, as even though one tool (symbols) was found proportionally more in the statements of scientists in the media arena, the other (metaphors) was absent. Finally, for the issue of climate change evidence for the adaptation of scientists to the criteria of the media was found, as in the science sphere no use of metaphors or symbols was present but in the media sphere scientists did make use of them.

4.4.2.5.POLITIZATION

As previously noted actors transform research objects in to fields of political action by assigning responsibilities, courses of actions and by making references to societal context (Weingart et al. 2000). This behavior is here called 'politization' of the scientific fields and will be a factor that if present gives evidence of medialization. In order to examine the politization of the issues, 'interest positions' of the actors appearing in the discourse will be examined. The classification here used follows von Prittwitz's interest triangle in environmental politics (1990, p.116). One of these positions will be specifically examined here namely, the *causers* of environmental or forest related problems. If speakers identify responsible parties which, in their eyes, are the causers of the environmental (forest related) problems that is being discussed, then their statements gain in news-value for the media as it adds an element of controversy to them. If scientists are seen to follow the strategy of pointing fingers at particular parties as the ones responsible for the problems that are faced, then it can be concluded that scientists have incorporated to their

communication strategies a media tool, and can be thus said to be medializing their statements.
The results will show the total causers of the forest related problems paying particular attention to the statements of scientists. Tables 4.17 to 4.19 summarize the results of the speakers found in the news articles and the corresponding responsible party that they see as causers of the problems that are being discussed.

Table 4.17 shows the causers according to speaker group for the subject of forest fires. The identifiable responsible party mainly syndicated by all speakers as the one which brought about problems related with forest fires was nature. Draughts, climatologic phenomenon like 'El Niño', or wind currents have created favorable conditions for the occurrence and spreading of forest fires. These natural phenomenons are the main causes that actors identify when assigning blame for the problems of forest fires (22%). The parties which are, after nature, mostly given blame for the occurrence of fires are enterprises (not considering 'other' category:

> "*Hundreds of forest and scrub fires, many of them deliberately set by companies that want to clear land for plantations and industrial estates*" (IHT 1997).

Table 4.17. Causers of problems in forest fires according to speaking actors (in % of total causers: material source "EQMGW"; own calculations)

Causers / Speakers naming causers	Politicians (n, % of N)	Administration (n, % of N)	Enterprises (n, % of N)	Nature (n, % of N)	Society (n, % of N)	Single persons or communities (n, % of N)	Experts (n, % of N)	Other (n, % of N)	Total Causers assigned by Speaker (N)	None
Scientists (24)	1 3,45%	1 3,45%	3 10,34%	9 31,03%	-	-	-	15 51,72%	***29***	17
Politicians (1)	1 100%	-	-	-	-	-	-	-	***1***	6
Administration (24)	1 2,94%	-	8 23,53%	8 23,53%	1 2,94%	1 2,94%	1 2,94%	14 41,18%	***34***	27
Media (43)	6 6,12%	6 6,12%	16 16,33%	28 28,57%	2 2,04%	14 14,29%	-	26 26,53%	***98***	6
Enterprises (1)	-	-	-	1 50%	-	-	-	1 50%	***2***	3
NGOs (1)	-	-	-	-	-	-	-	1 100%	***1***	3
International Organizations (3)	1 16,67%	-	-	1 16,67%	1 16,67%	1 16,67%	-	2 33,33%	***6***	4
Other Organizations (23)	4 11,76%	3 8,82%	4 11,76%	4 11,76%	-	1 2,94%	-	18 52,94%	***34***	12
Single persons/ communities (13)	4 23,53%	2 11,76%	-	2 11,76%	2 11,76%	-	-	7 41,18%	***17***	23
Experts (12)	1 5%	4 20%	6 30%	2 10%	-	-	-	7 35%	***20***	9
Other (6)	-	-	-	1 16,67%	-	1 16,67%	-	4 66,67%	***6***	10
Total causer *(% of N)*	***19 (7,66)***	***16 (6,45)***	***37 (14,92)***	***56 (22,58)***	***6 (2,42)***	***18 (7,26)***	***1 (0,40)***	***95 (38,31)***	***248***	120

The 'other' category concentrates a high percentage of the statements regarding the cause of forest fires. This group collects not only actors that have not been incorporated in previous categories but as well activities and sectors that are identified by actors to be the cause of problems: like 'the economy', 'illegal logging', or 'industrial activities'. Since individually these parties are not significant in the total causers named, no further analysis of this category is made.

Enterprises -and their intentions of clearing land in order to establish plantations- are the second most named party. Proportionally they are mostly blamed by the administration and the media. To a lesser extent blame is also assigned to politicians and single persons or small communities (both named in over seven percent of the times). Especially individual persons are singled as provokers of both intentional and unintentional fires.
Scientists are amongst the speakers that, regarding their total statements, appear the most assigning blame. From the 41 scientists that participated in the media discourse, 24 of them, more than half of the scientists, assigned blame to a specific party. It seems that in the arena the majority of the scientists participating are comfortable in blaming specific parties as responsible for the problems regarding forest fires. The other two speakers that in proportion to their total speaker participation assigned blame were the media (43 from the 49 speakers) and other organizations (23 from the 35 speakers). From the four specific parties scientists named (not considering other category), they mostly named nature as the main causer (for example the natural phenomenon of 'El Niño'). Additionally, enterprises where named three times -as responsible for land clearings for the establishment of plantations- and politicians as well as administration were named once each.

Even though scientists do participate naming causers for the problems concerning forest fires, blamed is mostly laid in responsible parties such as illegal logging (constituting 'other' category). From the specific parties identified, nature is the most named causer. This cannot be taken as a signal for confirming that scientists politicize their statements, as nature as a responsible is not a party that can have an active participation in discourse in the form of a speaker: it cannot defend itself. The discourse of scientists in the science arena showed as well that scientists mainly named nature as the responsible party, followed by society. Considering this, scientists maintain their "objectivity" in that they do not politicize the issue. Consequently for this particular issue, the politization of the statements of scientists, considered as a signal for the medialization of science cannot be confirmed.

Table 4.18 has been constructed to show how blame is distributed by the different speakers appearing in the media discourse on biodiversity.
This table shows that there are a few actors who participate in the discourse that do not assign blame to any specific party: politicians, administration, and enterprises. The actors who compromise themselves more in assigning blame, as a proportion of the total speakers of the particular actor-groups are: the media (from the 17 media speakers 13 assign blame), non-governmental organizations (half of the speakers belonging to this group), and other speakers (half of the speakers belonging to this group). Only a third of the scientists participating in the discourse name parties as responsible for biodiversity related problems.

Table 4.18. Causers of problems in biodiversity according to speaking actors (in % of total causers; material source "EQMGW"; own calculations)

Causers / Speakers naming causers	**Politicians (n, % of N)**	**Administration (n, % of N)**	**Enterprises (n, % of N)**	**Other organizations (n, % of N)**	**Society (n, % of N)**	**Single persons or communities (n, % of N)**	**Other (n, % of N)**	**Total Causers Assigned by Speaker (n, % of N)**	**None**
Scientists (9)	-	-	2 16,67%	-	1 8,33%	3 25%	5 41,67%	***12***	19
Politicians (0)	-	-	-	-	-	-	-	**-**	1
Administration (0)	-	-	-	-	-	-	-	**-**	7
Media (13)	5 17,86%	5 17,86%	4 14,29%	1 3,57%	3 10,71%	4 14,29%	6 21,43%	***28***	4
Enterprises (0)	-	-	-	-	-	-	-	**-**	3
NGOs (12)	3 17,65%	3 17,65%	2 11,76%	1 5,88%	3 17,65%	1 5,88%	4 23,53%	***17***	12
International Organizations (2)	1 50%	-	-	-	1 50%	-	-	***2***	5
Other Organizations (1)	-	-	-	1 50%	1 50%	-	-	***2***	3
Single persons or communities (3)	-	-	-	-	2 100%	-	-	***2***	7
Experts (2)	-	-	2 66,67%	-	-	-	1 33,33%	***3***	3
Others (2)	-	-	-	-	1 50%	-	1 50%	***2***	2
Total causer *(% of N)*	***9 (13,24)***	***8 (11,76)***	***10 (14,71)***	***3 (4,41)***	***13 (19,12)***	***8 (11,76)***	***17 (25)***	***68***	***66***

Scientists have a moderate participation in naming responsible parties. From the 28 scientists participating in discourse, nine of them assign blame, meaning that every third scientists participating ventured to name some type of party as responsible. The most named party -aside from other category- were single persons or small communities, followed by enterprises, and finally society. The only real contribution to the politization of the scientists' statements is done when they name enterprises as those who are to blame for the biodiversity-related problems. Interesting to note is that unlike all other issues, nature was not named by scientists or by any other speaker participating in the discussions.

This is different from what was seen in the scientific discourse, where nature was one of the main causers of problems. This is explained when looking deeper into the articles that make up the discourse. Most of the articles deal with the loss of biodiversity; this loss is not a natural phenomenon but is always assigned some sort of responsible party; in the case of scientists, blaming hunters or illegal loggers for the destruction of habitats of biological species and to a smaller degree blaming enterprises.
There is another difference that becomes apparent when examining the global scientific discourse: the proportion of scientists that participating assigning blame was higher in the media discourse than in the scientific one. From all authors of the scientific publications analyzed, only 23% ventured to name some responsible party in their statements, from all speakers participating in the scientific discourse only 18% assigned blame. Both distanced

from the third of the scientists appearing assigning blame in the media discourse. This could be a signal for the adaptation to the rules of the media by scientists in their statements, as they venture more in the media discourse. However, in the media discourse they name only enterprises as a responsible party which might be seen to contribute to the politization of the issue, while in the scientific discourse they name both enterprises and the administration: which might be taken as venturing more politicized statements. Thus, it is not only the proportion of scientists who venture in naming causers, but the identifiable responsible parties that might have the chance to speak in the discourse –and thus be seen as contributing to the politization of the issue- that must be taken into consideration when examining if science has become politicized and by consequence medialized. Therefore, no conclusive evidence can be found for the issue of climate change and the politization of it by science or scientists through their statements.

The mentioning of nature as a responsible party is also not practiced by all other speakers which assign blame. These other speakers focus -aside from society or single persons or communities- on parties such as politicians and administration: for example the media blames in over 17% both these parties for their responsibilities for not protecting species from the dangers of society. Another important part of the blame allocated by the media is distributed equally between enterprises (illegal activities that cause damage to species) and single persons or small communities (farmers who slash and burn the forest to clear land in the Amazon, illegal loggers cutting trees).

Finally, climate change might be an issue in which responsible parties of problems leading to climate change might be more readily named. Table 4.19 shows the actor-groups and the responsibility they assign to responsible parties in the issue of climate change.

The speaker groups which proportionally participate the most in assigning blame are the media (almost two thirds of the speakers of this group assign blame), single persons or communities (from eleven participating in this group, five assign blame), international organizations (a third of all speakers from this group assign blame), and non-governmental organizations (three from 13 assign blame). The media mostly feel that the administrative sector is responsible for climate change. As an example, when reporting on the negative of the United States to ratify the Kyoto Protocol and their willingness to search for alternative methods to deal with climate change, the media emphasize:

> "*the (US) Administration has been reluctant to do anything that would raise the price of fossil fuels and discourage their use*" (IHT, 2001)

The previous is an example of the reluctance of the USA to advance in fundamental issues regarding mitigation measures. International organizations make an appearance mostly naming society as responsible for the problems associated with climate change.

Table 4.19. Causers of problems in climate change according to speaking actors (in % of total causers; material source "EQMGW"; own calculations)

Causers / Speakers naming causers	Politicians(n, % of N)	Administration (n, % of N)	Enterprises (n, % of N)	Nature (n, % of N)	Society (n, % of N)	Single persons or communities (n, % of N)	Other (n, % of N)	Total Causers Assigned by Speaker (n, % of N)	None
Scientists (13)	1 7,69%	-	1 7,69%	2 15,38%	4 30,77%	-	5 38,46%	***13***	70
Politicians (1)	-	-	-	-	-	-	1 100%	***1***	9
Administration (2)	-	1 33,33%	-	1 33,33%	-	-	1 33,33%	***3***	24
Media (20)	1 3,45%	9 31,03%	3 10,34%	2 6,9%	4 13,79%	4 13,79%	6 20,69%	***29***	12
Enterprises (1)	-	-	1 100%	-	-	-	-	***1***	15
NGOs (3)	-	2 66,67%	-	-	1 33,33%	-	-	***3***	10
International Organizations (8)	-	1 8,33%	-	1 8,33%	6 50%	1 8,33%	3 25%	***12***	15
Single persons or communities (5)	1 20%	-	-	-	2 40%	-	2 40%	***5***	6
Experts (5)	-	-	-	-	-	-	-	***-***	7
Other (4)	1 20%	-	-	-	2 40%	-	1 20%	***5***	22
Total causer (% of N)	***4 (5,56)***	***13 (18,06)***	***6 (8,33)***	***6 (8,33)***	***19 (26,39)***	***5 (6,94)***	***19 (26,39)***	***72***	**190**

Scientists participate in the blame assignation proportionally lower than the above mentioned speakers. From the 83 scientists participating in the discourse, only 13 of them named a specific party as a guilty party. Scientists mostly blame society for the problems, followed by nature but, scientists do point their finger at actors such as the government, and enterprises. One group of scientists allocated blame to the United States government for contributing to global warming and for not ratifying the Kyoto Protocol in detriment of the environment (IHT 2003). Plantation companies are seen as responsible by another scientist for endangering the environment as they clear people of their lands and use the lands fast-growing tree plantations, usually of one species, which contributes little to the off-setting of carbon and may be prejudicial for nature and local communities (IHT, 2002). Compared to the global scientific discourse, the participation of scientists assigning blame is lower both regarding all authors of the scientific publications as well as all other speakers participating in the scientific discourse. Additionally, the responsible parties named in the scientific discourse by scientists are mostly the same as in the media discourse: no great differences can be observed. Consequently, the politization of the statements of scientists cannot be confirmed because, on the one hand, the low participation of scientists assigning blame, and on the other hand, because no great differences were found between who scientists name in the scientific discourse and, who they name in the mass media discourse. Therefore, it can be stated that politization as a contributing factor for confirming medialization in this issue is not present.

4.4.2.5.1. SUMMARY POLITIZATION

Following what Weingart (2001) has stated on politization, scientists become political actors when they, in their statements, find identifiable responsible parties for the problems that they are discussing. It is in the mass media interest as a gate-keeper to include speakers in the articles that may give more news value to their stories. More news value will be achieved when speakers politicize their statements. This would translate to scientists, when uttering statements, identify parties as responsible for the problems and damages that the forest faces and suffers. In the three issues discussed, the participation of scientists assigning blame only once reached more than half the scientists participating in the issue: in forest fires. However, the practice of assigning blame is not the only criteria that should be examined if confirmation for the politization of the statements is to be found Scientists must also name specific identifiable parties as those causing the problems. In all three issues scientists mostly name parties that cannot participate in the discourse in order to defend themselves from these accusations, these are: nature, society, and other parties as sectors or activities. Therefore, politization of the statements cannot be confirmed. This is even further strengthened by examining the responsible parties in the scientific discourse: no great difference between those names in either arena was found. Therefore politization must herewith be denied with the consequence that this factor does not help in confirming the medialization of science.

4.4.3. MEDIALIZATION IN THE NATIONAL MASS MEDIA DISCOURSE

Previously medialization of science has been examined on a global level. The focus of this section is the national media discourse and the different factors that might give evidence of medialization. Therefore extensiveness, pluralization, controversy, communication tools, and politization will be examined through the three issues selected.

4.4.3.1.EXTENSIVENESS

As previously stated, a factor which gives evidence of medialization is the increment through time of the reports media published on scientific issues. The reports in the national media on the issues of climate change, biodiversity, and forest fires prove to be less than the reports found in the global media. A total number of 102 articles were found in which forest science made an appearance in combination with the issues of biodiversity, climate change, and forest fires. As a reminder 119 articles were found relevant when analyzing the global media (see table 4.12). The national media does not seem to give that much attention, or priority, to the reports where science relating to forests is concern. When comparing the forest related topics to topics of environmental nature or scientific topics covered by the national media, it is seen that these forest related issues do effectively receive less attention. An internet search done through the search function of the newspaper "*El Mercurio*" from 31.08.1999 till 31.12.2003 yielded for the key words "climate change", on the one hand, and "stem cells" on the other, 268 and 714 articles respectively[65]. Of course not all these articles may deal with the scientific side of

[65] The Spanish words used in the key word search were. "cambio climatico" and "célula madre".

the issues but, they can help see that the national media, as was the case of the global media, find the forest related issues not as interesting to cover than other scientific or environmental issues.

The distribution through time of the total articles considered can be seen in table 4.20. The year where the most number of articles appeared was 1998 and the year with the least articles 1995. This does not mean that in 1995 no articles were written which touched upon issues concerning forest, it means that news where science related to forest and the three issues was discussed did not appear in the reports of the media. However, the absence of articles from 1995 may also be attributed in some degree to errors in recovering the articles from the media. The search for articles from 1994 to 1996 was carried out manually examining all editions of the newspaper for these years. The search might then not have yielded all articles that discussed science and forests in the context of the three issues chosen. There is no possibility to verify whether this is effectively the case, as no other option of searching articles for these years was available to the researcher at that time.

Table 4.20. Distribution of total articles in "*El Mercurio*" for all issues (Source: own calculations)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	*TOTAL*
N	3	0	14	13	16	4	12	13	14	13	***102***

Table 4.20 shows that throughout the years the number of articles dealing with science and the forest related issues have not increased. An initial increase from the years 1994 and 1995 to the year 1996 can be seen from which the existence of extensiveness might be foreseen. However, the sharp drop in the year 1999 and the constant number of articles appearing afterwards shows that there is no increase in the attention the media gave to the scientific issues after the initial rise. The drop in attention for the year 1999 coincides with the drop of attention of the global media in the same year to the issues (table 4.12) and can be associated to the lack of the 'catastrophic events' that were covered in the previous two years (for example forest fires in Asia). The global media as well have a relative steady coverage of the issues. Thus the same trend observed in the global media can also be observed in the national media regarding the stability over time of the reports on science relating to forest and the three issues selected. The low number of articles in the first years of analysis is, as well, a coinciding point for both levels analyzed. The global media produced one, eight, and one articles in the years 1994, 1995, and 1996 respectively (table 4.12) and the national media produced three, cero, and 14 articles in those same years. A possible explanation for this is that, apart from forest fires, the issues had not been considered as important to cover because the international processes associated with them (Convention on Biodiversity and the Kyoto Protocol) might not have had -to that point in time- the public visibility that they might have afterwards achieved. From the previous results it may be concluded that the attention of the media is not awoken by the issues of science and forests that were here analyzed.

The issue which dominates the reports on forest science is forest fires. With 42 articles it is this issue which is mostly discussed in the national media not only regarding forest science (or science related to forestry) but as well as regular news and reports that the

media write; these regarding the damages and risks of forest fires[66]. Table 4.21 summarizes the number of articles found for the three issues analyzed.

Table 4.21. Number of articles for Biodiversity, Climate Change, and Forest Fires (Source: own calculations)

	Biodiversity	Climate Change	Forest Fires	*TOTAL*
Total number of articles	30	30	42	***102***

The issues associated with forest fires are of more interest to the national media than issues related to biodiversity or climate change. The reports emphasize the damages and risks that fires provoke on nature, enterprises (and their plantations), individual persons (fire fighters getting hurt, as well as families being affected), and society in general. The articles where science is the focus have to do with ways of tracking fires -in order to effectively fight them- through, for example, the incorporation geographical information systems; scientific studies which investigate the most common causes for the occurrence of forest fires in Chile (which according to the studies presented are mostly of human nature) are also an example of this.

The articles of climate change focus on reports that give information on the international processes occurring to mitigate or give information on climate change, like the Kyoto Protocol and reports of the Intergovernmental Climate Change Panel; they also focus on the benefit enterprises might gain if they become involved in the 'business' of climate change mitigation through clean development mechanisms that allow industrialized countries to mitigate their carbon dioxide emissions by investing in projects that reduce emissions in developing countries. Chilean actors emphasize the opportunities this mechanism has for the Chilean forest sector and experts analyze methods for carbon sequestration.

The issue of biodiversity focuses on the biological diversity both in other countries and within Chile, and the challenges they are faced with regarding conservation actions. Reports on Chilean biodiversity focus on native forests and the potential for its preservation, as well as specific actions that have successfully been carried out in order to preserve certain species living within the forests.

Figure 4.25 shows how the articles found in the time period from 1994 to 2003 were distributed amongst the different issues.

This figure shows that biodiversity, starting in the year 1996 has a regular presence in the national mass media, reaching in that particular year a maximum of 5 articles published, which is afterwards only equaled in the year 2003. For both the years 1996 and 2003, articles touched on the protection of specific areas which are rich in biodiversity not only in Chile (both by State and private actors) but -in one article of 2003- in China as well (EM, 30.12.2003). Several articles in 1996 reported on events like a scientific conference on biodiversity in Chile carried out where activities, such as the homogenization of productive systems worldwide, are seen by participating scientists as a negative effect on biodiversity (EM, 25.04.1996). Or reports on a Conference of the Parties to the Convention on Biodiversity carried out in Argentina in 1996 (EM, 11.12.1996).

[66] Forest fire is the issue in which the most articles were found. From 301 articles only 42 were found to deal with the issues selected and forest science.

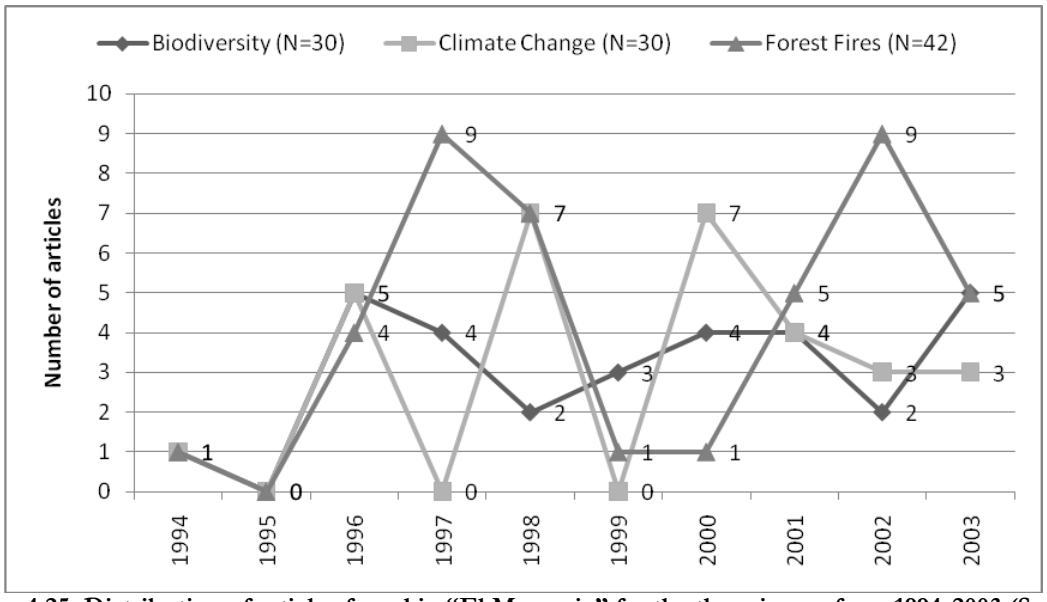

Figure 4.25. Distribution of articles found in "El Mercurio" for the three issues from 1994-2003 (Source: own calculations)

Comparing the national tendency of the number of articles published about biodiversity to the global tendency (figure 4.22) it can be seen that on a global level the attention of the media to this issue was smaller in terms of number of articles published than on the national level (24 articles on the global level versus 30 articles on the national level).

Climate change is a most variable subject in comparison to biodiversity. It goes from no articles being published some years to peaking three times throughout the ten years. The three peaks are in 1996, 1998, and 2000.
In the year 1996 the topics of the articles touched upon the functions trees and forest have in capturing carbon dioxide from the atmosphere raised the question whether Earth will be able to stop global warming and, reported on the influence forest fires have on the change in climate. From the five reports appearing in 1996 three of them deal with these issues on a global level and only two of them on the national level of Chile and Brazil. The article dealing with Brazil shows how the forest fires taking place in the Amazon have an effect on world climate (EM, 11.05.1996). The Chilean based article deals with national scientific initiatives which assigned a considerable amount of money to various national scientific projects in which native forests of Chile are the focus of one specialized field of research. The reported objective of this project is to gain a better understanding of climate change, how to measure its' effects, and provide input for national policies on native forests that may help give solutions to the present problems of the forest.
In 1998 there were a total of seven articles published that discussed science regarding the forest. From these seven articles, five of them referred to national issues while two to global ones. The nations being considered in the reports are Chile and Costa Rica. The news reports centered on Costa Rica, focus on the successful experience of selling carbon dioxide emission bonds to industrialized countries. Costa Rica and its' projects are set up in the media as an example to be followed by the Chilean forest sector. These articles are chronological predecessor of articles published in the same year dealing with examples of how the Chilean forest sector will incorporate the strategies of selling 'carbon bonds'. In 1999 again no articles were published that touched on the subject of climate change, forests, and forest science. This is compensated in the year 2000 where seven articles were

published (the same number as in the previous peak). The focus this year is articles that centered on news not arising from the national level but from a global or regional one. The national level dealt with two articles centered in Chile both dealing with the business of selling 'carbon bonds' (emission trading). The five remaining articles dealt with international events that are relevant to the changing of the climate and the steps the world is taking to try and solve these problems. From this year onward, climate change articles where science is discussed, become a constant in the reports by the national media. Averaging in the following three years 3,3 articles per year, which represent a mixture between events happening on a national level other than Chile (a report on Japans' experience regarding 'carbon bonds') and on a global or international level: ratification of the Kyoto Protocol, international meetings on climate change, and interviews with personalities that have strong opinions on climate change.

For climate change the number of articles is higher on the global level than on the national one: 44 articles that touched upon science, forest, and climate change on the global level and on the national level 30 articles were found. The global level articles focus on more general questions about how Earths' climate has changed and, whether it will be able to recover from the impacts it has suffered -with trees and forests being a fundamental part of the process as they can absorb carbon dioxide-. There are also differences in the distribution through time of the number of articles on the global and national level. For instance (and from fig. 4.22), no reports are found in the year 1996 in the global media, but on the national level this year is one where the most amount of article is found (peak). There could be tardiness on the part of the national media to report on events that were covered on the global level, as 1995 is the first peak that is observed for this issue on the global level (fig. 4.22). However, the analysis of the national articles shows that the events covered by the national media do not coincide with those on the global level for the previous year. In 1998 both national and global levels peak in their amount of reports covered. Yet, the reports once again did not coincide between the two. Finally, the global media peaked once again in the year 2001 but the national media did not regard the issue as frequently as, for example, the previous year.
This comparison shows that no coincidence can be seen regarding the amount of coverage that both level of the media give to this issue, as well as the topics covered; which might indicate the lack of influence of the global on the national media.

The news reports on forest fire have two specific years in which the media draws more attention to the events dealing with this issue namely, 1997 and 2002. In 1997, aside from the reports on forest fires occurring in Chile (and the science discussed in them), news reports focus on the fires events occurring in Asia that affected not only the local population there but the whole planet; as fires are a source of carbon dioxide emissions which affect the Earths' climate. In 2002, again Chilean fire events are covered; particularly reports that discover the causes for forest fires, but international events are also present; in this case forest fires occurring in Australia. 1998 is also a year with a strong presence of reports on this issue. This is mainly due to the fires occurring in the Amazon Region. In the remaining years, all (except 1995) have some presence of reports that discuss science and forest fires, their focus being on the national level of Chile.
For forest fires the lower level of articles are found on the national level (42 articles) than on the global level (51 articles, fig. 4.22) for the time frame analyzed. The tendencies for the national and global level coincide in the time-span 1997-1998. Both levels report on

the fires occurring in the Asian and Amazon region. This indicates that catastrophic international events do receive similar coverage by both levels of media. The national media, as seen above, increases in the year 2002 it reports on this issue. The global media experience as well an increase. The issues do not, once again, coincide. While the global media reports on fires in Asia, the United States, the '*science of fires*', amongst other topics, the national media concentrates on national events such as the causes of the forest fires occurring in the country, and only once on an international forest fire event (taking place in Australia). This situation confirms what is found regarding climate change issue namely, that the levels do not coincide on their news coverage. Coincidence is seen only in the face of a catastrophic event of large size (as the fires in the Asian region for the years 1997-1998 have shown).

4.4.3.1.1. SUMMARY EXTENSIVENESS

The results presented here show that the coverage of the events by the media depends on the type of events that occur. For biodiversity, events taking place throughout the time frame analyzed may not be seen as extra-ordinary in order to increase its media coverage. Both national and global relatively homogeneous distribution through time of the biodiversity articles confirms this. On the contrary for what occurs in the years 1997-1998 for the issue of forest fires. The Asian fires were seen both by the global and national media as events worthy to be covered extensively (relatively larger number of articles published); indicating that a catastrophic event will capture the attention of the media on both levels. The reports of climate change on both levels show that it is far from being an issue which is regarded with equal priority by the national and global media, in the sense that events being reported on by these levels do not coincide for the periods of time in which on each level it has peaked.
The results show that none of the news coverage of the issues has increased over the time frame analyzed. There are certain increases of the media attention to them at particular points in time, but not enough to give evidence that might help confirm the medialization of science.

4.4.3.2.PLURALIZATION

Whether the reports in the national media have opened themselves up to the participation of actors other than scientists delivering relevant information for the discussion of issues is a characteristic seen through the different speakers that are present in the discourse. A discourse will be pluralized when actors other than scientists participate in the discourse. Table 4.22 shows the speakers present in the discussion of the three issues.

Table 4.22 shows that there is a variation of actor-groups present in the media discourse on forest science. At least twelve different actors-groups participate. The most prominent groups in all three issues are the media, scientists, and actors belonging to the administration sector. There is also an important participation of politicians and non-governmental organizations in all three issues. The issue with most speakers is forest fires (151 speakers) followed by biodiversity (122 speakers), and finally climate change (98 speakers). The number of articles was greatest for forest fires (42 articles) which means that on average this issue had 3,6 speakers per article. For biodiversity and climate change

the number of articles was 30 each. This means that on average for the time period analyzed 4,1 speakers are found in biodiversity and 3,3 speakers in climate change. Consequently, the greater number of articles published (as the case for forest fires) is not indicator for a greater number of speakers participating in the media discourse.

Table 4.22. Speakers in the national media discourse on forest science and the three issues analyzed (Source: own calculations)

	Forest Fires		Biodiversity		Climate Change	
	n	% of N	n	% of N	n	% of N
Scientists	17	11,26%	29	23,77%	24	24,49%
Politicians	14	9,27%	5	4,10%	9	9,18%
Administration	40	26,49%	14	11,48%	8	8,16%
Media	36	23,84%	25	20,49%	21	21,43%
Enterprises	3	1,99%	-	-	5	5,10%
NGOs	9	5,96%	14	11,48%	7	7,14%
International organizations	1	0,66%	4	3,28%	10	10,20%
Associations	4	2,65%	6	4,92%	-	-
Other organizations	9	5,96%	5	4,10%	4	4,08%
Single persons / communities	10	6,62%	8	6,56%	5	5,10%
Experts	3	1,99%	7	5,74%	2	2,04%
Other	5	2,65%	5	4,10%	3	3,06%
TOTAL (N)	***151***		***122***		***98***	

The participation of scientists is highest in the climate change and biodiversity issue, and lowest in the forest fire issue (as percentage of participation). This result coincides with those found for the global mass media discourse (table 4.13). However, on the global level there was a greater difference between the participation of scientists in climate change and the other two issues (see table 4.13). On the global level scientists accounted for 15,13% of all speakers in forest fires, 25,45% in biodiversity, and 33,60% in climate change. On the national level the difference was not as pronounced, as scientists account for 11,26% of all speakers in forest fires, 23,77% in biodiversity, and 24,49% in climate change. These numbers also reflect that scientists participate relatively less in the national media discourse on forest science than in the global media discourse. It seems that when reports touch on scientific issues the national media –even though it does privilege scientists in comparison to other actors incorporated in the discourse- gives other actors opportunities of including their knowledge or points of view.

In forest fires a lower participation in discourse is experienced by scientists. Their main role participating in discourse is delivering facts regarding environmental factors that cause forest fires like, for example, droughts and 'El Niño'. Scientists also appear defending forest fires as a natural event that helps forest regenerate and, in the case of one article, have helped decrease climate change (EM, 11.05.1996). In climate change, scientists give examples on how much carbon dioxide is emitted because of construction activities (EM, 12.04.1994), deliver information on how the transmission of particles emanating from forest fires have a drastic effect on the world's climate acting as a 'cooling effect' on the Earth (EM, 11.05.1996), or give predictions on how much the Earth's temperature will increase due to the increase in greenhouse gases concentrated in the atmosphere (EM, 19.09.1996).

Krumland (2003) in her results from analysis of the German national media, found that the participation of scientists was limited to a low percentage in comparison to other actors participating in the media discourse on forest (2,6% of the total actors). Her results, however, were not limited to the analysis of articles where forest science, or science related to forests, was discussed, but covered the whole range of forest related reports. The participation of scientists is then understandably lower than other actor-groups, such as administration in the case she presented, as many reports do not consider the intervention of scientists in order to present relevant information. Krumland further found that the political actors were the most frequent ones participating in the discourse along with actors from the administrative sector (18,1% the former and 16,8% the later). The greater participation of politicians is justified by Krumland (2003, p.93) because of the resources and status within the political system which favors the incorporation of them in the public discourse (as politicians belong to the center of the political system they have more chances to be incorporated by the media in the discussion of the issues). This opposes what is here found in the global and national media discourse on forest science. It is speakers from the administrative sector which are more frequently incorporated into the discourse on both levels. Politicians are relegated in some cases behind actors such as scientists, non-governmental organizations, and international organizations. That politicians do not make use of their position (in terms of resource and status) to join the discussion related to forest science in the media discourse can be an indicator that these topics are not seen as 'important' by politicians, or that their impact on the public and its' opinion is not as great, or of political relevance, as other issues that might call for a greater participation of the political sector (for example stem cell research). In the data analyzed here, it is up to the administration to deal with the issues relating to forest science.

The relative participation of the media in the national level is larger than that on the global level for all issues: always over 20% on the national media discourse and between 12% and 18% on the global media discourse. This result reflects that the national media has a more active role in incorporating their interpretation patterns in the reports on forest science than on the global level.
A higher role is played by non-governmental organizations in the discourse on biodiversity than any of the other two (11% versus 7% and 6% of climate change and forest fires respectively). This coincides with the result found for the global media discourse (table 4.20). It is in the issue of biodiversity where non-governmental organizations are focused on bringing into the discussion their views on losses of biodiversity and pronounce themselves on issues like the market economy and the pressure it has on the biological diversity, especially native forests, of the country. NGO actors are the third most common group in this issue to bring their interpretation patterns in the discussion; this can be the consequence of the professionalization of the public relations that these groups undertake (Krumland 2003, p.92). The non-governmental organizations are conscious of the importance of public opinion and their effect on the support of their issues (Krott 2005, p.85) and accordingly have learned (through public relations specialists) to use the different PR instruments in practice. The use of those instruments would facilitate the incorporation of their interpretation patterns into the mass media discourse, in comparison to other actor-groups that have not learned the benefits of public relations. This tendency, of using public relations, can thus be an

explanation why NGOs are an important group participating in the discourse on biodiversity and climate change, and to a lesser degree in the issue of forest fires. Their interest, or the political relevance the first two issues, might be a higher motivation for these organizations to participate.
The question remains as to why it is in the issue of biodiversity that the NGOs tend to participate more than in the other two issues. Krumland (2003, p.138) concludes that it is not only the resources that organizations invest in public relations or the status within the political system they possess that leads them to participate or be included in the discourse but, actors -and particularly these organizations- will be highly involved in the discourse on a specific topic the more the public- as well as the political interest in the issue is. For biodiversity the public interest may be greater than in climate change as the former can be exemplified or personalized '*better*' than climate change; as the '*agonizing*' species is much more identifiable than the increase of carbon dioxide emissions released to the atmosphere. In climate change the proportion of NGOs participation is lower than biodiversity and for forest fires their participation is even lower. This does indicate that the type of issue that is being discussed determines the participation of certain actors, in this example of non-governmental organizations.

Another actor which, as non-governmental organizations, invests resources in public relations and does appear in the discussion of issues relevant for society, are International Organizations such as the United Nations, the Food and Agricultural Organization, or the World Bank. The participation in the national media discourse of these types of international organizations is greater in climate change (10,2%), followed by biodiversity (3,28%), and finally a very low participation in forest fires (0,66%). The same order in proportion of participation is seen in the global media discourse (table 4.13). This would consequently give basis for confirming that it is the issue which determines the participation of organizations -which make use of specialized public relations- in the discourse.
Biodiversity is an issue which experiences a higher participation of non-governmental organizations and less the interest of international organizations, while in the issue of climate change the opposite is true. Thus, for those organizations that count with resources to invest in public relations, the determining factor for participating in the discourse is the forest related issue which is being discussed. The lower participation of both groups in the issue of forest fires both on the national as well as the global level might be, as well, confirmation for this.

For forest fires the mayor group participating in discourse is the administration. Every third speaker belongs to this group (26,49%). This is an expected result, as it is the administration the actor in charge of talking to the media regarding the fires (occurrence and trajectory) and the extent of damages associated with them. It is specifically the forest administration, which is incorporated in the forest fires articles. The Chilean forest administration, for example, carried out research leading to the discovery of the mayor causes of forest fires in Chile (EM, 10.10.1997). The results of this research are afterwards highly mentioned in the reports of the media on forest fires by all actors participating in the discourse. The administration is the third most important group participating in biodiversity and the fifth group in climate change.
The role of politicians is relatively higher in forest fires than in the other two issues, in terms of percentage of participation in discourse. The most interesting result is that from

the 14 politicians found participating in the forest fires discourse, 13 of them are foreign to Chile. Only in one case did a national representative of this actor-group participate delivering a statement. All other politicians belonged to countries such as the United States, Australia, Indonesia, Malaysia, or Brazil. This is a result of the number of news that had to do with the enormous fire events occurring in those countries and the necessity of the politicians to assume a role in the public discussion of those events. For example the Indonesian President asking for forgiveness of the neighboring countries as the smoke emanating from the forest fires in this country was gravely affecting, as well, the health of the population of these other countries. It thus seems that on the national level, politicians do not need to participate in the discourse, leaving the media coverage to be attended to by the administrative sector.
From the other actors that appear, single persons or communities have been singled out in order to exemplify how their lives have been affected by the fire events. For example a nurse from hospital in the Amazonia who reported on the cares given to children affected by the forest fires in 1998 (EM, 24.03.1998) or a civil engineer who gives his opinion on how the laws and regulations regarding the use of fire in Chile (mostly in the rural areas) are permissive and lack implementation, resulting frequently in rural fires getting out of control and affecting forests and plantations (EM, 24.03.1994).

4.4.3.2.1. SUMMARY PLURALIZATION

These results on the variety of speakers participating in discourse show that on the national level there is a pluralization of the discourse on forest science on all three issues analyzed as measured through the amount of different actors present. This is slightly different from what was found for the global media discourse, as the issue of climate change was to some extent less pluralized than the other two because of the higher level of participation of scientists in the discourse. However, even with the level of participation of scientists in the discourse there were other actors which made their interpretation patterns heard in the media.

4.4.3.3.CONTROVERSY

The previous result on pluralization showed that different interpretation patterns from different speakers were incorporated into the discourse. Three to four specific groups were most frequently represented with their interpretation patterns in the national mass media (from table 4.23: scientists, media, administration, and non- governmental organizations). As speakers, other than scientists and their interpretation patterns, are participating in the discussion, controversial view points between the actor-groups might be found. The existence or lack of controversy, as seen through the balance or disequilibrium between types of assessments of speaker statements will be here on analyzed. As a reminder, controversy is here defined as being present when the proportion of one type of assessment has a majority and the sum of the two remaining assessments does not surpass a third of the total assessments.
First, the events being covered in the articles are considered. Following this, the statements of the speakers participating in the issues are examined in order to find possible controversy present in the discourse.

Figure 4.26 shows the assessment of the events for the three issues analyzed. The media selects reports on events that are mostly controversial in the cases of biodiversity and climate change. In both these cases there is a relative homogeneous distribution of the statements between the three possible assessments, as the sum of the not-dominating event assessments reaches over a third of all event assessments.

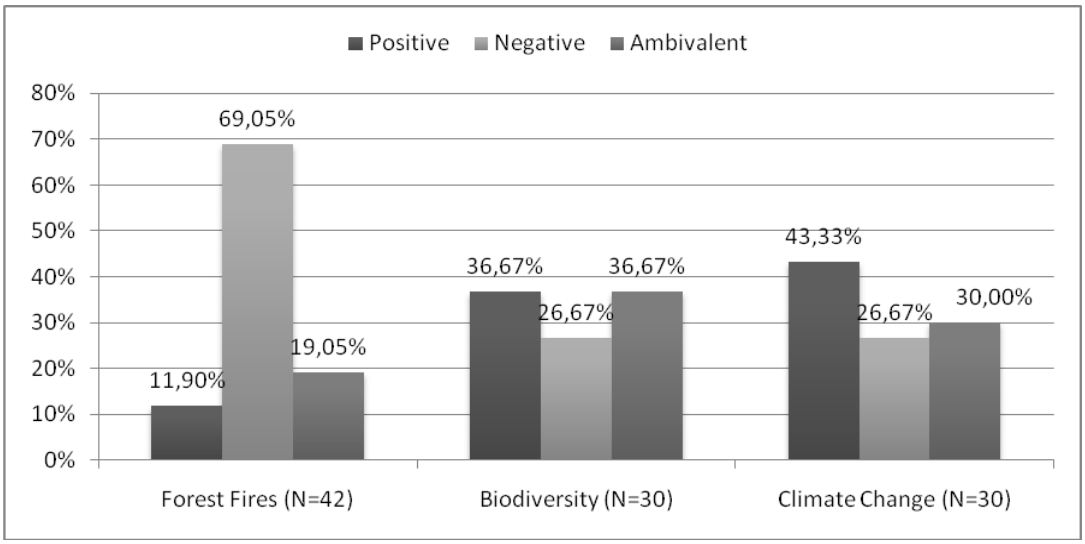

Figure 4.26. Assessment of event according to issue in the national media discourse on forest science (Source: own calculations)

For forest fires the most frequent events covered in the media are negative events. The coverage of negative events reaches 69,05% of all forest fires articles. Ambivalent events are 19,95% of all events and positive events 11,90%. Negative events report on forest fires causing damages throughout Chile, as well as in other countries where these 'catastrophes' have been taking place. For example, in the years 1997 and 1998 reports touched on the fire events occurring in Australia, Brazil, or Asia and the 'drastic' consequences for the nature –especially forests- and the population.

Positive events covered by the media include a 'positive surprise' of the decrease in the area of forests that have been burned in the year 2000 (EM, 19.03.2001) or, reports on 'great' efforts being made to train different actors to help fight the appearance of forest fires (EM, 09.01.1997). Ambivalent events include reports on how forest fires are being subdued due to climatic events like rain, these articles limit themselves to report on how rains are extinguishing fires and do not assign any judgment or normative value to these reports (EM, 04.04.1998, 01.04.1998). Other ambivalent event includes a report on an investigation carried out by the forest administration which reported on the most common causes of forest fires in Chile (EM, 13.11.1997).

The proportions of events presented for forest fires make clear that there is one assessment that clearly dominates namely (negative ones) and the proportion of other assessments of events present do not surpass one third of all assessments. Even though the distribution in the three types of events are not as clear favoring negative events as was the case on the global level (see figure 4.23 where negative events in forest fires reached over 90%), there is still a clear domination of the proportion of negative events. Thus controversy is not taking place in this issue.

This is different for both biodiversity and climate change. Figure 4.26 illustrates that the proportions of events that fall into the three different categories examined is not as differentiated as in the forest fire issue.
For biodiversity the total ambivalent and positive events are equal (36,67% of all events) and the negative events are in a minority with 26,67% of all events (which represents eleven articles). There is no great difference between the percentages of each category. Positive events that are reported on by the media include China creating the '*biggest Panda reserve of the world*' in the year 2003 (EM, 30.12.2003), or how the city of Santiago de Chile is '*going to the rescue*' of its native flora by implementing a project which recovers knowledge about regional native plants and trees, as well as creates a documentation center in order to make available the gathered knowledge, all this in a botanical garden within the city (EM, 03.02.2003). Negative events, on the other hand, include individuals opinion on how those in charge of conserving the natural resources of the country do not consider the role the native forest of Chile has on the preservation of the fauna which occupies the forests which results in lacking policies (EM, 01.07.1994); or how, according to a publication of Chilean authors in the scientific journal 'Science', the biodiversity of the native forests of Chile is '*agonizing*' (EM, 24.12.1998). Finally those events which carry no judgment with them, or have a balance in how the event is viewed, refer to how the biological diversity of the country is in part found in the hands of the State but much more in the hands of private owners which thus challenges the discussions on native forest legislation (EM, 24.05.1999); the article goes on to present a balance number of different positions in favor and in opposition to certain methods of how biological diversity should be managed. Another ambivalent event refers to the occurrence of a scientific conference as a response to the Convention on Biodiversity from 1992, in which scientists -or experts- discuss, amongst other issues, how biodiversity should be measure (EM, 25.04.1996).
The events selected by the media thus represent different aspects of the scientific discussion on biodiversity and forests. Consequently, controversy for the issues of biodiversity on the national level is found in the national mass media discourse.

Controversy is also found in the issue of climate change. However, not as pronounced as in biodiversity since the percentages of positive, negative, and ambivalent events are slightly more diverse than for biodiversity. Positive events covered for climate change reach 43,33% of all events, followed by 30% ambivalent events, and finally 26,67% negative events. Even though the positives events dominate with more than 40% of the total events, the proportion of negative and ambivalent events is high enough for controversy to be considered present (higher than on third of all assessments). Climate change events, which have positive connotations tied to them include, reports where the forest and its ability to sequester carbon is seen as a '*great business opportunity*' for a country (not only Chile but other countries as well) and particularly the forest sector (EM, 06.06.1998). Another example of a positive event is a news report of a project envisioned by Chilean authorities in order to reduce emissions of carbon dioxide and so '*contribute to fighting*' the global greenhouse effect. Ambivalent events include a report on a scientific study carried out by Chilean scientists (amongst scientists from other countries) where they investigated fossils of *Fitzroya cupressoides* (Alerce) with the objective of examining the human influence in the present climate change (EM, 12.05.2001). Another ambivalent event includes a report describing how much carbon dioxide forests effectively sequester (EM, 08.08.1996). Finally negative events report of the consequences on climate of the

human activities which are responsible for emitting green house gases to the atmosphere (EM, 19.09.1996); this report emphasizes how the natural processes of capturing green house gases has been saturated because of the human activities which liberate more emissions than can be naturally assimilated.

The previous results show that depending on the issue, controversy will be present or absent. On the one hand, for forest fires on the national media discourse no controversy regarding the event reports is found. On the other hand, for both biodiversity and climate change controversy is found. Both these results coincide with the global level. In order to examine whether this is also the case regarding the statements that speakers make in each of these issues, the assessment of them will be examined.

As in the global level, there is a variety of speakers making statements on the national level regarding all three issues. Controversy may arise between different interests groups who participate in discourse because of their possibly different interpretation patterns regarding the issues being touched upon. Consequently, their statements must be considered in order to examine whether controversy is or is not present. Figure 4.27 has been constructed for this purpose.

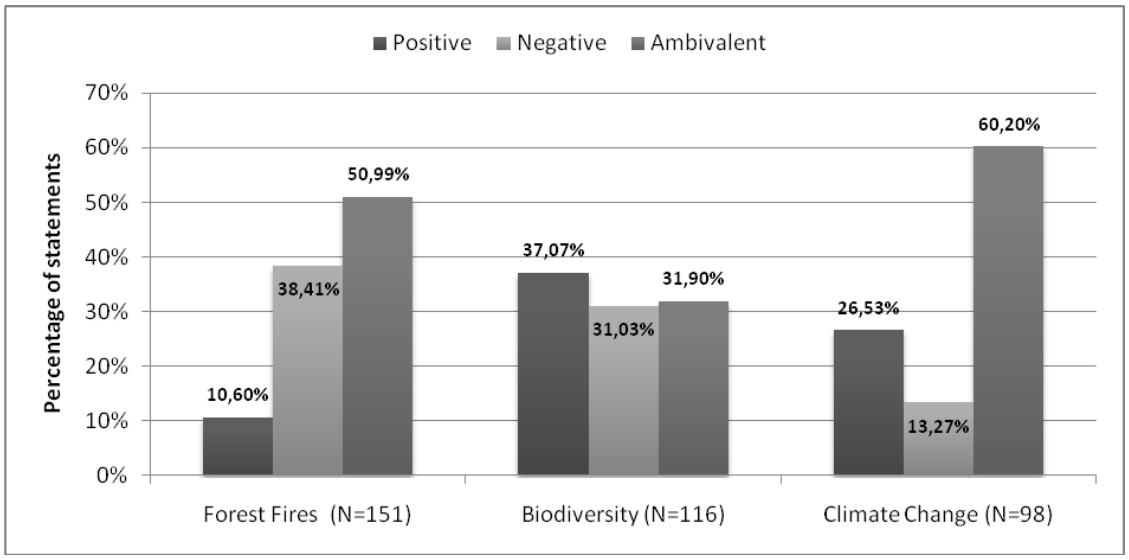

Figure 4.27. Assessment of total statements for the three issues in the national media discourse on forest science (Source: own calculations)

The event assessment previously showed that forest fires were the one issue where no controversy was present (figure 4.26). Figure 4.27 shows that the most frequent type of statement assessment in this issue are the ambivalent ones (total almost 51%). This can be seen as an indicator of controversy being absent, as it is the dominating position. However, there were both positive and negative statements being uttered by speakers (10,6% and 38,41% respectively). These numbers, and particularly the amount of negative statements (it is larger than the set limit of a third of all statement assessments), cannot be seen as evidence of the lack of controversy in the discussion of the issues. Therefore, controversy is present in the speakers' statements on forest fires. As an example, the director of a National Park in Australia -when interviewed on the scale of the fires affecting the area of Sydney- says:

> "*from an ecological point of view, this is a tragedy, since it was already affected by a fire in 1194 and the park had only partially recovered*" (EM, 27.12.2001: author's translation)

This can be taken as a negative statement as the concept of 'tragedy' has a negative connotation. Ambivalent statements include a director of a research organization in the Amazon who spoke in the media regarding the possibility that their research organization be affected by the fires:

> "*our research organization focused on native species which is located in the middle of the property* (where the forest fire was occurring) *is not is not in danger*" (EM, 24.03.1998: author's translation)

For biodiversity the presence of controversy is more easily observed, as the three types of assessments are close together in frequency. The highest type of statements being uttered in the articles are positive statements, with 37,07% of all statements. As an illustration:

> "*Costa Rica is a pioneer country in this issue. It already has contracts with … in an effort to generate resources through their use for the sustainability of the genetic and biological resources of the country*" (EM, 11.07.1998: author's translation)

This is a positive statement given by a scientist as it emphasizes Costa Rica as a positive example in the particular issue being discussed. Negative and ambivalent statements amount to a bit over 31% each. Thus, since there is no single type of statement that dominates the discussion it can be concluded that there is controversy in the statements of the speakers.

For climate change a not as clear picture as for the previous issues is seen. The assessment of events showed controversy, but ambivalent statements cover over 60% of all statements; positive statements have a considerable representation with 26,53% of all the statements uttered. Negative statements have here a small presence: only in 13% of the cases. The not insignificant amount of statements that are uttered in a positive way (more than the limit of one third of all statements) then, act weighing down the importance of the ambivalent ones. Therefore, controversy can be observed.

When comparing the results to the assessment of the statements that were uttered in the global media discourse no great differences are observed. Figure 4.23 showed that in all statements there was always one assessment that overshadowed the rest. However, the two other remaining types of assessment always had an important participation in the discourse (always summed more than a third of the total statements). This, therefore, confirmed the existence of controversy in the statements of the speakers for the three issues on the global level. On the national level majorities of one type of assessment were found but the two remaining assessments together counted for more than one third of the total assessments in the statements. Consequently in the three issues on the national level, regarding the statement assessments of the speakers is controversy found.

Controversy might not only be present when considering the events and statements of all participating speakers, but might as well be present within the different actor-groups finding opportunity to speak through the media. A possibility might then be that on the level of event and all statements controversy is absent in an issue, but when looking into the different actor-groups speaking they deliver different –maybe contradicting- assessments in their statements. Table 4.23 presents the different groups of actors participating in the discussion of the issues and their respective assessments. Highlighted are the statements of speakers where no controversy can be verified (as one type of assessment dominates and the others do not together reach over one third of all assessments).

For forest fires, the groups where one type of statement assessment was clearly dominating were international organizations (only one statement, thus no controversy), non-governmental organizations (more than 77% of the statements are negative), scientists (76% of the statements were ambivalent), and administration (ambivalent statements reach 67% of all statements of the group). Thus, in these groups controversy is not a characterizing factor of the statements of the actor-groups. For the issue biodiversity, only in one actor-group was a domination of one type of assessment found namely, in the statements of politicians (where 60% were negative). In climate change (as in forest fires), five actor-groups were found in which the assessment of the statements could be seen as lacking in controversy: experts (only one statement, thus no controversy), international organizations (90% of the statements are ambivalent), enterprises (80% ambivalent statements), politicians (where 89% of the statements are ambivalent), and scientists (66% of the statements were ambivalent).

Scientists enter in controversy within their ranks only in the issue of biodiversity. Positive statements amount to 44% of the total, while ambivalent to 34%, and negative to 20%. Thus, the highest type of statement assessment is positive, but the important participation of the other two types of assessment allow for controversy to be present (over one third of all assessments). In both the other two issues scientists mostly participated with ambivalent statements; where the low percentage of the other types of assessments thus indicates a lack of controversy on the part of this actor group.

The issue biodiversity does not only confirm the apparent controversy in the statements of scientists but can be seen as well in all other speaker-groups. Therefore, from the three issues analyzed it would seem the most controversial one. Speakers may not only present different opinions from other speaker-groups, but as well enter in controversy with speakers belonging to their own ranks. However, this must be taken with care, as the issue biodiversity is rich regarding the particular topics being discussed, and so it might be that controversy is present but that it is present because speakers are referring to different topics within the issue. Accordingly their points of view might reflect this and give an idea of controversy where there is none.

Table 4.23. Assessment of speaker statements in the national media discourse on forest science and the three issues (Source: own calculations)

FOREST FIRES	Positive		Negative		Ambivalent		Total
	n (16)	% of Total	n (58)	% of Total	n (77)	% of Total	N=151
Scientists	2	11,76%	2	11,76%	13	76,47%	**17**
Politicians	2	14,29%	4	28,57%	8	57,14%	**14**
Administration	5	12,50%	8	20%	27	67,50%	**40**
Media	4	11,11%	21	58,33%	11	30,56%	**36**
Enterprises	-		-		3	100%	**3**
NGOs	1	11,11%	7	77,78%	1	11,11%	**9**
International organizations	-		-		1	100%	**1**
Associations	1	25%	2	50%	1	25%	**4**
Other organizations	-		5	55,56%	4	44,44%	**9**
Single persons/communities			7	70%	3	30%	**10**
Experts			1	33,33%	2	66,67%	**3**
Other	1	20%	1	20%	3	60%	**5**

BIODIVERSITY	Positive		Negative		Ambivalent		Total
	n (46)	% of Total	n (36)	% of Total	n (40)	% of Total	N=122
Scientists	13	44,83%	6	20,69%	10	34,48%	**29**
Politicians	1	20%	3	60%	1	20%	**5**
Administration	5	35,71%	4	28,57%	5	35,71%	**14**
Media	12	48%	5	20%	8	32%	**25**
NGOs	3	21,43%	5	35,71%	6	42,86%	**14**
International organizations	2	50%	2	50%	-		**4**
Associations	-		3	50%	3	50%	**6**
Other organizations	2	40%	1	20%	2	40%	**5**
Single persons/communities	2	25%	5	62,50%	1	12,5%	**8**
Experts	3	42,86%	2	28,57%	2	28,57%	**7**
Other	3	60%	-		2	40%	**5**

CLIMATE CHANGE	Positive		Negative		Ambivalent		Total
	n (26)	% of Total	n (15)	% of Total	n (65)	% of Total	N=106
Scientists	4	16,67%	4	16,67%	16	66,67%	**24**
Politicians	1	11,11%	-		8	88,89%	**9**
Administration	6	37,5%	2	12,50%	8	50%	**16**
Media	7	33,33%	2	9,52%	12	57,14%	**21**
Enterprises	1	20%	-		4	80%	**5**
NGOs	2	28,57%	3	42,86%	2	28,57%	**7**
International organizations	-		1	10%	9	90%	**10**
Other organizations	2	50%	1	25%	1	25%	**4**
Single persons/communities	2	40%	1	20%	2	40%	**5**
Experts	-		-		2	100%	**2**
Other	1	33,33%	1	33,33%	1	33,33%	**3**

The possible controversy within the group of scientists in biodiversity might be illustrated by the examples hereon depicted. A positive statement of scientists is that of a Uruguayan scientists who emphasizes as an '*example to be followed*' the role of scientific networks have in certain natural reserves of different South American countries. This scientist highlights as example:

> "*Venezuelan natural reserves which have programs of sustainable development, a scientific research and interdisciplinary training program on sustainable development*" (EM, 17.09.1996; authors' translation)

An anthropologist warns:

> "*not to exaggerate the paradigm of free trade which throws of balance the sustainable development, which brings about an irrational exploitation of resources in detriment of future generations"* (EM, 06.06.1997; authors' translation)

The previous being an example of negative statements.
Finally ambivalent statements reflect the knowledge of scientists transmitted through the mass media; in the same article mentioned previously, a forest scientist describes that ten million years ago in order to sustain one person's living for one year 100 hectares of forest were necessary. He goes on to conclude that

> *"[N]ow-a-days through a relatively small extension of land dedicated to agriculture and grazing it is possible to preserve a good portion of the Earth by producing big amounts of food in an efficient way"* (EM, 06.06.1997)

These examples show that scientists give opinions and deliver information on different issues within biodiversity. Some positively emphasize the role that science has had in preserving species diversity, some emphasize the threats that '*market-economy*' has on biodiversity, and others state information that they manage regarding biodiversity. They are not necessarily making statements that touch on the same particular issue, thus whether the variety of the assessment of statements can be seen as controversial within this particular group is open for interpretation. A deeper analysis of how scientists frame particular problems regarding biodiversity would shed more light to the issue whether they use the media to enter into controversy within and outside their own ranks.

The national scientific discussion (scientific discourse on forest science) regarding biodiversity delivered the result that speaker statements lacked controversy, as there was a clear majority of them favoring ambivalent statements (figures 4.21 and 4.22).

The results on the global level regarding the statements of the particular actor-groups participating in the discourse (table 4.14) showed that scientists uttered controversial statements when referring to forest fires and biodiversity. Climate change lacked controversy: there was one type of assessment which predominated and the other two types did not reach the limit set for the statements to become controversial, namely a third of all statements uttered. For biodiversity, the controversy of scientists' statements is not as clear as in climate change, as the articles dealt with heterogeneity of topics that

made the comparison of the controversial statements difficult. In climate change the lack of controversy was mostly due because the scientists who participated charged their statements with negative judgment or normative values. The negative assessments they made considered the '*alarming' extinction of species'*.

The analysis of the national scientific discourse on forest science as seen through the issue of biodiversity showed that no controversy was found either for all speakers participating as for all authors of the scientific publications. The national media discourse showed that both speaker statements and scientists' statements referring to this issue were controversial. Thus not only is there a presence of controversy when examining all different speakers participating, but also when examining the particular group of scientists. On the national media level, these mainly uttered statements with positive connotations, however both negative and ambivalent statements were found (which together reached over one third of all scientists' statements). Therefore here, the medialization of scientists' statements can be observed: as when they participate in the media discussion not only ambivalent statements can be found (as is the case in the objective field of science) but scientists are willing to utter statements that have both positive as well as negative connotations.

4.4.3.3.1. SUMMARY CONTROVERSY

The previous section has shown that controversy differs whether the analysis is focused on the totally of the events reported on in each issue or the statements found in each issue. For the assessment of the events, controversy was found both in climate change and biodiversity. Regarding the assessment of the total statements for all three issues controversy was found, however, climate change being the issue in which controversy was less evident (because of the higher percentage of ambivalent statements).
The statements assessment of scientists is not controversial for the issues of forest fires and climate change but controversial when dealing with topics in biodiversity. Not only scientists are controversial in this issue, but all other actor-groups as well.

4.4.3.4.COMMUNICATION TOOLS

As in the global media discourse, a look into the communication tools that speakers use in their statements when communicating their interpretation patterns in the national mass media will give indication on whether they have adapted media tools in their statements and thus suggest the existence of medialization.

Table 4.24 shows, that there are a number of statements where no communication tool could be observed. In 21 of the 151 statements of forest fires no communication tool was present (13,9%). In biodiversity there were a total of 122 statements made and in 25 statements (20,49%) no tools were found. In climate change from the 106 statements found in 20 of them (18,87%) no communication tool was found. Thus the majority of the speakers which made statements found the need to use the different communication tools examined.

Table 4.24. Number of speaker statements using and not using communication tools in the national mass media for the three issues (Source: own calculation)

	Forest Fires		Biodiversity		Climate change	
	n	% of N	n	% of N	n	% of N
Statements using tools	130	86,09%	97	79,51%	86	81,13%
Statements not using tools	21	13,91%	25	20,49%	20	18,87%
Total Statements (N)	***151***	***100%***	***122***	***100%***	***106***	***100%***

Table 4.25 shows the number and percentage of statements using the different communication tools found for all speakers in the issues analyzed.

The majority of the statements were found to be making use of descriptions, as was the case for the global discourse. All actors relay on descriptions to explain in more detail their points of view on particular issues. The second most frequent use in the statements of a communication tool is similar in biodiversity and climate change: symbols. Symbols are, however, only the fourth most frequent communication tool found in speakers' statements in forest fires (not considering 'other' category as this is an aggregation of several other types of tools that individually did not reach the important percentages in their use). For forest fires the second most frequent use of a communication tool in the statements are historical references.

Table 4.25. Number and percentage of statements using the communication tools found in the national media discourse on forest science (Source: own calculations)

	Forest Fires		Biodiversity		Climate Change	
	n	% of N	n	% of N	n	% of N
History	27	17,88%	20	16,39%	13	12,26%
Technology	13	8,61%	3	2,46%	12	11,32%
Metaphor	9	5,96%	6	4,92%	5	4,72%
Symbol	11	7,28%	40	32,79%	19	17,92%
Description	123	81,46%	74	60,66%	76	71,70%
Other	11	7,28%	22	18,03%	25	23,58%
Total Statements (N)	***151***	***100%***	***122***	***100%***	***106***	***100%***

Historical references, are the fourth most frequent tool used in the statements for both biodiversity and climate change. The use of metaphors is relegated to a last place of usage for both forest fires and climate change, being second to last in biodiversity (winning only to technological references by three statements). Consequently, the two communication tools which are mostly associated with the media (namely symbols and metaphors) have found different degrees of acceptance amongst the speakers participating in discourse. While symbols are frequently found in the statements of biodiversity and climate change – ranking second and third respectively in the number of statements using this tool - they are less frequent in forest fires: ranking fourth (not considering 'other' category, as this is an aggregation of other tools that individually did not have a significant participation)-. Thus, this type of tool does seem to find acceptance by speakers (depending on the issue). Metaphors on the other hand, rank last in their use in the statements of forest fires and climate change. Making it, thus clear that speakers when they communicate they do not favor this particular media-associated communication tool. Consequently, the media-

related tools here analyzed have contradicting destiny regarding their use amongst speakers in the different issues.

The attention now turns specifically to the tools used by scientists in their statements in order gain more insight into the medialization hypothesis here tested. Medialization, as proposed by Weingart (2001) and Nelkin (1987) assumes that scientists will adapt to the criteria of the media when speaking regarding public issues. The adaptation of the media criteria, or media rules, is here seen through the presence or absence of the communication tools associated with the media namely, metaphors and symbols in the statements of the speakers. Therefore in order to conclude whether scientists have adapted themselves to these criteria, they would -on the one hand- have had to use these tools in their statements and do so in percentage that might come close to the percentages of use by the media, and on the other hand do so proportionately more than in the scientific discourse. Table 4.26 illustrates the different tools used in their statements by scientists, by the media, and as well by non-governmental organizations in the different issues analyzed. The inclusion of NGOs as a comparison group is reasonable, as these organizations are –in comparison to scientists- an actor-group frequently appearing in the media commenting on issues of (in this case) environmental nature. They are considered 'medialized actors' as they depend on the media for the communication and dissemination of their activities.

For the issue of forest fires the media uses a greater variety of tools in their statements than scientists. This is not surprising as the speakers of the media write the articles and thus must make of use of different tools. Scientists do not make use of any of the two tools associated with the media (metaphors or symbols), where as the media does make use of these tools but favors descriptions and historical references to both metaphors and symbols. The low percentage of statements by the media that use metaphors and symbols may be an indicator that forest fires is an issue in which the coverage of the issues is not seen to call for explanations where tools such as metaphors and symbols are needed. Or it might indicate the lack of interests of the media to 'medialize' this issue. Also an interesting results is that in one case, the media did not use any communication tools to deliver its' statement, whereas all scientists which appeared participating in the discourse made use of at least one communication tool. Non-governmental organizations are the actor group which proportionately makes more use of metaphors and symbols.

Examples of the historical references used by the media include a detail historical description of the fires that have caused mayor changes in the portrait of the forest in Chile (EM, 11.05.1999). Or the reporting in the number of fires that have occurred in Chile in 'the last 21 years' which have caused a forest loss of the equivalent of 3% of the national territory (EM, 19.03.2001). Historical references used by scientists include the comparison through time of the intensity in which the 'El Niño' phenomena has appeared and has affected the Asian region, particularly motivating the occurrence of forest fires; as well comparative references of how the smoke emanating from the fires surpasses the air pollution of cities like London in the 1950s when the practice of burning coal was frequent (EM, 26.09.1997).

The metaphors used by the media include, for example, comparisons between tall buildings and 'spectral shadows' as a way of exemplifying just how intense the smoke

emanating from the forest fires is (EM, 26.09.1997). Another example is how the media compare the forests to 'photographs' of people which through time are never the same, this illustrates the readers how through time the forest experiences changes as well (11.05.1999). 'Smokey the bear', a recognized symbol for the fight against forest fires in the United States, is used by the national mass media when asking what happened in light of the mayor fire events that occurred in the United States hampered by the 'let it burn' policy of the forest service of that country (EM, 29.05.1997). Another example are the 'dead and dry barks' that remain in the territories where forest fires have taken place and where till that point in time no answer was given regarding the cause of the fires (EM, 25.03.1998).

In the issue of biodiversity there are scientists who choose not to use any of the communication tool here examined. In nine of the 29 statements from scientists no communication tool was found, in other words in almost a third of the statements of scientists no communication tools was found. Scientists expressed opinions on the issues but could not even be considered as descriptions. Whereas the statements of the media were always filled with at least one of the communication tools examined.

The tools most frequently used by scientists, as well as by the media are once again descriptions. In comparison to forest fires, scientists in the issue of biodiversity do make use of metaphors and symbols. The difference in the proportion of use of these two tools by both the media and scientists is however not large. In two statements, scientists use metaphors, the same number of statements as the media but important is that as percentage of the statements, scientists use metaphors less than the media does.

The relative use of symbols is a bit more differentiated between the two groups. Scientists' use of symbols is a little less than a third of all their statements, while the media uses this tool in a little less than a half of all its' statements. Comparing the proportions of the scientists' statements using these two tools and the proportion of media statements of the same two tools there can be no absolute claim that scientists are adapting to the criteria of the media. However the considerable proportion of scientists that use symbols in their statements might be an indicator that they do medialize to some degree their statements.

Table 4.26. Number and percentage of scientists, media, and non-governmental organizations' statements using communication tools in the national media discourse (Source: own calculations)

Scientists	Forest Fires		Biodiversity		Climate Change	
	n	% of N	n	% of N	n	% of N
History	1	5,88%	4	13,79%	5	20,83%
Technology	2	11,76%	1	3,45%	8	33,33%
Metaphor	-	-	2	6,89%	2	8,33%
Symbol	-	-	9	31,03%	4	16,66%
Description	17	100%	15	51,72%	20	83,33%
Other	-	-	2	6,89%	6	25%
Total Statements (N)	***17***	***100%***	***29***	***100%***	***24***	***100%***
None	-		9		3	

Media	Forest Fires		Biodiversity		Climate Change	
	n	% of N	n	% of N	n	% of N
History	13	36,11%	11	44%	6	28,57%
Technology	4	11,11%	1	4%	2	9,52%
Metaphor	5	13,88%	2	8%	1	4,76%
Symbol	5	13,8%	12	48%	6	28,57%
Description	34	94,44%	20	80%	18	85,71%
Other	3	8,33%	4	16%	10	47,62%
Total Statements (N)	***36***	***100%***	***25***	***100%***	***21***	***100%***
None	1		0		1	

NGOs	Forest Fires		Biodiversity		Climate Change	
	n	% of N	n	% of N	n	% of N
History	1	11,11%	1	7,14%	1	14,28%
Technology	1	11,11%	0	-	1	14,28%
Metaphor	2	22,22%	1	7,14%	1	14,28%
Symbol	1	11,11%	1	7,14%	2	28,57%
Description	6	66,66%	10	71,42%	3	42,86%
Other	1	11,11%	4	8,57%	0	-
Total Statements (N)	***9***	***100%***	***14***	***100%***	***7***	***100%***
None	2		4		3	

Example of metaphors used by scientists include reference to protected areas in Chile as 'stepping stones' in between fragments of adult forest that allow the mobility of mammals which require ample territories to maintain their sustainable population (EM, 26.09.2003). Examples of metaphors used by the media include an 'ear tug' as metaphorical examples of what should be done to those actors who go too far in their efforts to protect biodiversity as well as to those enterprises or persons who act in an irresponsible way towards biodiversity (EM, 16.07.1996).

Symbols used here by scientists include naming specific trees species as examples of the diversity of forest that has been affected through time in Chile or to illustrate that when those specific species are present owners cannot harvest them calling on the State to compensate the owners (EM, 24.05.1999). Particular animal species are used by as symbols by the media to illustrate the dangers that all species in a determined geographical area are threaten because of diverse human activities that perturb their natural habitat, namely the forests (EM, 01.04.2003).

For the issue of climate change a similar picture is seen as with biodiversity. The majority of the statements that scientists make incorporate some sort of communication tool. Only in three out of the 24 statements made by scientists no communication tools were present. There was only one case found in which the media did not communicate through the use of any of these tools. Proportionately the media uses metaphors and symbols more often than scientists in their statements (again not an unexpected result). The difference between the two is however not large. Scientists, in this issue, favor symbols to metaphors. But their use of media-related tools is low compared to, for example, the amount of times descriptions and technological references are present in the statements. This makes it difficult to assert that scientists have adapted their statements to the criteria of the media.

Scientists have used metaphors to illustrate what it would be like to use forests as a source of combating climate change in that forest owners 'rent' their forests to enterprises who are willing to pay for the environmental services the forest provides (EM, 22.10.2001). Another example shows scientists referring to the surplus of non-liberated carbon dioxide emissions that Russia 'owned' as 'hot-air' (08.12.2003). The only metaphor used by the media was the use of the illustration of a 'greenhouse' to illustrate how the emissions of gases such as carbon dioxide affect the temperature of the earth (EM, 13.04.2003); in this case from the metaphor used the process of global warming was in detail explain to the readers in opposition to other articles were greenhouse gases, greenhouse effect are use without further explanation.
The reference to photographs were the forest is portrayed after harvesting are symbols used by scientists to indicate the different transition stages a forest goes through, afterwards giving way to the re-growth of species (EM, 12.04.1994). The media, in one particular statement, makes reference to a forest enterprise as a way of exemplifying the 'innovating proposal' that forests capturing carbon dioxide from the atmosphere mean and the success of selling the bonds as a way to effectively contribute to the mitigation of climate change (EM, 11.12.2000).

In the issue forest fires, Asian politicians make -as an example of symbols- references to agricultural fields which, in a 'regular year', would be covered in 50 meter of water as an example of other consequences the drought is having on the area (EM, 23.06.1998). One non-governmental organization which participates making use of symbols in forest fires, uses symbolic statistics which illustrate damages that the forest has suffered throughout history because of human participation in forest fires, lack of implementing existing laws and regulations, and because of different natural phenomenon which occur in Chile (EM, 09.03.1998). These examples give evidence that other speakers are making use of symbols.

Examples of other actor-groups making use of symbols in the issue of biodiversity include politicians making reference to e.g. Chinas' government exemplifying through the Pandas their conservation efforts (EM, 30.12.2003); administration also made use of symbols, particular forest reserves as examples of the success of the conservation efforts done by the forest administration (EM 17.09.1996); NGOs as well using the Convention of Biological Diversity as a symbol of what the government in Chile should implement in the country (EM, 11.12.1996); associations exemplifying through speakers naming Eucalyptus as a species that owners should be allowed to plant in their own lands (EM, 24.05.1999); and single persons or communities use the transformation of the environment of a lake in the south of Chile as a symbol for the negative impacts that the construction of a hydroelectric power plant has had on it (EM, 18.10.1999).

Finally, climate change shows as well that other actors incorporate symbols in their statements. Examples of symbols that single persons or communities use is the mentioning of a farm in Costa Rica, as an example of the successful business venture of selling the carbon dioxide captured by the forests within it which gives the introduction to explaining how the market of carbon bonds would work (EM, 06.06.1998). Alongside this actor-group, speakers belonging to the administration, NGOs, and international organizations as well make use of symbols. Symbols used by the administration include the use of the concept 'eco-efficiency' when addressing what the forest enterprises in Chile should be aiming for (EM, 21.09.1998). An example of a symbol used by non-governmental organizations is an environmental report appearing in the year 2000 which was used as basis for advocacy of for reducing human consumption and carbon dioxide emissions (EM, 21.10.2000). A similar use of the 'Kyoto Protocol' as a symbol for supporting courses of actions to reduce carbon dioxide emissions is made by international organizations (such as FAO).

On the global level, scientists compared to the media were found to proportionately incorporate less frequently media-related communication tools than the media in their statements. This is as well the case when scientists were compared to NGOs in forest fires and climate change. However, in biodiversity they proportionately were more incline to incorporate metaphors and symbols in their statements than NGOs. This implies that for biodiversity the statements of scientists reflected an adaptation to the criteria of the media in the public discourse, as compared to actors who are more familiarized with the criteria of the media (e.g. non-governmental organizations) utter in their statements the media-related communication tools that can be associated with the medialization phenomenon.

On the national level in the issue of forest fires scientists did not make any use of metaphors or symbols, therefore no comparison with the two more medialized actor-groups can be carried on. Consequently for this issue, no adaptation of scientists' statements to the rules of the media can be said to take place. In the issue of biodiversity, the use of symbols by NGOs in their statement is proportionally lower than the use of the same communication tool by the media and by scientists. This could be an indicator that scientists are adapting their statements to the rules of the media. The same cannot be stated for metaphors, as scientists in their statement use proportionally less metaphors than the other two medialized group. It is to be noted that the proportions of use of this particular tool are not that different for each of the three actor-groups. Therefore, this

and the previous result on symbols can give indications that scientists are adapting their statements to the media criteria. Finally, for the issue of climate change the numbers show that it is the issue furthest away from a medialization of the statements of scientists when comparing them to the other two actor groups. The proportion of scientists' statements that use metaphors is more when comparing them to the media, but less when comparing them to NGOs. Both media and NGOs proportionally use more frequent symbols in their statements than scientists. Thus, no adaptation to the criteria of the media can be implied.

4.4.3.4.1. SUMMARY COMMUNICATION TOOLS

Table 4.26 showed that there is one issue in which no media-related communication tool is found: forest fires. In the other two issues, scientists appear in their statements making references to metaphors and symbols. For the two issues, symbols are always proportionately preferred to metaphors in the statements. In climate change, the participation of these tools in the total tools used by scientists is not as great as in the issue of biodiversity. This might be an indication that scientists, depending on the issue that is being discussed, choose to incorporate more or less media-related communication tools in their statements. Which issue is considered as one where these tools are necessary by scientists, might depend on the public and political interest of that particular issue. Here, forest fires is the issue in which scientists made no use of these communication tool; this might be because it might not be as 'interesting' to the public as other scientific issues which are more visible in the media and thus to the public (for example stem cell research as Schäfer (2007) points out).

4.4.3.5.POLITIZATION

Following Weingart (2001), scientists act as political actors when, in their statements, they make reference to causes and causers of the problems being discussed. By assigning blame through their statements in the mass media, scientists become political players trying to position themselves in the public discourse. Politization, as a 'medialization' factor, will contribute to evaluating the existence of medialization in so far as scientists do –in their statements- single out specific actors or groups of actors as being responsible for the problems associated to each of the issues. Additionally, the politization of a statement will further depend on which type of actor is being blamed. Actors who do not have the possibility to directly participate in the media as speakers cannot be considered actors that contribute to a politization of a statement. For example, nature or society can be considered by actors as responsible parties for particular forest-related problem. However, they cannot participate in the public discourse (not considering, particularly for nature, that there might be groups of actors which might speak on its' behalf) and so cannot be taken as making a contribution to the politization of the statements.

For each of the issues, the causers of problems are tabulated against those speakers who assign them those positions, namely the speakers making statements in the discourse. Tables 4.27 to 4.29 show this mapping of interest position.

Table 4.27 deals with the issue of forest fires. From examining pluralization it was clear that a variety of speakers participate in the science-related articles on forest fires (table 4.22). There are a total of 151 different speakers participating in the discourse on forest fires. Table 4.27 shows that 63 speakers that did not name any causers in their statements, representing 41,72% of all speakers. The actor-groups who mostly remained silent regarding assigning blame are associations (75% did not assign blame), followed by politicians (71,43% did not assign blame), and single persons or communities (60% of these participants). The participants who mostly take part assigning blame are international organizations (the one organization participating named a causer), the media in 75% of the cases have assigned blame (27 speakers from 36), NGOs, experts, enterprises, and other actors also have a big participation in naming causers. Scientists are in an intermediate situation: seven of the 17 scientists participating did not assign blame (41,17% of all scientists).

From table 4.27, most actors blame nature as the most frequent causer of damages and problems that arise in this issue. Here '*forest fires*' along with, for example '*high climatic temperatures*' and '*increases in pastures which were brought on by increased rains*' (EM, 06.02.2003) are all natural causes that have provoked some sort of damage or created problems. Nature as a causer is identified in 45% of the cases. Eight out of the eleven different speakers mostly blame nature; they are scientists, media, administration, international organizations, associations, non-governmental organizations, experts, and other speakers. Some speakers only name nature as responsible (international organizations, associations, and experts). While other speakers, for example scientists and the media, distribute the blame of problems through different actors; each indicate nature in over 40% of all the cases they assign blame but name other actors as for example society, single persons or communities, politicians and in the case of scientists also to the media.

The second most frequent actors to which speakers assign blame are single persons or communities. Most speakers who participate in the discourse recognize that the fires occurring in Chile have been either intentionally or unintentionally provoked by individual persons (e.g. EM 03.03.2002). This has been ratified by research carried out by the Chilean Forest Service which investigated the most frequent causes of forest fires in the country (EM, 13.11.1997 and 26.12.2003). In these studies, and according to the statistics kept by both the Forest Service and a special division of '*forest police*', the main culprits of the fires that affect forests and plantations throughout the country are single persons who either deliberately (arson) or unintentionally (because of badly put out camp fires) have been responsible for initializing fires.

After nature and single persons, society is the actor which is identified by speakers as causing fires. Some actors name society as causers of the fires extending in Asia in the year 1998 (EM, 23.06.1998), or they name society as being directly or indirectly responsible for the forest fires occurring in the country (EM, 22.11.1997).

Table 4.27. Causers of problems in forest fires according to speaking actors in national media discourse in absolute value and as % of total causers (N=140; source: own calculations)

Causers / Speakers	Politicians (n, % of N)	Administration (n, % of N)	Media (n, % of N)	Enterprises (n, % of N)	Nature (n, % of N)	Society (n, % of N)	Single persons or communities (n, % of N)	Other (n, % of N)	*TOTAL CAUSERS (N)*	None
Scientists	-	-	1 7,14%	1 7,14%	6 42,86%	3 21,43%	1 7,14%	2 14,29%	***14***	7
Politicians	2 50%	-	-	-	1 25%	-	1 25%	-	***4***	10
Administration	1 3,13%	1 3,13%	-	1 3,13%	16 50%	4 12,5%	9 28,13%	-	***32***	18
Media	5 10,64%	-	-	2 4,26%	22 46,81%	5 10,64%	8 17,02%	5 10,64%	***47***	9
Enterprises	-	1 50%	-	-	1 50%	-	-	-	***2***	1
NGO	1 6,67%	2 13,33%	-	2 13,33%	4 26,67%	2 13,33%	2 13,33%	2 13,33%	***15***	3
International organizations	-	-	-	-	1 100%	-	-	-	***1***	0
Associations	-	-	-	-	1 100%	-	-	-	***1***	3
Other	-	1 7,14%	-	-	7 50%	2 14,29%	3 21,43%	1 7,14%	***14***	5
Single persons or communities	1 12,5%	1 12,5%	-	-	2 25%	-	3 37,5%	1 12,5%	***8***	6
Experts	-	-	-	-	2 100%	-	-	-	***2***	1
TOTAL (% of N)	***10 (7,14)***	***6 (4,29)***	***1 (0,71)***	***6 (4,29)***	***63 (45)***	***16 (11,43)***	***27 (19,29)***	***11 (7,86)***	***140***	*63*

Politicians are as well identified as a causer in the articles regarding forest fires, but not by scientists. They mainly are singled out because of their responsibility in not preventing tragedies related with the occurrence of forest fires. For example, the media names government as being in coalitions with enterprises to provoke fires in Indonesia as a cheap method to clear land that can be later used for plantations (EM, 26.09.1997). Another mention of the government as provoker of forest fires is made by the media (in this case a foreign mass media editorial). In that case, the Brazilian government is blamed for the lack of '*environmental efforts*' they have made in order to protect the Amazon from deforestation and fires (EM, 04.04.1998). Administration is also blamed because of e.g. their lack of prompt reactions when fires occur. Other examples include single persons who have participated in discourse criticizing the forest administration for not being able to implement the laws that regulate the burnings carried out in rural areas which quickly get out of control (EM, 24.03.1994), or enterprises claiming that it is the bureaucracy of the forest administration that does not allow enterprises to cut the allowed quotas of needed trees (EM, 29.05.1997). Scientists are well are silent regarding the possible responsibility of this group on problems relating to forest fires.

From the results of table 4.27, when scientists assign blame they do it to a variety of actors, which could be a first indication for their statements to be considered being used in a political way. However, apart from nature, scientists mostly name society and 'other' as main responsible; both actors which cannot have a position as speakers in the public discourse. The category 'other', for example, is occupied by responsible actors indicated

by scientists such as '*roads*' and '*railroad lines*' (EM, 29.05.1997), which also are not actor-groups that can occupy a place in the public discussion as speakers. Actors that are given a chance to speak in the discourse, and which are indicated by scientists as responsible, are the media itself and enterprises. The media was named once as presenting news '*irresponsibly*' regarding the fires that occurred in Yellowstone National Park in the United States. In this case a scientist was the one assigning blame to the media (EM, 29.05.1997). Enterprises are named by one Brazilian scientist as responsible for breaking '*environmental regulations*' that influence the occurrence of forest fires in the Amazon region (EM, 04.04.1998). These causers do not, however, represent a big proportion of the blame assigned by scientists: together they represent no more than 15% of the total causers named by scientists; therefore making it difficult to conclude that the statements of scientists are in any way politicized.

On the global level, scientists named actor-groups such as politicians, administration, and enterprises, alongside with nature and other groups as causers. The proportion of blamed assigned to the first group (politicians, administration, and enterprises) was however not very different from the proportion assigned to the media and enterprises on the national level. On the global level politicians, administration, and enterprises were named in 17,24% of the times scientists named causers (table 4.17); compared to the 15% that media and enterprises were assigned on the national level. Independently of the level, enterprises are the actor-group which is considered as having responsibility of the problems that forest fires carry by scientists.

The causers of the issue of climate change are shown in table 4.28. From the speakers that appear in the discourse, those who do not name causers in their statements, thus not politicizing their statements, are experts and enterprises. The two experts and the five enterprises that were found as speakers do not assign any blame. Politicians do not make a practice of assigning blame in their statements: six from nine of those appearing in the discourse did not assign blame. Scientists followed as actors not pointing fingers at those who are to blame for the problems related to climate change (a bit over half them did not assigned blame). 50% of speakers such as the European Union or United Nations, which conform the category of international organizations, assigned blame to other actors (five of ten speakers). The rest of the speakers (the media, administration, and NGOs) do blame some other actor as causer of problems.

The actor which was mostly named as causing climate-change related problems, such as the increase of carbon dioxide emissions to the atmosphere, is again nature (not considering 'other' category, comprised for example by '*responsible actors*' of damages, '*ecological movements*', '*developed nations*', amongst many other). Nature is named as responsible in almost a quarter of the total times causers are named in the discourse. Society and single persons or communities followed closely each with an absolute value of 11 times named (representing 13,92%).

Scientists, for example, when speaking about a project presented in Chile to tackle the greenhouse effect problem, name '*gases*' or '*greenhouse gases*' as the causers for the increment of the Earth's temperature (EM, 04.06.1996). The media makes reference to '*climate changes*' that are foreseen to occur with the increase in the Earth's temperature, as being responsible for difficulties that will be faced by the agricultural and forest sectors (EM,

22.01.1998). In both these cases the word 'nature' is not indicated by actors as being responsible for the difficulties, but they are presented as nature-related phenomenon, thus nature is seen to be blamed by the speakers.

Table 4.28. Causer of problems in climate change issue according to speaking actors in national media discourse in absolute value and as % of total causers (N=79; source: own calculations)

Causer / Speaker	Politicians (n, % of N)	Administration (n, % of N)	Enterprises (n, % of N)	International organizations (n, % of N)	Associations (n, % of N)	Nature (n, % of N)	Society (n, % of N)	Single persons or communities (n, % of N)	Experts (n, % of N)	Other (n, % of N)	*TOTAL CAUSERS (N)*	NONE
Scientists	1 5,88	-	-	-	-	5 29,41	4 23,53	-	-	7 41,18	***17***	13
Politicians	3 100	-	-	-	-	-	-	-	-	-	***3***	6
Administration	1 12,5	-	1 12,5	-	-	2 25	-	-	-	4 50	***8***	2
Media	2 7,41	-	1 3,7	1 3,7	1 3,7	7 26,93	5 18,52	2 7,41	-	8 29,63	***27***	7
Enterprises	-	-	-	-	-	-	-	-	-	-	**-**	5
NGO	1 20	1 20	-	-	-	-	1 20	-	-	2 40	***5***	2
International organizations	-	-	-	-	-	3 37,5	1 12,5	-	-	4 50	***8***	5
Other	-	-	-	1 33,33	-	-	-	1 33,33	-	1 33,33	***3***	3
Single persons or communities	1 12,5	-	1 12,5	-	-	1 12,5	-	1 12,5	1 12,5	3 37,5	***8***	0
Experts	-	-	-	-	-	-	-	-	-	-	**-**	2
TOTAL (% of N)	***9 11,39***	***1 1,27***	***3 3,8***	***2 2,53***	***1 1,27***	***18 22,78***	***11 13,92***	***4 13,92***	***1 1,27***	***29 36,71***	***79***	***45***

Society, or '*man and its' activities*', are named by scientists as responsible for the increase of carbon dioxide emissions which can no longer be assimilated by the atmosphere, as it is saturated (EM, 19.09.1996). This is an example also applicable to media naming society as causer (EM, 20.11.1999).

Politicians are named in 11,39% of the cases; they are named by many different actors: scientists, administration, media, non-governmental organizations, single persons or communities, and as well by other members of the same sector. For example, the government of the United States is blamed by a reader of the media (single persons) for their responsibility for being one of the largest actors to emit carbon dioxide into the atmosphere (EM, 10.05.2000). One scientist was found to be indicating politicians as responsible for some kind of miss-happening. In the article, a Chilean scientist, who participated as the Chilean delegate to an international meeting held in Milano in the year 2003, accuses the Russian government for being able to delay at their will the ratification of the Kyoto Protocol, in other words for not showing the necessary '*good will*' to ratify the international agreement (EM, 08.12.2003). Politicians blame other actors in the same category as for example is the case in an article (EM, 15.07.2002) in which three Senators in Chile blame '*the scandalous way*' in which the United States Government has not ratified

the Kyoto Protocol. Therefore, politicians do appear as being blamed, in the previous example, the United States Government.

Compared to the global level, scientists at the national level were less cautious in their statements participating proportionately more frequently assigning blame than scientists on the global level (table 4.19). On both levels, scientists mostly name nature and society as the main responsible actors. These are, once again, actors which cannot defend themselves against these accusations, as they cannot ask for a speaking space in the public discourse. Aside from other groups named, both on the global as on the national level politicians are indicated as responsible actors by scientists. But the proportion of politicians compared to nature and society is so low. Consequently this cannot be taken as indication that scientists politicize their statements by naming causers.

Finally for the issue of biodiversity, table 4.29 shows how the different speakers present in the discourse found a variety of actors as being causers of the problems. The actors which mainly participate in assigning blame are single persons or communities and the media. The former has a speaker participation of eight from which only two did not name any causers. The latter participates in the discourse with 25 speakers from which eight did not assign blame. Another actor which frequently speaks naming causers is the administration (total of 14 speakers from which six blamed an actor as responsible). The remaining actors participated with either 50% or less of speakers naming causers of problems. Experts, non-governmental organizations, and international organizations (these two considered actors who are familiar with the rules of the media) are amongst those with the least of their speakers participating in naming responsible actors.

Scientists were not far from these actor-groups. From the 29 scientists participating in discourse only eight of them named causers. Consequently, if only the number of scientists participating here is considered then the politization of the issue by scientists (as seen by the proportion of speakers within a group that participate assigning blame) cannot be confirmed, as the majority of the scientists (21 from 29 scientists) prefer not to name any actors as responsible for the biodiversity related problems.

The most frequent actor named as causer (aside the 'other' category) is society. For example a media correspondent named the German society as the responsible for the felling of the primary forests in that country which resulted in the enormous loss of diversity of trees in that area (EM, 11.07.1998). Scientist as well name society. Ecologists from one of the most prestigious universities of the country, for example, name society as the one responsible for pressures on the diversity of the 'temperate forests' because the lands which these forests are native to are the same lands that are coveted by Chilean society for agriculture-related activities, forest activities such as plantations, and grazing (EM, 24.12.1998).

Table 4.29. Causers of problems in biodiversity issue according to speaking actor in national media discourse in absolute value and as % of total causers (N=65; source: own calculations)

Causers / Speakers	Scientists (n, % of N)	Politicians (n, % of N)	Administration (n, % of N)	Enterprises (n, % of N)	NGO (n, % of N)	Nature (n, % of N)	Society (n, % of N)	Single persons or communities (n, % of N)	Other (n, % of N)	*TOTAL (N)*	NONE
Scientists	1 14,29	2 28,57	-	-	-	-	2 28,57	-	2 28,57	***7***	21
Politicians	-	-	-	-	-	-	-	-	2 28,57	***2***	3
Administration	-	1 14,29	-	-	-	1 14,29	2 28,57	1 14,29	2 20,83	***7***	6
Media	-	-	2 8,33	4 16,67	-	1 4,17	8 33,33	4 16,67	5 20	***24***	8
NGO	-	-	-	2 40	1 20	-	-	1 20	1 20	***5***	11
International organizations	-	-	1 100	-	-	-	-	-	-	***1***	3
Associations	-	-	-	-	-	-	1 50	-	1 50	***2***	3
Other	-	-	-	2 25	1 12,5	-	-	1 12,5	4 50	***8***	6
Single persons or communities	-	1 11,11	1 11,11	2 22,22	-	1 11,11	1 11,11	1 11,11	2 22,22	***9***	2
Experts	-	-	-	-	-	-	-	-	-	***0***	7
TOTAL (% of N)	***1 1,54***	***4 6,15***	***4 6,15***	***10 15,38***	***2 3,08***	***3 4,62***	***14 21,54***	***8 12,31***	***19 29,23***	***N=65***	***70***

Enterprises are the second most frequent actor-group assigned with responsibilities for the problems affecting the diversity of species found in the forest. For example, enterprises are singled out by the media as playing a major role in the disappearance of species because of the 'irresponsible' way in which they carry out their operations (EM, 16.07.1996). Biotechnical enterprises are also blamed by the media for the loss of biodiversity because of the need for the genetic resources that are found within forests (EM, 11.12.1996). Non-governmental organizations name enterprises as responsible of obtaining financial benefits at the cost of the diversity of species found in the forest and not contributing to their preservation (EM, 19.12.1996).

Single persons or communities follow enterprises as those seen with responsibilities regarding the problems biodiversity faces. 12,31% of all causers named belong to this group. Several speakers name single persons. For example, the media writes that single persons act in irresponsible ways regarding biodiversity (EM, 16.07.1996) because sometimes the activities of individuals negatively affect biodiversity. Individual forest owners are as well accused by the media because their forest-related productive activities threaten the biodiversity of the native forests (EM; 24.05.1999). Fishermen, people practicing sports like jeep races, alongside cattle that graze in a Nature Sanctuary are all indicated by the media, a speaker belonging to the administration, and a representative of a museum as being causers of the loss of biodiversity in this nature park (EM, 01.04.2003).

Speakers that belong to the sector of politicians and administration are equally blamed by actors as being responsible in some degree for the negative pressures on biodiversity (4

times each equivalent to 6,15% of the total causers). Scientists are proportionately the actors that most frequently named politicians. But two other actors as well make reference to politicians (single persons and administration). For example a letter sent by a reader accuses the Chilean Senate of their '*inexplicable and embarrassing*' delay in ratifying the international convention on biodiversity approved in Rio de Janeiro in 1992 (EM, 01.07.1994). The speaker belonging to the administration which makes reference to politicians as causers of problems blames the government for not investing enough resources in scientific investigations that may help protect biodiversity (EM, 17.09.1996). Scientists participating in the discourse, who chose to name politicians as responsible parties of the loss of biodiversity in the country are in one case from Chile and in the other from Costa Rica. In both cases, scientists emphasize the role politicians have in the lack of the existence of a legal framework that helps protect biodiversity, specifically the diversity of forests in the Chile (EM, 10.03.2001) and protect the genetic resources found within the forests in Costa Rica (EM, 11.07.1998). Therefore, their participation in naming causers in the discourse is not insignificant.

Examples of speakers blaming the administration include an international organization – specifically, a representative of the Food and Agriculture Organization (FAO)-. This speaker blames the administration in charge of the protected areas in Chile for not having the necessary know-how to treat issues that escape their specialties, for example education, public health, rural development, agriculture and social services which are included in the concept of biosphere reserve (EM, 17.09.1996). A conflict regarding the limits of a national park where diverse biological species are conserved, has a community of persons in the central part of Chile blaming the responsible Ministry for not regulating the distribution of lands which they allege, according to historical references, belongs to them and not the park (EM, 07.08.1997). The media, for example, accuses the administration -particularly those responsible for the assignation of resources- for putting difficulties to a legal project which would assign forest owners a subsidy for sustainably managing native forests (EM, 20.08.2002).

A particular situation occurs with scientists. There is one case in which a speaker associated to the category scientists blames other scientists for a problem. Particularly a Chilean biologist accuses her colleagues for focusing their research in particular geographic zones in Chile (the south and large cities) and 'completely ignoring' others, in detriment of the scientific information that could be gathered (EM, 05.06.2001). The same type of situation occurs in the category of non-governmental organizations. There is one speaker blaming another speaker from the same category. This particular case occurs because a United States representative of one non-governmental organization accuses other non-governmental organizations from the United States of a new form of '*imperialism*' in that these send money to countries like Chile in order to stop some areas of economic development in the countries (EM 9.11.2000).

The results and examples for the issue of biodiversity presented above, for the first time show that nature is not the most named causer of the different problems portrayed in the media by speakers participating in discourse. The actors who participate here prefer to name other specific actors as being to blame for the different problems exposed. The participation of scientists is low regarding the number of speakers who named responsible actors, which would indicate that as a group they choose not to politicize their statements.

But looking at those scientists who do choose to assign blame, it seems that they do politicize their statements as they name actors who do have a chance to speak in the media discourse; going so far, in one case, to assign blame within their own ranks. Those scientists on the national level making statements in which blame is assign politicize their statements proportionately more than those scientists who choose to politicize on a global level (table 4.18). On this last level, the only actor-group named by scientists are enterprises, but their participation in the total blame assigned those not surpass 20%.

4.4.3.5.1. SUMMARY POLITIZATION

Two may be the signals to uncover the politization of scientists' statements in the issues here analyzed. On the one hand, the proportion of scientists choosing to assign blame in comparison to the total scientists participating in the specific issues, and on the other hand, whether the actor-groups scientists have named may be allowed to act as speakers in the discussion in the media.

For forest fires scientists favor assigning blame in their statements: over 55% of the scientists participating assigned blame. However, in their statements the actor-groups which dominated as causers were nature and society: almost two thirds of all causers belonged to this group. Considering both these results, scientists do not politicize their statements.

For climate change, a little over the half of the scientists participating chose not to assign blame, and those who did concentrated their efforts in naming once again nature and society as the main causers of the climate change related problems –specifically of the increase in carbon dioxide emission. There was a great deal of other actors or groups named -for example developed countries- which could give indication of the politization of the statements but as they are too generic (no specific actor named) they cannot be considered as such. Consequently, the scientists in this issue also do not politicize their statements.

Scientists proportionately participate less in assigning blame in the issue biodiversity than either of the two previous issues. Almost two thirds of the scientists present in the media discourse make statements were blaming actors is not a practice undergone. The remaining third of the scientists who do assign blame refer to politicians and scientists themselves as responsible actors; this indicating a politization of the statements. However, for the whole of scientists participating this is not enough to conclude that they as a group politicize their statements.

Considering the three issues analyzed, there is no base on which to confirm the politization of science, therefore no confirmation of the medialization of science can be given through this result.

4.4.4. MEDIALIZATION OF SCIENCE AS SEEN BY SCIENTISTS

The distortions in communication that have been previously examined refer to how medialization manifests itself through the public and scientific discourse on forest science found in the mass media and scientific publications respectively. The third hypothesis proposed in the medialization framework has to do with the behavior and attitudes of scientists who work in the field of forest science toward the mass media. Proposed was that if medialization of forest science exists, then scientists will recognize the influence of media in their research related activities. Recognition of the media influence on individual scientists is examined through data gathered from a survey administered to scientists world-wide who have been carrying out research in a forest-related field. If, in answering the questions posed, scientists recognized the influence of the media on their research interests and organizations then it can be concluded that the medialization of forest science exists

As mentioned previously in the methods and material chapter, the survey administered was an online questionnaire targeted at scientists working in the field of forest science (not exclusively targeted to forest scientists) carried out in February 2006. A filter question was instated in order to assure that only scientists answer the survey. Because the population of scientists working in the forestry field cannot be exactly determined, all pertinent results presented here represent the participants who answered the survey. No general conclusions can be undertaken for those scientists who for diverse reasons did not take part in the survey.

Several key issues were examined in order to gather evidence of medialization. Questions were posed to reveal, on the one hand, individual behavior and attitudes of scientists towards the media and, on the other hand, organization-related questions in order to see whether scientific organizations have recognized the importance of the media by acknowledging that to treat them, specialized knowledge of public relations is a plus. This would be reflected by the existence of specialized public relations persons or department that can either help deal directly with the media or can deal with them on their own.

A total of 340 answers from scientists were valid and build the results here reflected. The participants of the survey were mostly forest scientists (202); the second majority was scientists from natural sciences (60). The third greatest group was scientists who had studied both forest and natural science (35). Social scientists included in the survey amounted to 21 participants and scientists who had studied both social and forest science amounted to 15. Participants who had studied something outside these categories, or those who has studied a combination of the categories previously mentioned, amounted to a total of seven participants.

4.4.4.1.WORK TIME

Starting point was to identify whether communicating with the media has any importance for scientists working in this field. Participants were asked to distribute the total amount of time they spend working amongst different activities; one of which was communicating

through the media. By asking this question, results allow a comparison between communicating in the media and other activities which scientists are faced with during their work time, such as research and writing scientific publication. Table 4.30 summarizes the statistics of the results found for 332 participants which answered consistently to the questions (the distribution of work time through all activities equaled 100% of their total work time).

Table 4.30. Statistics for "Distribution of work time" (N=332; source: own calculations)

	Research	Teaching	Writing scientific publications	Conference	Fund raising	Administration	**Communicating in the mass media**	Other
Mean (in % of work time)	38,22	11,23	14,68	5,55	5,32	16,19	**2,27**	6,54
Std. Error of Mean	1,26	0,88	0,66	0,32	0,44	1,011	**0,28**	0,81
Median (in % of work time)	35	5	10	5	0	10	**0**	0
Mode (in % of work time)	50	0	10	5	0	10	**0**	0
Std. Deviation	23	16,05	12,01	5,86	8,04	18,43	**5,13**	14,84
Variance	529,28	257,58	144,34	34,39	64,71	339,67	**26,29**	220,18
Maximum (in % of work time)	100	60	79	50	50	95	**40**	95

As can be seen from table 4.30, participants had great variability in their answers. This is a reason not to take the mean as a valid comparative statistics as there were many outliers and extremes that influenced it. The mode will be taken to compare the activities undertaken by the participants as this indicates the answer mostly repeated by the participants. As can be seen from the previous table there were three activities which most of the participants did not spend any of their work time carrying out. These were: 'teaching', 'fund raising', and 'communicating in the mass media' (not considering 'other' activities), all with mode values equal to 0% of their work time. The activity in which most work time was spent was 'research'. Most of the participants answered that from their total work time they spent 50% of it dedicated to research. 'Writing scientific publications' and carrying out some sort of administrative activity were with 10% of the total work time, the two activities which followed. Participating in conferences was also an activity to which scientists assigned 5% of their work time. These are all activities that relate to scientific work, nothing outside the traditional view of what a scientist does.

Taking a closer look at the distribution of the answers participants gave to the activity of 'communicating in the mass media' shows that almost two third of the participants distributed absolutely none of their work time to communicating in the mass media (figure 4.28). 45 participants (13,55%) answered that they spent 5% of their work time in this activity, and 16 (4,82%) participants answered they spent only one percent of their work time carrying out this activity. These are conclusive numbers as they indicate that communicating in the mass media is not a priority (or may not in the 'job description') of scientists working in this field. The result is even more grounded on the fact that this activity has the least variation in response for all participating scientists (table 4.30).

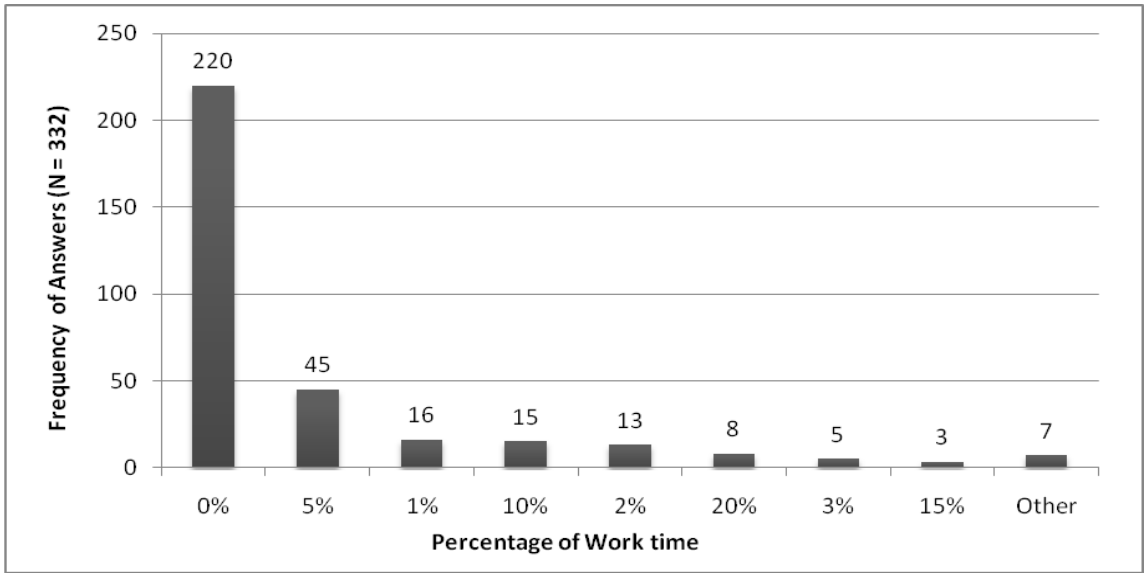

Figure 4.28. Frequency of 'communicating in the mass media' as work time activity (N=332; source: own calculations)

4.4.4.2.SUPPORTERS IN TIMES OF CRISIS

Even though communicating with the media is not an activity which is carried out as part of their job, scientists may be confronted to talk to the media at some point in their scientific careers since, and following the argumentation behind the medialization assumption, science and scientists need to open themselves to the public in order to gain legitimation and support. If the mass media is to be seen as an opportunity for scientists to gain support, then it could be recognized by scientists as an ally in times of crisis situations. This is why participants were asked about which actors or institutions would they turn to for support in the hypothetical case of a crisis such as a budget reduction in their organization. If the media is mentioned as an actor that can help in such situations, then scientists are recognizing that the mass media has some sort of influence on decision that can help. Amongst different actors, participants were asked to choose three as supporters in troubled times. The answers are portrayed in table 4.31. The main four supporters were national government (200 answers), research organizations both on a national and international level (92 answers each), and local or regional government (86 answers).

23 different participants considered the mass media, on one of the different levels, as a possible supporter in such crisis situation; which is very far from being considered an important supporter. Those actors for which media can be a supporter in crisis situations are of the opinion, that they should orient themselves to national media in detriment of local or international media; as 15 participants proclaimed that they would turn to the national media in such a situation (1,47% and 0,88% respectively).

Looking at the background of these participants they can be identified regarding certain common characteristics. Of the 23 participants, 14 (60,87%) of them worked in senior positions within their organizations such as senior researchers, professors, heads of departments, and presidents or directors. The number of participants that considered the media as a supporter but which had lower positions in their organizations totals nine. This

would seem to indicate that the higher the position within an organization the more importance the media is given as a supporter. However, when considering the total number of participants and their positions another picture arises. From the total participants there were 216 which had higher positions (senior research, professors, heads of departments, and presidents or directors) and 124 with lower positions (postdoctoral researches, doctoral students, scientific assistants, and other types of positions). The percentages of participants with higher positions that considered the media as a supporter was then 6,48% of the total higher positioned participants; the percentage of lower positioned scientists that considered the media as a supporter was 7,25% of the total lower positioned scientists. Consequently, no conclusion can be reached whether media as a supporter is considered so more by senior staff than by junior staff; as the percentages are not dissimilar.

Table 4.31: Mentions of main supporter in case of a crisis situation such as budget reduction (N=340; source: own calculations)

	International (% of N)	National (% of N)	Local/Regional (% of N)
Government	47 (13,82)	200 (58,82)	86 (25,29)
Research Organization	92 (27,06)	92 (27,06)	29 (8,53)
NGO	52 (15,29)	51 (15)	27 (7,94)
Company	23 (6,76)	76 (22,35)	51 (15)
Media	**3 (0,88)**	**15 (4,41)**	**5 (1,47)**
General Public	3 (0,88)	16 (4,71)	11 (3,24)
Other	7 (2,06)	12 (3,53)	10 (2,94)

Whether higher educational background is a reason for being more open to the media as a supporter, as well cannot be confirmed. From the 340 participants, 26 of them had a bachelor degree (or equivalent), 84 of them had a master degree, 211 had a Ph.D. or higher qualification and 19 participants had some other qualification. From these, three bachelor holders considered the media as a supporter (11,54% of total bachelors), eight had a master (9,52% of all master holders), eleven a Ph.D. (5,2% of all Ph.D. holders), and only one had another sort of qualification (5,2%of all other). It would seem that the lower the educational level the more the probability that they consider the media as a supporter in crisis situations. When analyzing the correlations between the educational degree of the participants and the media named as a supporter on different levels (international, national, or regional/local), results show that there is a significant negative correlation between the two (Pearson correlation was -0,114, significant at 0,05). Hence, participants with lower levels of educational degrees consider with more probability the regional/local media as a supporter in crisis situations. No other significant relation between the educational degrees of the participants and considering the media as a supporter in any level was found.

4.4.4.3.BENEFITS OF COMMUNICATING THROUGH THE MEDIA

These answers consider all scientists participating in the survey. In order to gain more information on how scientists consider the media it is necessary to examine the opinions and behavior of those scientists which have had experiences with communicating with the mass media. Evidence of medialization might be more grounded if those scientists with media experience recognize that the media is an important channel of communication which has certain benefits that help gain legitimation and support. Consequently, participants were asked if they had communicated through the media. From the total number of participants 232 of them (68,23%) had either tried to communicate through the mass media or had achieved it through, for example, contacts with journalists. These participants were afterwards asked to select the three main benefits which communicating through the media brought. The results in figure 4.29 show that scientists working in forestry consider that spreading knowledge on forest science through the media is the main benefit: "*dissemination of knowledge*" obtained the most answers namely, 207 of the 232 possible answers, representing 89,22% of the total. "*Positioning the role of science*" was the second most frequent answer given by scientists. 113 participants (48,71% of total participants) considered this to be a main benefit from communicating with the media. Other answers show that the media is considered a source of potential for exposure of the scientists and of their work: "*opportunity for others to contact you for collaborative purposes*" received 67 answers (28,88%); "*getting your name known*", in other words building some sort of reputation, was important for 22 scientists (9,48%). "*Attract possible funding*" was a benefit named by 48 participants (20,69% of total participants) who then indirectly recognize that the media has some sort of influence on those actors who are responsible for financial support decisions.

The previous result considered only those participants that had communicated through the media or at least tried to (had contact with the media but were not successful in their communication efforts). It does not provide information on the views of all other participants, which without having actively communicated through the media may have specific views on the benefits that the media might have for their own work and in general. Even though this result is limited to the participants that actually had access to the questions, it does deliver evidence of the 'popularization of science'; where scientists create knowledge and afterwards disseminate it to the public (through a specific transmitting channel). The transmission of knowledge is done in a simplified way through the media (Hilgartner, 1990). The role of the transmitting channel as seen by scientists is only to transmit the information received from the scientists. This means that media only serve the purpose of transmitting the scientific information and/or findings that scientists see fit to transmit to the public. The scientists taking part in this survey, who had communicated through the media, see that the main benefit (over 89% of the participants saw this as a benefit) to be gain from this activity is the transmission of information (dissemination of knowledge). This result corroborates the traditional model of popularization of science (Weingart, 2002) where scientists see the mass media only as the channel of information transfer and not as an actor which might have an influence on science itself (for example by attracting possible funding). However, that scientist see the media as a way in which they can position themselves, in other words gain in legitimation, is an indicator that they recognize that mass media can contribute to how science, and scientists, are seen by other actors. Recognizing '*positioning the role of science*' as a benefit

implies that science rivals with other activities in society and, in order for science to be known, it must be illuminated with a favorable spotlight. Seen this way, '*positioning the role of science*' recognized as a benefit by almost half of the participants considered implies that some sort of legitimation is being sought out by scientists.

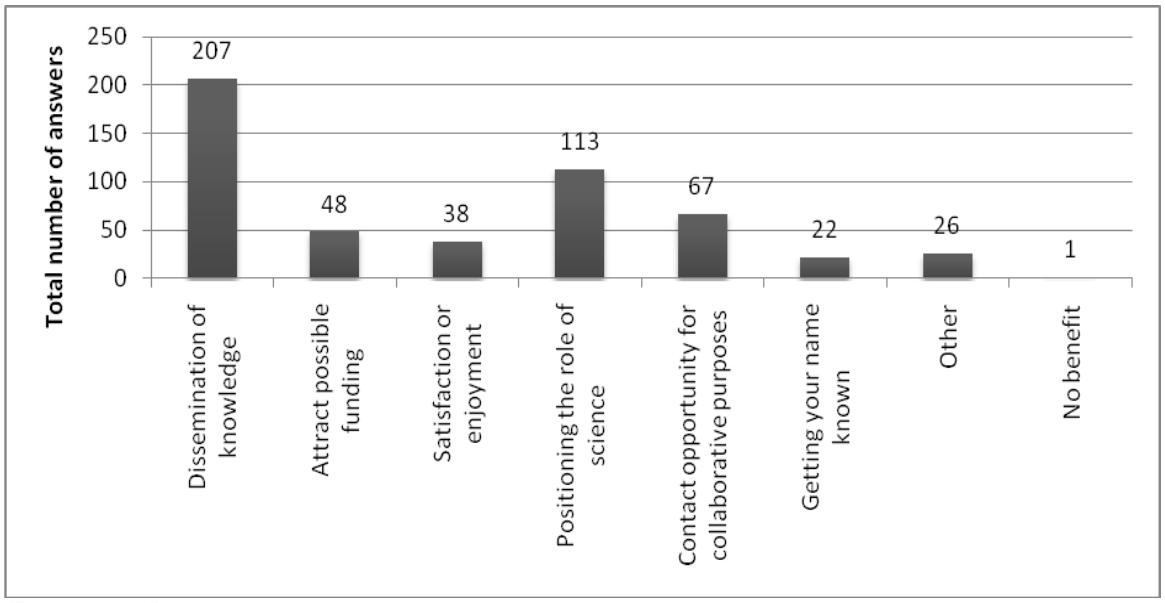

Figure 4.29. Benefits of communicating through the media as seen by participants who tried to or had communicated with the media (N=232; source: own calculations)

Scientists also recognize that the mass media is a showcase in which they and their work can be seen by other actors. A considerable 28% of the actors recognized that they could benefit from collaboration when communicate through the mass media. Hence, scientists recognize that other scientists may be informed by the mass media of their work which then may lead to future collaborations. This is similar to what Phillips et al. (1991) had found in their work regarding how results of scientists that are published in the mass media are frequently perceived by their peers.

It is curios to note that, even though scientists recognize that the mass media can help with collaboration, it does not help in building reputation. Only 9% of the participants saw that communicating through the mass media was beneficial for their reputation (or getting their name known). It seems that the reputation that may be built through this specific communication channel is not desired by the scientists or is not perceived.

Another aspect that the medialization assumption sees as happening is that possible funding may be gained when scientists use the media as a communication channel. 20% of the participants in this survey recognize that communicating through the media might help gain financial resources. Even though it is not a high percentage, scientists do – through this percentage- recognize that some financial resources may be gained if they communicate through the media.

Consequently, these results show that individual scientists do recognize that communicating through the media is associated with certain benefits that can be associated to the medialization of science: legitimation of science, source of future collaboration and to a less extent access to financial resources. However, the traditional

view that the media is a channel in which scientific information is only transmitted is still dominant within scientists (as 89% of the participants showed with their answers).

4.4.4.4.FACTORS INFLUENCING RESEARCH ACTIVITIES

In order to examine more closely if media has any recognized influence on scientists, the factors that have influence their research activities are examined first of all for all scientists participating in the survey and then for those who communicated through the media. Figure 4.30 shows the responses for all scientists participating in the survey. From the figure it is clear that for all participants the most influential factor in their research activities has been the available financial resources to carry out research (229 answers; 67,35%). With this answer they are stating that where there is money there is research interest awoken, however always considering their personal interests (as this was the second most influential factor for research activities with 184 answers; 54,11%). Scientists have been aware of the discussions going on within the scientific community and recognize that they have had an influence on their research activities (third most influential factor with 149 answers; 43,82%).

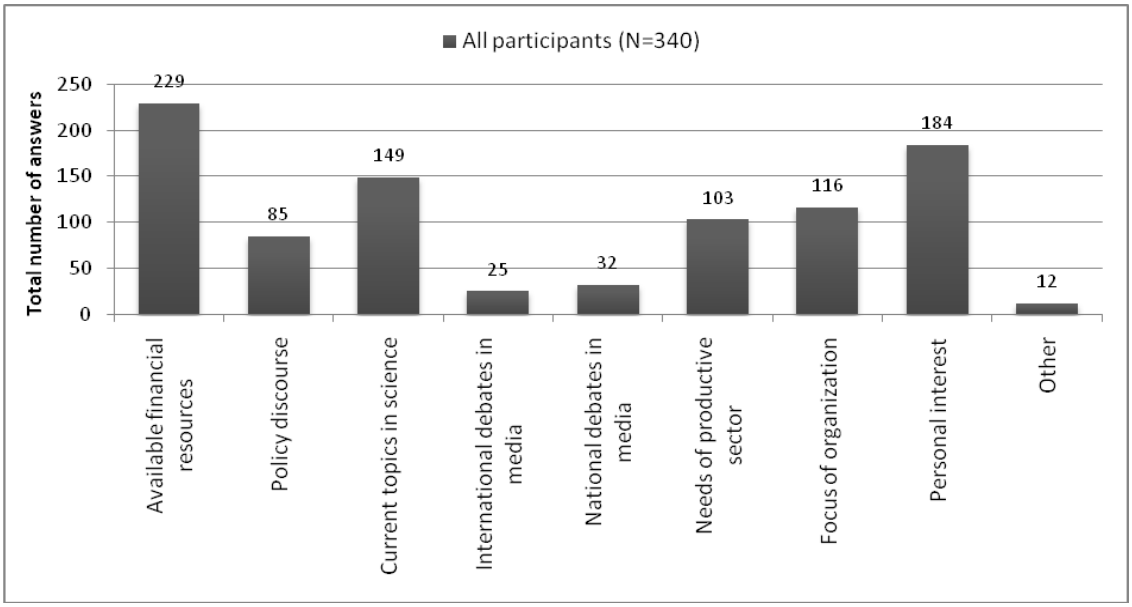

Figure 4.30. Factors which have influenced research activities of scientists participating in survey (N=340; source: own calculations)

Of course scientists are not cut-off from what goes on within their organization and so 34,11% of them recognize that the focus of their organization determines in some degree their research activities (116).

Research, as a response to the productive needs of society, is seen as well as a factor that has some degree of influence in the research activities carried out: 30,29% of the participants recognize it as influential. Policy discourse is somewhat distanced from the main influential factors, a quarter of the participants recognize the discussions and discourses of policy sector as influential towards research activity.

A most interesting result for medialization, are the number of participants who admitted that issues which have been debated in the mass media had an influence in their research activities. 32 participants (9,41%) declared that debates in national media were influential

while 25 participants (7,35%) declared that international debates in the media had had an influence on their research activities. Comparing these numbers to the total answers that participants gave other factors, both on an international and national level, scientists are assigning little recognition to the media having any influence on their research activities; as total answers assigned to the debates in the media were the lowest from all factors. This then would imply, for the medialization assumption, that there is no reciprocal effect of the media on science; therefore no medialization.

There could, however, be differences between groups of participants in the survey. Those scientists that have had contact with the media or have made efforts to do so may have different views on the influence of the media in their research activities than those who have not. This is the reason why a comparison between those scientists who communicated through the media and those who have not is helpful. Table 4.32 is built by separating the two groups and examining the proportion of answers given to each influencing factor.

Table 4.32. Factors influencing research activities of scientists communicating and scientists not communicating through the media (as % of their total answers; source: own calculations)

	Participants communicating (% of N=232)	Participants not communicating (% of N=108)
Available financial resources	155 (66,81%)	74 (68,52%)
Policy discourse	61 (26,29%)	24 (22,22%)
Current topics in science	104 (44,83%)	45 (41,67%)
International debates in media	19 (8,19%)	6 (5,56%)
National debates in media	22 (9,48%)	10 (9,26%)
Needs of productive sector	72 (31,03%)	31 (28,70%)
Focus of organization	80 (34,48%)	36 (33,33%)
Personal interest	123 (53,02%)	61 (56,48%)
Other	11 (4,74%)	1 (0,93%)

A result that becomes evident is that the answers given to the debates in the media -both in international and national debates- for both groups of participants are the lowest participants gave to any of the influencing factors. The number of answers participants gave to both these factors, as percentage of the total scientists who communicated and who did not communicate, is similar. From the participants who did communicate through the media (232 participants) 22 of them (9,48% stated that national media debates had influenced their research activities. From the scientists who did not communicate through the media (108), ten of them (9,26%) claimed that the national debates had an influence on their research activities. Participants who did not communicate through the media proportionately attached lower recognition to the debates in the international media that participants who had communicated (or tried to). Nevertheless, the proportions are not that dissimilar: 5,56% of the participants who did not communicate stated that international debates in the media were important for their research while 8,19% of the scientists who had contact with the media stated the same.

Since both the proportions are low, no significant difference can be observed between the two groups. What can be inferred through this is that scientists do not recognize the influence of the media in their work; which would give grounds for negating the medialization assumption for these participants.

4.4.4.5.SOURCES OF INFORMATION

Negating the medialization assumption might be further confirmed, if another result from the survey is observed. Participants were asked to choose from a list of different sources which of them represented the ones from which they obtained their scientific information. Table 4.33 shows the main statistics of how participants have chosen (by distributing 100%) between the different sources of information (for those participants which gave consistent answers[67]). As with the distribution of work time the variability of the answers given here was very high for all different sources of information and so the mean value for each source of information is not a good statistic to observe. The mode will then once again be taken as a comparison statistic. This statistic shows that scientists did not consider the media as a source of information (most frequent value is 0).

Table 4.33 further shows that the mass media is not the only source of information that is not considered as such by participants. Government and national research organizations are as well sources which are not recognized by scientists as relevant for obtaining information. The traditional sources such as journals both national and international, as well as books are recognized by scientists mostly contributing with 10% from all of the chosen information sources. Contact with colleagues is as important to scientists as these traditional ways of obtaining information. What is interesting is that the Internet is an information source as important for the scientists participating in this survey as the traditional sources and contacts with colleagues.

Table 4.33. Statistics for "Sources of basic information for research" (N=318; source: own calculations)

	National forestry journals	International forestry journals	National conferences	International conferences	Internet	Government	National research organizations	Books	Contact with colleagues	**Mass media**	Other
Mean	10,53	20,17	5,81	7,38	25,45	4,02	4,70	8,70	9,06	**1,60**	2,59
Std. Error of Mean	0,62	1,02	0,33	0,43	1,18	0,40	0,35	0,43	0,47	**0,19**	0,59
Median	10	15	5	5	20	0	4,5	10	10	**0**	0
Mode	**10**	**10**	**5**	**5**	**10**	**0**	**0**	**10**	**10**	**0**	**0**
Std. Deviation	11,06	18,14	5,96	7,6	21,03	7,13	6,18	7,67	8,39	**3,43**	10,49
Variance	122,35	328,91	35,52	57,76	442,44	50,84	38,24	58,86	70,35	**11,76**	109,95
Maximum	75	80	50	50	100	50	50	40	50	**20**	85

[67] Consistent answer means by adding the percentage they assigned to all sources of information they chose they total 100%.

To examine just how many participants regarded the mass media as a relevant or irrelevant source of scientific information figure 4.31 was constructed.

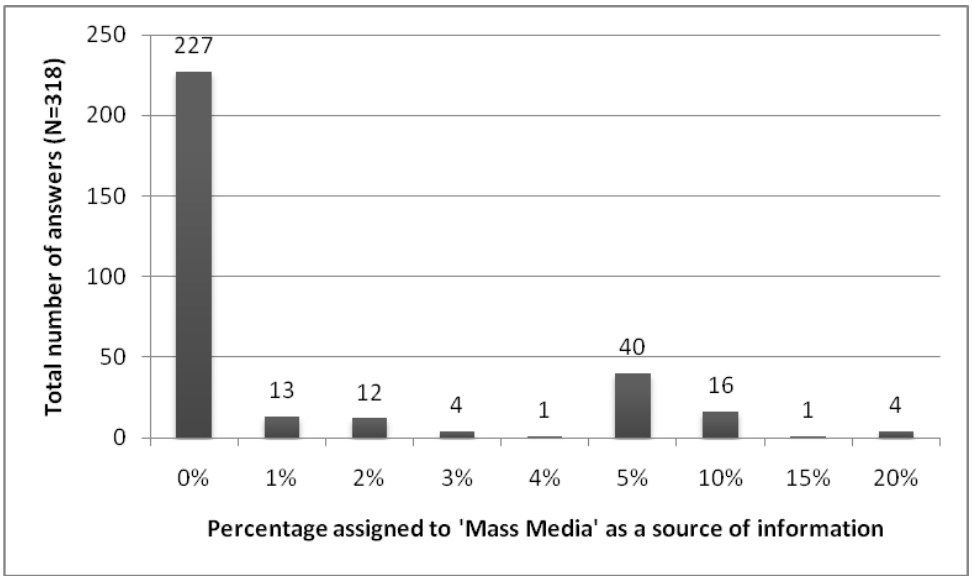

Figure 4.31. Total number of answers to the percentages assigned to the 'Mass Media' as information source by participants (N=318; source: own calculations)

From the 318 answers considered in this question, almost three quarters of the participants stated that mass media was not an information source. A total of 56 participants assigned the mass media an importance between five and ten percent of the total distribution of information sources. This is almost one fifth of all participants, which might not seem an insignificant amount; however it is when comparing it to the importance participants assigned other sources of information.

As an example the mass media is compared to two other sources of information chosen by scientists. This can be seen in figure 4.32. The two sources chosen to make the comparison are the internet and international forest journals (in print form). From how scientists have assigned their importance to these different information sources, the low importance of the mass media for scientists is evident. From the mode values in table 4.33 no great differences were observed between the different sources. 10% was the value that most repeated itself as importance given to the internet and international forestry journals, opposing the value mostly given to the media of 0%. Over 61% of all participants assigned more than 11% to the internet as an important source of information and over 53% of the scientists assigned more than 11% of the total importance to international forestry journals. However, for the media almost three fourth of all scientists assigned 0% as the importance they gave to the mass media.

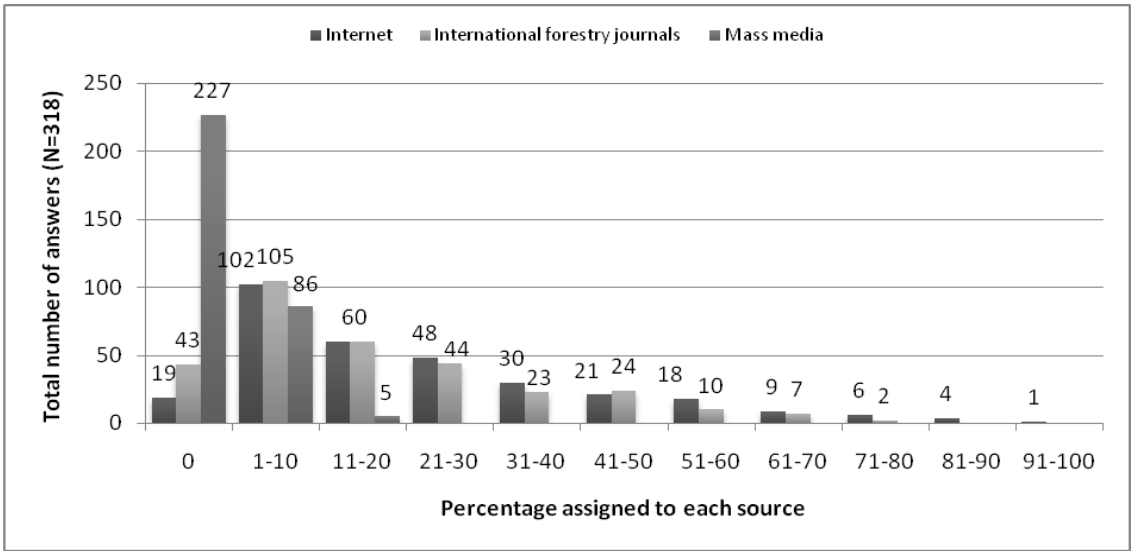

Figure 4.32. Importance assigned to three different sources of information: internet, international forestry journals, and mass media (N=318; source: own calculations)

From these results, it is confirmed that scientists do not consider the media as a source of information. This then is evidence that forest science is not medialized in the sense that scientists do not recognize any influence the media and its rules have on their scientific activities –or at least they do not acknowledge any influence.

The results presented in this section, regarding the individual behavior and attitudes of scientists working in the field of forest toward the media, state that the media has no recognized influence on the research activities of scientists. This result contrasts with results taken from the field of climate change science. In her research Post (2008) surveyed 133 climate change scientists in Germany in order to, amongst other objectives, examine whether they recognized the media having an effect on climate change research. Post's result (p.127) show, that 62% of the climate change scientists recognized that the reports of the media on climate change have had an influence on the direction that climate change science has taken. 71% of the scientists recognize that the reports have an influence on the reputation of the scientists and 74% of the scientists recognize that the reports have an influence on the assignation of financial resources for climate change research. Post's results speak of recognition on the part of climate change scientists that media has an influence on research activities, thus it is a signal for medialization.

Post notes that climate change scientists also recognize that the media reports have positively influenced research on different aspects of this particular science, like human influence on climate as well as climate modeling, but have different opinions when it comes to topics like paleoclimatology or the natural variation of climate (p.28 ff.). Scientists, working in the research areas of human influence and modeling of climate change, who took part in the survey recognize that the reputation of scientists working in each of these two areas have profited from the reports in the media of these specific areas: 76% of the scientists working in these two areas (N=94) say reputations of scientists working in the human influence on climate have profited, while 70% the respondents say that reputations of scientists working in the field of climate modeling have profited. Scientists working in the other two areas (paleoclimatology and natural variability of climate) are more skeptical regarding the reputation-profit of scientists because of the media reports. Scientists tend to state that the reputation of scientists in

either one of these fields has neither profited nor suffered from the reports (pp.145-6). Finally, regarding the distribution of 'research money' scientists state the research areas of human influence on climate as well as climate modeling have profited from '*research money*' because of the media reports, while the research areas of natural variability and paleoclimatology have neither profited nor lost financial resources because of the media reports (p. 151 ff.).
What Post is showing is that for research areas within a greater research field there are differences in how scientists perceive the influence of the media on them. Those areas which have touch on human responsibility or which help improve predictions regarding climate change are the ones that are seen to be favored by the media reports. Whereas areas that are more distant to society, like paleoclimatology or natural variability of climate, tend to be seen by scientists as neither profiting nor losing because of the media reports.

The results from the survey carried out on scientists relating to forest science and those of Post do not coincide regarding the influence of mass media on research; but it has some similarities regarding that a portion of scientists who have had contact with the media (and have either been successful or unsuccessful in communicating their information) recognize that communicating is a source of legitimation (almost half of the participants), collaboration (28% of participants), and to a less extent source of visibility for gaining financial resources (20% of participants).

4.4.4.6.PUBLIC RELATIONS

Individual scientists might not acknowledge that media has an influence on science, but maybe the stand points of the organizations where scientists work in do. The recognition that the media is an important actor might be acknowledge by organizations in that they are prepared to deal with them in a professional manner. This meaning that they acknowledge that, to deal with the media specialized knowledge is needed by, for example, counting with a public relations (PR) department or specialized persons in charge of PR.

Scientists participating in the survey were asked whether they knew if their organizations had public relations departments. 335 responses were considered. From these, 265 scientists (79,10%) confirmed that their organizations had either PR offices/departments or persons (within or outside their organization) which are in charge of such tasks. 43 scientists (12,84%) claimed their organizations did not have such department or persons in charge, while 27 participants (8,06%) did not know or did not remember whether their organization possess such a department or has persons in charge of PR issues. Figure 4.33 shows the organizations participants belong to and the existence or lack of PR departments or persons in charge of those activities.

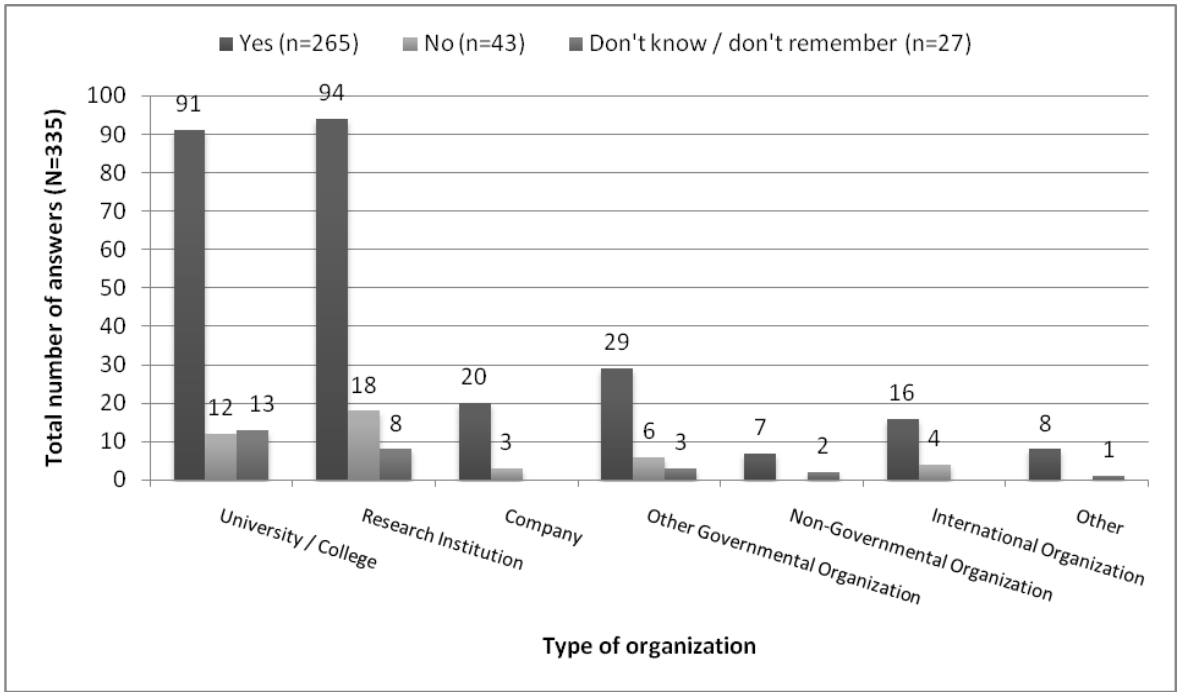

Figure 4.33. Type of organization and the existence or lack of PR departments/persons (N=335; source: own calculations)

From this figure it can be seen that the majority of the organizations participants belong to have some sort of specialized public relations specialists who are in a position to deal with the specialized criteria of the media. For each type of organization, more than three fourths of the participants belonging to them recognized that their organizations had a PR department or persons in charge of public relations. For example, 91 participants belonging to universities answered positively to the questions which represents 78,45% of all participants belonging to universities. This shows that organizations which engage in scientific research recognize the importance of dealing with media by assigning financial resources to public relation activities (seen through the existence of specialized persons in charge of PR or because of the existence of public relation departments). This result does not provide, however, sufficient evidence to claim that medialization of science is present. It can only express that the mass media is recognized as an important actor which must be dealt with in a professional manner by having trained personal in the organization help deal with it.

4.4.4.6.1. SUMMARY MEDIALIZATION AS SEEN BY SCIENTISTS

The results of the survey carried out shows evidence for denying the medialization assumption for forest science. Different aspects have been examined through the answers of scientists' world-wide working in the field of forest science. Communicating through the media as a work related activity, the mass media seen as supporter in times of crisis situations, having tried or not to communicate through the media as well as the benefits associated to the communication in the media, and its' influence on the research activities of individual scientists, are all factors that have been seen –through the answers given by scientists participating- in their majority to deny the existence of the medialization of science. One factor that might help confirm medialization is the majority of research organizations that have public relations departments in charge of dealing with the media.

Through this, it seems that organizations are aware that the media is an important actor and have been willing to invest financial resources in public relations that might help them gain visibility in front of the media. However, this recognition seems not to transfer to the level of individual scientists, as the answers they have given reflect that the traditional model of popularization of science is still very much in place. This result compared to other scientific arenas, as for example results for climate change science illustrate, are very much in opposition to the medialization of science. There are however small recognition on the part of scientist of benefits that communicating through the media brings them and science in general namely, a source of legitimation, collaboration, and a distant gain of financial resources. The participants that did recognize these benefits are not, however, the dominating majority, which then can only be taken as small hints regarding the existence of the medialization of forest science.

4.4.5. SUMMARY MEDIALIZATION HYPOTHESES

The previous sections have dealt with the existence or non-existence of the medialization of science. The hypotheses built regarding medialization focused on three areas: the scientific arena, the mass media arena, and the behavior and attitudes of individual scientists towards the mass media. The medialization assumption states that in the face of decreasing financial resources and constant questioning by the public, scientists and science will orient themselves to the mass media and their criteria in order to gain legitimation and increasing, by doing so, their visibility in front of those actors who decide on financial resources assigned to scientific research. If medialization occurs, then it will be reflected not only in the way scientists confront the media or science is dealt with in the media, but also in how science is communicated in the scientific arena.

Medialization has been here operationalized through different factors: extensiveness, pluralization, and controversy following Schäfer (2007); and following Weingart (2001) and Nelkin (1987) communication tools and politization. If these factors are found within the sphere of science -examined through the formal channel of scientific communication that are scientific publications- and within the sphere of the mass media –examined through news reports of newspapers and magazines- then, medialization may be confirmed. As well, medialization may be confirmed if a factor not present in the scientific arena is suddenly present in the mass media sphere, especially regarding the statements of scientists. Medialization may be further evident through the attitudes individual scientists have, or state in having, regarding the influence mass media has on their research activities. It is with this background that analysis of medialization on a global and national level has been undertaken.

Table 4.34 has been constructed to summarize the absence or presence of the medialization of science. The two arenas of discourse, all three topics, as well as both levels (global and national) are depicted regarding the previously mentioned medialization factors.

Table 4.34 shows that in the global scientific discourse on forest science, considering the factors here analyzed, no medialization of science can be confirmed. All factors, with the exception of the extensiveness of the issues, are not found within the scientific articles

and statements of scientists. The increase in the number of publications might be a reaction to the international policy processes such as the Convention on Biodiversity and the Kyoto Protocol which have relevance for forest science; for this to be stated with certainty deeper analysis of the publications are needed: through for example, a framing process of the naming of such events within the publications.

Table 4.34 also shows that the single issue on the national scientific level -which could be analyzed for the factors previously mentioned- delivered no evidence of medialization. However, this result must be taken with care, as the number of scientific publications was low (only six for the ten years analyzed). Improvement is needed by further identifying the relevant scientific literature that forms the national scientific discourse on forest science: for example through future consideration of conference proceedings, or scientific journals associated with other fields of science, like for example biology.

Table 4.34. Results of medialization in scientific and media discourse on forest science (Source: own construction)

	Scientific discourse on forest science				**Media (public) discourse on forest science**					
	Global			National	Global			National		
	FF	Bio	CC	Bio	FF	Bio	CC	FF	Bio	CC
Extensiveness	+	+	+	X	---	X	+	X	X	X
Pluralization	X	X	X	X	+	+	+	+	+	+
Controversy	X	X	X	X	+	X	X	X	+	X
Communication tools	X	X	X	X	+	X	+	X	+	X
Politization	X	X	X	X	X	X	X	X	+	X

Where: FF= Forest Fires; Bio= Biodiversity; CC= Climate Change
X= absence of medialization; --- = no conclusive evidence; **+**= presence of medialization

The global media discourse on forest science, shows different results for different issues. Climate change was the issue in which three medialization factors could be proven to exits: the number of media articles grew through time (extensiveness), a great variety of speakers –other than scientists- were found to be participating, and scientists in their statements used media-related communication tools (as well as in comparison to the scientific discourse). The two factors that gave evidence for the absence of medialization were controversy and politization. Scientists had a unified point of view when delivering their statements –regarding the normative evaluation within them- and, they did not (as well as in the scientific discourse) make use of their statements by naming specific responsible parties which could be associated to a politization of their statements. If the medialization factors are weighted equally, then the results found for this issue can be said to be giving evidence of the medialization of forest science.

For forest fires, evidence of medialization can as well be found. From the five factors analyzed, three delivered evidence that supports medialization (pluralization, controversy, and communication tools), one does not deliver conclusive evidence (extensiveness), and one can be associated to an absence of medialization (politization).

Finally, for biodiversity four of the five medialization factors are not found nor in the articles nor in the statements of scientists. Only the inclusion of a variety of different actors –different than scientists- is found to have taken place. It seems that in this issue,

scientists observe their 'scientific objectivity' and seem not to give in to the pressures that could give rise to medialization.

The results on the national level of the media discourse showed that the issue in which medialization can be confirmed is biodiversity. This is the issue in which four of the five different medialization factors were found to exist. The only evidence that spoke against medialization was the presence of extensiveness. For this issue no increase in the attention the media gave it –reflected through an increase through time in the newspaper articles appearing- was found. Climate change as well as forest fires both were issues in which only one medialization factor was found: the chance for speakers –other than scientists- to give their points of views on the particular issues being discussed (pluralization). However, this is not enough to confirm the existence of medialization of forest science.

Throughout this work, reference has been made to the global scientific and global media (or public) discourse on forest science. On the one hand, results have shown (section 4.2.1) that the discourse emanating from the scientific sphere cannot be regarded as a global discourse but is dominated by scientists affiliated to particular countries (mostly industrialized countries) presenting research results from these particular countries. Not a global discourse is then extracted from the publications analyzed but a national one. On the other hand, the consideration of the mass media selected as global can be as well disputed. Both the 'global' media here selected are based and owned by actors in industrialized countries. The existence of correspondents in diverse places of the globe speaks of a compromise of these media to achieve the widest possible coverage in the news they can select. However, results regarding both the countries of origin of the speakers participating in the discourse (Kleinschmit et al. 2008) as well as the countries of event covered by the media (EQMGW, 2008) have shown that there is a domination of high income countries in detriment of lower income ones (Centers dominating over Periphery). There is no balance in the reports that the media print. In other words, there is asymmetry in the communication of these topics. Thus, this questions the strength of the media discourse analyzed here as being considered a global discourse.

Individual scientists working in the field of forestry have stated that the mass media has no influence on their research activities. Scientists who participated in the international survey carried out have stated that communicating with the media is not an important activity which they are confronted to and consequently do not dedicate work-time to it. When confronted with a hypothetical crisis situation that would affect their work conditions, scientists do not recognize that the media could act as a supporter. Even though scientists, when asked about what benefits of communicating with the media has, confirm the traditional deficit model of science communication (in which they create knowledge and the media just transmits it), some benefits were expressed by scientists who had communicated through the media or had tried to. These benefits were: positioning the role of science (seen as seeking legitimation of society) and the opportunity for others to contact them for collaborative purpose (they are indirectly recognizing that their peers pay attention to the media). To a smaller degree mass media was said to help gain financial support for scientific research. However, all these three benefits were far behind from the benefit of '*transmitting scientific knowledge*'. Scientists as well do not recognize that the media had any influence in their research activities nor is a

source of scientific information. This last result might seem to contradict the previous result that a benefit of communicating with the media is collaboration chances (thus peers look to the media for scientific information), but this particular benefit was only recognized by scientists who had communicated (or tried to) and not by all scientists – who manifested that the media was not a source of information. Finally, the organizations in which these scientists work seem to recognize that resources must be invested in some sort of specialized knowledge on public relations (be this a specific department or persons in charge) in order to deal with the media.

Table 4.35 summarizes the contribution of the mentioned factors to the confirmation or denial of the medialization of science. From the table, and considering that all these factors were considered to weight equally in order to reach a conclusion on medialization, then no medialization can be found from the information recollected reflecting behavior and attitudes of these particular scientists towards the media, as four of the six factors were not found.

Table 4.35. Summary attitudes of individual scientist working in the field of science towards mass media (Source: own construction)

	Work-time	Supporter in crisis situation	Benefits of communicating	Influence on research activities	Source of scientific information	Public relations department or persons
Attitudes of scientists towards the media	**X**	**X**	**---**	**X**	**X**	**+**

Where: **X** = absence of medialization; --- = no conclusive evidence; **+** = presence of medialization

This result opposes results found in the field of climate change published by Post (2008). She found that scientists have recognized that within the greater research field of climate change, particular fields of climate change science have profited by the coverage regarding them by the media. She has concluded that those topics which are more visible to society are in fact more medialized. Human influence on climate change and climate change modeling are considered by climate change scientists to have profited regarding financial resources assigned to the issues, scientists working in the field have profited in reputation because of the media reports, and the direction research has taken has as well been influenced by these reports. These are all signs of medialization that are as well described in the theoretical considerations of Weingart (2001). Post is then concluding, as well as Schäfer (2007), that the visibility of the issue of science being considered (in terms of presence in the media) is a strong indicator of the degree of medialization that that particular field can evidence. The three forest science related issues here analyzed are then not good examples of issues in which medialization of science may be found, as they are not as visible in the mass media as those exemplified and analyzed by both Post (2008) and Schäfer (2007). Consideration might be given to how visible these topics are to society, following what both Post and Schäfer indicate as a condition to medialization, which might then give indicators of how medialized the forest issues might be or become in future. However, to claim that forest science is nearer or farther from society, or is more visible or invisible to society cannot be ventured with the data here analyzed.

The results have finally shown that the medialization of science, by example of the three forest science related issues, is not present.

5. CONCLUSIONS

This work has focused on examining the discourses on forest science occurring in the scientific sphere and the mass media sphere (as an approximation of the public sphere). The two main questions posed regarded the existence of a deliberative discourse on forest science and the existence of distortions in communication processes that might distance the discourses from a deliberative ideal and might evidence strategic instead of communicative action on the part of scientists. Based on the theory of 'Communicative Action' of Jürgen Habermas, discourses are ideally expected to include all those with interests in the discussions. As the fulfillment of this ideal is question because of the existence of power structures –which are not dealt with by Habermas-, Michel Foucault's consideration on power have been used as a way of explaining the expected distance –or distortions- between the discourse on forest science and the deliberative ideal. These distortions act upon not only in the way communication processes are carried out but on the level of individual scientists that might, faced with distortions, orient their actions not communicatively but strategically; or in other words, pursue their own particular interests and not those that might lead to agreements arising from the force of the better argument.

In the previous chapter (chapter four), detailed results have been exposed in order to verify or falsify different hypotheses that have been constructed considering the research questions posed and the theoretical background used. In this section the main results and conclusions are summarized in order to give answer the research questions put forward.

5.1. FINDING A GLOBAL AND DELIBERATIVE DISCOURSE ON FOREST SCIENCE

The analyses that have been undertaken have focused on global and national discourses. This work has assumed that 'global discourses' exists and can be examined for both the scientific sphere as well as the mass media sphere. The assumption that global deliberative discourses exists is, as a result of this work, contestable.

5.1.1. GLOBAL DISCOURSE

As authors have noted, science has undergone several changes that have affected its communication processes. According to Wagner (2008), the flow of communications beyond boarders has facilitated the move from '*international*' science-where scientists work in more than one country financed by more than one country (or source) under the protection of their respective governments- to '*global*' science -where scientific activities are carried out in which scientists are free to move and join forces to tackle common problems (p. 31). Following this, a global discourse exists in so far as individual scientists have become mobile in the world of science -moving nearer because of the different communication advances that shorten geographical distances- and established scientific ties with scientists from other countries. This condition is however not sufficient for a discourse to be truly global.

If science –particularly forest science- is to help solve the globally discussed forest related problems, it must reflect discussions on the problems faced in different corners of the globe, as well as discussing the global consequences of them. What this means is that in the scientific discussions the different problems and perspectives must as well be recognized, integrated, and discussed. A global discourse must then be as well, a deliberative one.
In the scientific arena, discourses are formally channeled through scientific journals (amongst other forms of communication). If these journals reflect the plurality of countries representing interested scientific parties in 'global' science, then the talk can be of an existing global deliberative scientific discourse on forest science. The scientific publications chosen for the analyses carried out were chosen because of the importance attributed to them by the global scientific community and the diversity of research topics which are portrayed within them.
The analysis of the publications constituting the scientific discourse on forest science – represented by the top 25% most cited scientific publications- show that those shaping the discussions in forest science are mainly from English speaking industrialized countries such as the United States, Canada, and England. Other industrialized countries such as Finland, Sweden, and Austria (amongst others) –who do not have English as a native language- are as well present in the discussions but in proportions very far away from the previous mentioned countries. This can be the result of many factors: the quality of research; the decisions of the scientific journals to publish articles by certain scientists from certain countries and not others; the attention or demand of the scientific community to particular research issues and localities; the small interests non English-native speaking scientists might have to publish in English; and/or the small incentives they might have to write in English and thus compete for a place in the scientific discussions that form the global discourse, as well as the access to these publications. Whatever the reason behind this, this result reflects the particular orientation of the scientific discourse on forest science to the points of views (or results) of a particular group of researchers: those whose native language is English. This then cannot be seen as a global discourse, as it is determined by a particular group. It could be then named the '*English*' scientific discourse on forest science.

However, the discourse could still be considered global if the scientists take global perspectives on the issues being discussed; perspectives were global events reported on are favored over national or local events. Figure 4.12 showed that most research is being carried out in a national and local base with national and local perspectives. The problems depicted focus on specific countries or specific localities within these countries and shed little light to global events having global consequences. This tendency of forest science has as well not changed throughout the years (figure 4.11). This might be then seen to further contradict the existence of a global discourse but favor the existence of much more a national/local one. However, the problems related to forestry usually manifest themselves at local levels as Werland and Morisee-Schillbach (2008) note. This is necessary for issues related to forest because the information that is required at the global level must necessarily arise from the local levels that are being affected for their subsequent global analysis. Thus, the scientific discussions focused on national level do not automatically imply the non-existence of a global discourse. Further analysis of the publications is needed in order to see whether global perspectives are incorporated into

the discussions of the national/local results presented; framing the existence or absence of the global implication of the research might then help to determine whether a global discourse in this sense is occurring.

From the results presented, however, a 'global discourse' is very unlikely taking place in forest science. Those who shape the discourse are mainly from specific groups of countries –English speaking ones, and the research presented is being carried out in these same particular countries. Events presented have national or local connotation and hardly regional or global. Thus, from this evidence no global scientific discourse can be found. At most it can be said it is an international one in which several countries are taking part.

For the mass media, the name of global discourse associated to the discourses that appear in global media has also been used. Whether the media selected represent a global discourse is contestable. Points of criticism may include: the ownership of the media, both mass media selected for this study are owned by United States related media groups; the news coverage bias to events occurring in industrialized countries; and the chance to speak given mostly to actors from these countries in detriment to possible speakers from other corners of the Earth. The media chosen cannot be considered global based on these points of criticism but can be at most considered international –or with an international orientation. Therefore the communications that appear within it cannot be referred to as global discourses but at most international ones. Even though these media do have teams exclusively dedicated to and based in several different countries; have international editions of their newspapers and magazine; and have an internationally wide-audience, it is not enough to be considered a global media. Evidence for them to be considered as such, would be a balanced account of news occurring in all parts of the world or the inclusion of speakers from different countries which have interests in the specific topic being discussed. Here this specific point was not examine as results emanating from media analysis based partly on the data used in this work, have shown that the reality of these mass media is far from a global balance of event accounts and speaker participation (Kleinschmit et al. 2007, EQGMGW 2008). Therefore the scientific discourse found in the mass media selected as well may not be considered a global one but as well an international one.

In the future it is necessary to extend the research objects if truly global discourses are to be examined. Media based and owned by actors from different countries might have different coverage on the news being produced throughout the world. Consideration of scientific articles published in scientific journals in languages other than English, and which might not be covered by the ISI Web of Knowledge, are as well enrichments towards discovering global discourses.

5.1.2. DELIBERATIVE DISCOURSE

The second point that is contested on the basis of results shown here is the presence of a deliberative discourse. The Habermasian condition of free and equal participation in discourse has been shown not to exist when speaking of the science sphere. The frequent participation of scientists from high-income countries, specifically from those native English speaking countries makes a case against it. Not only this, but power structures

such as dominance of Centers over Periphery countries as well have been found, which further evidence the lack of a deliberative discourse and the presence of an empowered one; this on a '*global*' level.

The process of submitting and final selection of the scientific writings that authors submit to forestry journals is a limiting processes which excludes many research results: not everything can be published, alongside that not everything is 'worth publishing'. There are scientists from countries which might be carrying out interesting and 'worthy' research but due to different limitations may not be even reaching the processes of peer review of science. As well, those who finally do submit their publications must overcome many hurdles for their scientific product to finally acquire visibility from the scientific community. Those that are left out of build a true Periphery. Joining this Periphery will be those scientists, those research groups, those countries that even though were successful in achieving publications, will not be considered by the scientific community which has access to the medium where these publications are found. The discussion was here focused on the Center-Periphery structures present in the discourse on forest science. This means that from the scientific publications shaping the discourse, which countries are at a disadvantage in relation to others. The results presented in section 4.2 showed that the affiliation countries of the authors which dominated the discourse –which appeared more frequently- were scientists from high income countries: mostly from the United States, Canada, and United Kingdom. There was however exceptions such as the case of Brazil, which even though is not a high-income country still was considered as a Center country, according to the indicators used.

Since distortions regarding dominance of Center over Periphery are present, a possible movement towards an ideal global deliberative discourse could be through international collaboration. Results showed that in all three issues inter-organizational collaboration was kept to a minimum, carried out mostly in the issue climate change (when comparing proportions). International collaboration has, however been increasing through time in the issues here considered, however not as quickly as results for all fields of science show. Therefore, forest science is slowly moving to resemble the patterns of communication of science in general.

Looking deeper into the type of international collaboration taking place another argument against a movement towards a deliberative discourse was found. Results (research outsourcing) showed that when international collaboration occurred it was mainly characterized by Center countries carrying out research in Periphery countries. This speaks again of an empowered discourse; or as using Galtung's concept it speaks of imperialism.
However, it might be that through the networks of international collaboration that take place countries might form links that in future help them tap into resources that they would otherwise not have available. The networks of international collaboration showed even more evidence of Center domination. The linkages mapped for the issues analyzed discovered the importance of countries such as the United States and United Kingdom in linking the forest science community. The results also showed that there are divisions amongst those who collaborate: between Anglo-American and between European (especially Scandinavian ones) groups. Countries collaborating and forming ties usually move within their regions (either geographically or language determined). Therefore, even

though countries might be linked to others by international collaboration there can be no talk of a '*global community*' which is open for participation. Therefore it is even more difficult to find an approximation of a deliberative discourse.
In order to obtain even more evidence whether international collaboration implies a move toward a deliberative discourse may be in future achieved if the mapping of patterns of international collaboration includes more than just three issues and data from more than the five international journals examined.

These previous two sections (5.1.1 and 5.1.2) have shown that regarding the sphere of '*global*' science no deliberative discourse can be found, rather an empowered one.
The following section will summarize the results of the medialization hypotheses to give the answer to the question of whether, when faced with restrictions, scientists orient themselves to the criteria of the media as a way of strategic action.

5.1.3. MEDIALIZATION OF SCIENCE

The distortions of a deliberative communication were explained to be taking place when –and using Habermasian terms- the system colonized the lifeworld. This means, that steering media such as power and money influenced the actions of the actors. The distortion that was examined here was the medialization of science: the orientation of science to the criteria of the media. This orientation was said to be taking place as science is evermore confronted with legitimation questions –by society- and increasing competition for financial resources. Following Habermasian terms, the scarce financial resources are the steering media 'money' and the search for legitimation could be seen as a distortion due to power structures.
The medialization of science examined the communications of science within the sphere of science and within the sphere of the public (approximated by the mass media). Additionally, individual scientists should have recognized the influence of the mass media when surveyed for their attitudes and behaviors towards the media. Five factors were examined which if existing, would deliver evidence of this distortion. Additionally, differences could have been expected between the different levels of analysis: global and national; as different levels of communications might have sparked different positions taken by scientists.

The results for the three issues on a '*global*' level (section 4.4.1) showed that for the scientific sphere scientists maintained a traditional orientation in their communications. The speakers which spoke in the discourse were mostly scientists, leaving little room for other types of actors. There were however differences when examining the type of scientist that participated. The discourse was equally formed by scientists from the field of forest and from other natural science fields. There was no interdisciplinary in the discussion of the issues, which can be taken as evidence for a lack of deliberation insofar that other scientists should be incorporated in the discourse. For the medialization assumption this means that there is only a limited pluralization regarding the different scientific spheres and no pluralization regarding the opening of the discourse to other interested parties.
If the topics are differently assessed by the speakers, and especially by scientists, then controversy is present. Controversy –seen as a balanced account of the different event

and statement assessment- was absent. Scientists and the accounts of event were true to the scientific objectivity that is characteristic of natural sciences, where no normative value or judgment should be associated with the results being reported on.
Another factor absent was the use of media related communication tools. Descriptions, historical references, and technological references were preferred by scientists in their statements to media-related metaphors and symbols when illustrating their points of view.
The final factor that was absent was politization. Scientists remained neutral to naming specific political specific parties as causers of the problems faced by the forest in these three issues; which might as well be attributed to the scientific objectivity of scientists.
The only factor that was present and could positively confirm that medialization was the increase through time of the number of articles which reported on the selected issues. Even though this would give indication of medialization, it is not enough –in combination with the other analyzed factors- to confirm the medialization of science. On the contrary, medialization would have to be denied.
This means that even if scientists are feeling the pressures that would make them orient themselves and their communications to the media criteria, it is not having an effect on the internal communications of the science sphere.

On the '*global*' level of the mass media a slightly different picture arose. Of the three issues, factors which might confirm the medialization of science were found for forest fires and climate change.
For forest fires three out of five factors were found to give indication of medialization. If the factors are weighted equally, in terms of their contribution to the existence of medialization, then this issue can be said to be medialized. The question is why on the global level of science no medialization was found but on the global level of the media this was different? The answer may be delivered by deeper analysis into the articles that were published. Most articles dealing with forest fires revolved around the damages and impacts of catastrophic events consuming forests in determined regions. As such, the focus of the news is more related to the catastrophes associated to the events than to the science. This may be a reason that scientists behave differently than in their internal communication sphere. It may also be an indicator of what other research results have shown: that a scientific field or issue will become medialized when it is nearer –or awakens more interests- to the public.
For the issue of climate change as well there were more factors found which confirmed medialization than those founds which would deny it. The factors that act confirming medialization are extensiveness, pluralization, and communication tools. It could be that this issue is as well near to the interest of the public. But then why is biodiversity here the only issue in which more factors denying medialization than factors confirming it are found? Are the problems faced by different species within a forest ecosystem not of interest to the general public? And why is it that for this particular issue on the national level, factors were found that confirmed medialization in opposition to what happens on the global level of the media and science (as well as the national level of science)? These are all relevant questions that need to be answered if confirmation or denial of the medialization assumption is to be made. The specific characteristics that make an issue more prone to medialization by scientists and the media should then be subject to further research.

Individual scientists working worldwide in the field of forestry gave answers that further denied –with a few exceptions- the existence of medialization. Scientists did recognize that the mass media serves for collaborative purposes in the sense that other scientists, or other actors, might hear of their research and interest fields through it and contact them for collaborative purposes. This is recognition on the part of scientists that the media is acknowledged by their peers. Thus, media seems to have an effect on science. Additionally, some scientists recognized that the media might act as a potential showcase for obtaining financial resources for research. However, these small hints of recognition of medialization are obscured by the great percentage of scientists who see the media only as a means of disseminating scientific information. This is then a confirmation that the traditional deficit model of communication –in which the media is recognized only as a transmitter of information- is very much in place.

Habermas proposed that individuals would cease to act communicatively and act strategically when faced with pressures coming from the system: money and power. The medialization of science was seen as strategic behavior on the part of scientists, as they react to the media (change their communication behavior) when confronted by these pressures (e.g. by limiting financial resources). The results show that on the '*global*' as well as on a national level of the science sphere scientists were not behaving strategically, in the sense that hardly any indicators for medialization were found. On the sphere of the media, the strategic communication was determined by the issue being considered: in '*global*' media forest fires and climate change, in national media biodiversity. This leaves the question open for future research: what specific characteristics must an issue have for scientists to change their behavior from a communicative one to a strategic one when dealing with the media.

Here, discourses on forest science have been examined in order to find evidence of the existence of a deliberative discourse. On the one hand, evidence has shown that regarding free and equal participation, the communications being carried out in the science sphere are distanced from the deliberative ideal. On the other hand, however, scientists are not seen to be generally acting strategically when confronted by factors that might change their communicative behavior. Even though this last result might speak against distortions within the discourse on forest science, the empowered discourses that have been found speak in favor of distortions that need to be addressed if new ways of carrying out scientific communication are to be instated.

6. SUMMARY

Societies are evermore being referred to as '*knowledge societies*' in which scientific information plays an important role for their developments. Forest science has an important part to play, providing forest-related scientific knowledge which can be integrated into processes driving society. International policy events that relate to forest science, such as The Convention on Biological Diversity or the Kyoto Protocol, make it essential for forest science to transmit and integrate its knowledge into the different spheres of society. This knowledge –as well as that from science related to forests- is transmitted within the sphere of science as a mean of contributing to present scientific discussion. It helps reduce the uncertainties of forest-related phenomenon: as for example, sequestration of carbon dioxide by forest ecosystems. Forest-related scientific knowledge must also be integrated into public discussions on complex topics such as climate change, biodiversity, and forest fires as these issues have relevance–or impacts- on the lives and living conditions of many people throughout the world. Integrating scientific knowledge into the different spheres of society can only be done through communication processes. The diffusion –or communication- of this knowledge through any communication channel is here labeled the discourse on forest science. These discourses are essential for the scientific and public discussions that revolve around topics of the forests.

For the discourses on forest science and their communication to find legitimation in society, the characteristics of a deliberative discourse following Jürgen Habermas's '*Communicative Action*' are proposed as those that should be observed. When decisions are based on deliberative processes –communications- then these are seen as legitimate by all parties involved. There are, however, distortions –as explained by the existence of power structures following Michel Foucault's concepts- that cause a shift from deliberative discourse to one where these power structures determine the outcomes of the communications.

To examine whether the communication processes associated with forest science are influenced by these power structures or are in fact consequences of deliberative processes, two arenas where communication of forest science takes place are here observed: the scientific and the public (approximated by the mass media) arena.

On the one hand, the scientific sphere is examined to uncover the shift of the scientific discourse from a deliberative to an empowered one. To provide evidence of this, the condition of free access and participation of all actors with an interest in the discussions is examined. If no deliberative discourse is found then, power structures –reflected through the presence of *Center and Periphery* relations- should be observed distorting the communication process within the scientific sphere. However, resistance can take place which then might help in contesting the existing power structures. *International collaboration* within science is taken as resistance to overcome Center and Periphery relations. Through collaboration, an approximation to the condition of equal participation -by those with interests in the communications of forest science- can be achieved. Therefore, this is a way to approach a deliberative discourse.

On the other hand, the public discourse on forest science taking place through the mass media is examined. As distortions of the communication processes are not only found in the scientific sphere. Scientific research is more and more being question for its social relevance (legitimation). Additionally, within science there is a fierce competition for financial resources which affects research fields. This situation brings about changes in both external and internal forms of science communication. Forest science is not free from these pressures. Recognizing that the mass media are a powerful public platform where scientific issues are discussed, and that exposure in the mass media might help the position of science –the pressures that science faces may end with the '*medialization of science*': the orientation of science to the criteria of the media.

As two are the different arenas to undergo scrutiny for the existence or lack of a deliberative discourse, two are the research objects that have been selected for the empirical analysis. For the scientific discourse, publications appearing in scientific journals have been selected as these represent a formal channel of scientific communication; for the public discourse on forest science, news articles appearing in newspapers and magazines. Two levels of analysis are called for: a global and a national one –through the case study of Chile-. Three forest science related issues have been chosen for their political as well as societal relevance: climate change, biodiversity, and forest fires. Through a quantitative-qualitative content analysis, publications on these three issues in five global and one national scientific journal, as well as in two global mass media sources and one national newspaper have been examined. The time frame of 1994-2003 has been chosen as it may reflect reactions in both arenas -in terms of research carried out or media coverage- to the international political events that are relevant to forest science. Additionally, information of the attitudes towards the media of scientists working worldwide in the field of forestry have been gathered through a survey to further test the existence or absence of medialization of forest science.

Results regarding the global scientific discourse show that the communication of forest science is not characterized by a deliberative discourse, but more by an empowered one where Centers built by the United States, Canada, and to a less extent the United Kingdom dominate the discussion of the scientific issues here selected. Authors from countries whose native language is not English make it into the discourse but only in limited cases, as example Brazilian authors. Deliberation is also absent from the discourse when considering the scientific affiliation of the authors participating. In the issues analyzed, forest and natural scientists dominate the discussion in almost equal shares, leaving hardly any room for authors from other scientific disciplines –which might have an interest in participating. The discourse is mainly limited to the discussion of events taking place in single nations and in particular localities within it. In terms of the location of problems and events being discussed there can be no talk about the discourse being a global discourse; rather it is a national one.

As the discourse on forest science has been seen to be Center-dominated, collaboration may help to bring the communication process of forest science to a closer ideal of a deliberative discourse. Collaboration can help include the interpretation patterns of those parties with interests that may be ignored. Results show that forest science is slowly following tendencies of science in general in which more and more countries are becoming part of the discourse. Results on the international collaborative efforts however

show that there is no global interconnected community in the issues analyzed, but that collaborative efforts are mainly divided into Anglo-American and Northern-European research networks.

Distortions in the communication processes of forest science can also be seen through the presence of the medialization of science. Several were the factors analyzed that help to determine whether this distortion is present: extensiveness in the publication of the issues; pluralization of speakers participating; controversy in the events and statements of speakers -particularly of scientists-; the politization of the issue by scientists; and finally the presence of media-related communication tools in scientists statements. These factors show that for forest science, medialization is not present. Small differences were seen regarding the scientific and media discourse -for example in the pluralization of the speakers and the use of media-related communication tools by scientists - but which were not enough to confirm the existence of medialization. This is further confirmed when considering the behavior and attitudes of individual scientists working worldwide in the field of forest science. The medialization-related surveyed factors show that scientists who participated do not recognize the influence –or benefits- of media in their research activities. Consequently there is no recognition of medialization by them. These results contrast with other results of research carried out in other fields of science. For natural-science fields (like stem cell research) results have ventured that it is the importance –or nearness- that the particular field of science has with the public (seen as exposure in the media) that determines whether a field is medialized or not. According to this argument, and the results presented here, forest science seems not to be as near to the public as these other fields of scientific research, therefore not as medialized.

The distortions of the communication processes which distance the discourse on forest science from an ideal deliberative one have shown that, particularly in the scientific arena, the discourse present is an empowered one slowly moving in the direction of integrating other interested points of view.

7. ZUSAMMENFASSUNG

Zunehmend werden Gesellschaften als „Wissensgesellschaften“ beschrieben, in denen wissenschaftliche Informationen eine wichtige Rolle für die Entwicklung spielen. Auch die Forstwissenschaft nimmt eine wichtige Rolle ein, indem sie forstbezogenes Wissen bereitstellt. Dieses wird in Prozesse integriert, die wiederum die Gesellschaft beeinflussen. Internationale politische Ereignisse, wie das Übereinkommen über die Biologische Vielfalt oder das Kyoto Protokoll, machen es erforderlich, dass die Forstwissenschaft ihr Wissen in die unterschiedlichen Bereiche der Gesellschaft überträgt und integriert. Dieses Wissen trägt zur aktuellen wissenschaftlichen Diskussion bei und reduziert Unsicherheiten von forstbezogenen Phänomenen, z.B. die Senkung von Kohlenstoffdioxid durch Forstökosysteme. Zusätzlich muss das forstbezogene wissenschaftliche Wissen in die öffentliche Diskussion über komplexe Themen, wie Klimawandel, Biodiversität und Waldbrände integriert werden, da diese Themen relevant sind bzw. Einfluss auf das Leben und die Lebensumstände vieler Menschen weltweit haben. Die Integration von wissenschaftlichem Wissen in die unterschiedlichen Bereiche der Gesellschaft ist nur durch Kommunikationsprozesse möglich. Die Verbreitung oder Kommunikation dieses Wissens über unterschiedliche Kommunikationswege wird hier als forstwissenschaftlicher Diskurs bezeichnet. Diese Diskurse sind für die wissenschaftlichen und öffentlichen Diskussionen zum Thema Wald von besonderer Bedeutung.

Eine Möglichkeit diese Diskurse in der Gesellschaft zu legitimieren wird in dem theoretischen Ideal des deliberativen Diskurses nach Jürgen Habermas „kommunikatives Handeln“ beschrieben. Diesem Ansatz folgen können Entscheidungen von allen beteiligten Parteien als legitim angesehen werden, wenn sie auf der Basis von deliberativen Prozessen oder Kommunikationen getroffen werden. Dieses Ideal ist jedoch schwer erreichbar. Stattdessen kommt es zu Verzerrungen, wie die Existenz von Machtstrukturen nach dem Konzept von Michel Foucault beschreibt. Dadurch erhalten Diskurse die Oberhand, die nicht auf Grund deliberativer Prozesse sondern durch die vorherrschenden Machtstrukturen gebildet werden.

Um zu prüfen, ob die forstwissenschaftlichen Diskurse durch diese Machtstrukturen beeinflusst werden oder ob sie das Resultat deliberativer Prozesse sind, werden zwei Arenen untersucht, in denen die Kommunikation der Forstwissenschaft stattfindet: die wissenschaftliche und die öffentliche Arena (angenähert durch die Massenmedien).

Um die Verzerrung der Kommunikation in der wissenschaftlichen Arena aufzudecken, wird untersucht, inwieweit die Bedingung eines freien Zugangs und einer Beteiligung aller Akteure mit Interesse an der Diskussion eingehalten wird. Stellt sich heraus, dass sich der forstwissenschaftliche Diskurs nicht in einem deliberativen Prozess herausgebildet hat sollen die vorhanden Machtstrukturen – widergespiegelt durch die Präsenz von Zentrum und Peripherie Beziehungen – aufgedeckt werden. Es gibt jedoch Prozesse, die der Vermachtung von Diskursen entgegenstehen. *Internationale Zusammenarbeit* innerhalb der Wissenschaft kann dazu beitragen, die dominierenden Zentrum und Peripherie Beziehungen zu unterlaufen. Durch Zusammenarbeit kann eine Streuung der Beteiligung

am Diskurs und damit einen Schritt in Richtung eines deliberativen Diskurses erreicht werden.

Des Weiteren wird der öffentliche Diskurs über Forstwissenschaft in den Massenmedien untersucht, da Verzerrungen nicht nur in Kommunikationsprozesse innerhalb des Wissenschaftsbereiches zu erwarten sind. Die soziale Relevanz wissenschaftliche Forschung wird immer weiter in den Mittelpunkt gerückt. Zusätzlich findet in den Wissenschaften ein strenger Wettbewerb um finanzielle Mittel statt, der das wissenschaftliche Arbeiten beeinflusst. Diese Situation bringt Veränderungen der internen und externen Form der Wissenschaftskommunikation mit sich. Auch die Forstwissenschaften reagieren auf diese äußeren Zwänge. Die Massenmedien stellen eine mächtige öffentliche Plattform dar auf der wissenschaftliche Fragestellungen diskutiert werden. Zusätzlich können die Massenmedien dazu beitragen die Position der Wissenschaft zu verbessern. Diese Stellung der Massenmedien kann zu einer „Medialisierung der Wissenschaft" führen: die Orientierung der Wissenschaft an den Kriterien der Medien.

Für die die empirische Analyse der wissenschaftlichen und der öffentlichen Arena wurden unterschiedliche Dokumente herangezogen. Für den Wissenschaftsdiskurs wurden Publikationen ausgewählt, die in Wissenschaftsjournalen erscheinen, da diese Repräsentanten eines formalen Weges der Wissenschaftskommunikation darstellen. Für den öffentlichen Diskurs der Forstwissenschaft wurden Nachrichtenartikel ausgesucht, die in Tageszeitungen und Magazinen publiziert wurden. Die Analyse wurde auf zwei Ebenen durchgeführt: eine globale und eine nationale Ebene – letztere durch die Fallstudie in Chile. Drei forstwissenschaftliche Themengebiete sind im Hinblick auf ihre politische und soziale Relevanz ausgewählt worden: Klimawandel, Biodiversität und Waldbrände. Durch eine quantitative - qualitative Inhaltsanalyse wurden Publikationen zu diesen drei Themen in fünf internationalen und einem nationalen Wissenschaftsjournal, ebenso wie in zwei globalen Massenmedien und einer nationalen Tageszeitung untersucht. Der Untersuchungszeitraum umfasst die Zeitspanne von 1994 – 2003, da diese Periode von Reaktionen, in Form von Forschung oder Medienberichterstattung auf politisch relevante Ereignisse, die bedeutsam für die Forstwissenschaft sind, gekennzeichnet ist. Außerdem wurden Informationen über die Haltung von Wissenschaftlern gegenüber den Medien gesammelt, die weltweit auf dem Gebiet der Forstwirtschaft agieren, um die (Nicht-)Existenz oder von Medialisierung der Forstwissenschaft zu überprüfen.

Die Ergebnisse, die sich auf den globalen Wissenschaftsdiskurs beziehen, zeigen, dass die Kommunikation der Forstwissenschaft nicht von einem deliberativen Diskurs gekennzeichnet ist. Stattdessen handelt es sich um einen vermachteten Diskurs, bei dem USA, Kanada und zu einem kleinen Anteil Großbritannien im Zentrum stehen. Diese Länder dominieren die Diskussion der hier untersuchten wissenschaftlichen Themengebiete. Die englische Sprache ist dabei eindeutig als limitierender Faktor erkennbar. Autoren aus Ländern, deren Amtssprache nicht Englisch ist, nehmen am Diskurs nur in begrenzter Anzahl teil, z.B. brasilianische Autoren. Eine freie Beteiligung im Sinne eines Habermasschen deliberativen Diskurses fehlt ebenso wenn die Zugehörigkeit der teilnehmenden Autoren zu einzelnen Forschungsfeldern berücksichtigt wird. In den analysierten Themengebieten dominieren Forst- und Naturwissenschaftler die Diskussion zu gleichen Teilen. Dies lässt kaum Raum für Autoren anderer

wissenschaftlicher Disziplinen, die an einer Beteiligung interessiert wären. Der Diskurs beschränkt sich vornehmlich auf die Diskussion von Ereignissen in einzelnen Ländern und deren Örtlichkeiten. Die Verortung der Probleme und Ereignisse, die diskutiert werden, lässt den Schluss auf einen global geführten Diskurs nicht zu. Es handelt sich vielmehr um einen nationalen Diskurs.
Da die Ergebnisse den forstwissenschaftlichen Diskurs als Zentrums-dominiert charakterisieren, könnte Zusammenarbeit helfen, den Kommunikationsprozess der Forstwirtschaft näher an das Ideal eines deliberativen Diskurses zu bringen. Zusammenarbeit kann dabei helfen, die Interpretationsarten derjenigen Parteien mit einzubeziehen, die ansonsten im wissenschaftlichen Diskurs kein Gehör finden. Allerdings zeigen die Ergebnisse, dass die Forstwissenschaft langsam den allgemeinen Tendenzen der anderen Wissenschaften folgt, womit mehr Länder Anteil am Diskurs haben. Die Ergebnisse der Analyse der internationalen Zusammenarbeit der Länder zeigen jedoch, dass es keine globale vernetzte Gemeinschaft in diesen analysierten Themengebieten gibt und dass Bemühungen um Zusammenarbeit hauptsächlich in Anglo-amerikanische und Nordeuropäische Forschungsnetzwerke resultieren.

In der öffentlichen Arena stellt die Medialisierung von Wissenschaft eine Verzerrung im Kommunikationsprozess dar. Ob diese Form der Verzerrung auch in der öffentlichen Kommunikation forstwissenenschaftlicher Themen zu finden ist wurde anhand zahlreicher Faktoren untersucht, z.B. am Umfang der Publikationen in den o.g. Themengebieten, an der Pluralisierung der teilnehmenden Sprecher, an den Kontroversen in den Ereignissen und den Aussagen aller Sprecher – insbesondere der Wissenschaftler – , die Politisierung der Themengebiete durch die Wissenschaftler und schließlich an dem Vorhandensein von medienbezogenen Kommunikationswerkzeugen in wissenschaftlichen Aussagen. Diese Analyse dieser Faktoren zeigt, dass in der Forstwissenschaft keine Medialisierung nachweisbar ist. Es konnten nur minimale Unterschiede im Wissenschaftsdiskurs und Mediendiskurs festgestellt werden – z.B. in der Pluralisierung der Sprecher und dem Gebrauch von medienbezogenen Kommunikationswerkzeugen durch die Wissenschaftler. Eine Medialisierung im eigentlichen Sinne findet damit jedoch nicht statt. Dieses Ergebnis findet Bestätigung, wenn das Verhalten und die Haltung der einzelnen Wissenschaftler, die weltweit im Gebiet der Forstwissenschaft arbeiten, berücksichtigt werden. Die medialisierungsbezogenen Faktoren, die untersucht wurden, zeigen, dass die teilnehmenden Wissenschaftler den Einfluss oder die Vorteile der Medien in ihren Forschungsaktivitäten nicht erkennen. Folglich mangelt es auch an Interesse das Verhalten den Medienregeln anzupassen und eine Medialisierung bleibt aus.

Diese Ergebnisse stehen im Kontrast zu anderen Forschungsergebnissen, die in anderen Bereichen der Wissenschaft gewonnen wurden. In den Naturwissenschaften (wie Stammzellenforschung) haben Studien gezeigt, dass die Bedeutung oder die Nähe, die ein spezielles Wissenschaftsgebiet zur Öffentlichkeit hat (zu sehen in der Darstellung in den Medien), darüber bestimmt ob ein Gebiet medialisiert wird oder nicht. Unter Bezugnahme dieses Argumentes und der hier präsentierten Ergebnisse scheint die Forstwissenschaft nicht so nah an der Öffentlichkeit zu sein wie diese andere Wissenschaftsgebiete und somit nicht so medialisiert.

Die Verzerrungen des Kommunikationsprozesses, die den Diskurs der Forstwissenschaft vom idealen deliberativen Diskurs trennen, haben gezeigt, dass besonders in der Wissenschaftsarena der derzeitige Diskurs vermachtetet ist. Die internationale Zusammenarbeit kann jedoch als ein Richtungswechsel gedeutet werden, indem Sichtweisen anderer Akteure zunehmend miteinbezogen werden.

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9. ANNEXES

9.1. ANNEX I: CODING HANDBOOK

Number	Category Group	Category	Subcategory	Definition
General Information of Articles				
A0010	Year of Publication			Publication year of article
A0030	Source	1 Canadian Journal of Forest Research		Name of Scientific Journal or Mass Media source from which the article originated
		2 Forest Ecology and Management		
		3 Forest Science		
		4 Forestry		
		5 Journal of Forestry		
		6 International Herald Tribune		
		7 Time Magazine		
		8 Bosque		
		9 El Mercurio		
A0050	Number of authors			The total number of authors appearing in article.
A0070	Number of countries of authors of publication			The total number of countries that are associated to the authors of the publication.
A0080A – A0080I	Country of authors	Country of first author		Country of affiliation of author of the article, see details in article. If no country appears leave blank

A0090A – A0090I (referring to scientific publications)	Affiliation Institution	Affiliating Institution of first author	1. University/college 2. Research institution 3. Enterprise (company) 4. Government organization 5. Non-governmental organization 6. International organization 7. Other 8. Not recognizable	- **University**: - **Research institution**: all research institution that cannot be classified as university - Either public or private **enterprise** (is a profit seeking organization), e.g. Industrial laboratories, consultancies, multinational firms - **Governmenta**l organization that cannot be classified in the above categories. - **NGO** like Greenpeace or WWF - **International organizations**: E.g. European union organizations - **Other** institution /organization that cannot be classified in the previous categories; e.g. Think-tanks, - **Not recognizable**: no clear information appears in the article Problems: one author can have more than one affiliations (e.g. belongs to a foundation and a university)
A0100A – A0100I (referring to scientific publications)	Field of Science	Field of science of first author	1. Forest science 2. Nature conservation 3. Natural science (other than previous) 4. Social science 5. Other science 6. Not recognizable	The field of science to which the authors identify with. Taken from the direction of the article; from which perspective is the article written.
A0140C		3 Forest Fires		Articles that deal with origins, descriptions, and solutions of forest fires.
A0140D		4 Global warming and CO2 problematic		Articles in which consequences, causes, victims, solutions etc. of global warming and the CO2 problematic are an issue
A0140E		5 Biodiversity		Articles where the topic centers on e.g. losses of biodiversity, changes in the number of species, etc.
A0180	Assessment of Event	1. Positive		If the orientation of the event published in the article is positive
		2. Negative		If the orientation of the event published in the article is negative
		3. Ambivalent		If the orientation of the event published in the article is both positive and negative. Simultaneous and contradictory attitudes or feelings (as attraction and repulsion) toward an object, person, or action

A0190	Location of Issue	1 Global		Level on which the issue is taking place; If the actors refer to the issue on a scale dealing with the whole world or if it is located in a specific country or region. Global is selected when the entire planet is referred to as being involved in the issue. When the issue is a Global one, please proceed to category of A5010 'number of statements in article'
		2 Regional		Regional is selected when specific regions of the world are mentioned. E.g. countries form North America, South America, Europe, etc… When the issue is a Regional one, please go ahead to category of continents
		3 National		National is selected when specific countries are mentioned. E.g. Chile, Germany, Korea, etc., go to category name of country
		4 Local		Local is selected when the issue deals with a specific region of the specific country. E.g. One of the federal lands of Germany
		5 Not recognizable		
A0200		Name of Country		If the issue does refer to a single country, please enter the name of the country. Go on to referred continent in issue (mark the respective continent that the country belongs to).
A0270	Number of statements in Article			This refers to the number of different statements (points of view) that appear in the article. A statement is made by an actor either in direct (the article's authors make a claim) or indirect form (e.g. "Paine, et al. (1997) claim that the main actor responsible for forest fires is society itself").
C0001	Statement Number (case number)			Write a consecutive number of the statements in article. A statement is coded only when it has direct relevance to the issue at hand; always consider forest and other issue, e.g.: forest and biodiversity, forest and climate change, forest and ecosystem protection. Other statements are not coded. The first statement number of the issue "Forest fires" would be 30001 The first statement number of the issue "Global Warming and CO2 Problematic" would be 40001 The first statement number of the issue "Biodiversity" would be 50001 Statements made by one same actor are coded once, even

				if he/she appears in different parts of the article. One actor = one statement. E.g. Krott (2005) is named in the introduction and afterwards in the discussion, this would only be one statement.
Definition of Speaker (defined as all authors that wrote the text, or actors that appear cited, either directly or indirectly, in the publication)				
C0111	Number of defending positions/statements of the speaker	1 One		
		2 Two		
		3 Three		
		4 More than three		
C0121A	Speaking Actor	Scientists	1. Author 2. Self citing scientists 3. Other scientist(s)	Identify the scientists either as the author of the article or as other scientists that speak directly or indirectly in the article. **Author**: would be the scientists that wrote the articles. **Self-citing scientists**: refers to scientists that are cited in the article that are also the authors of the article. **Other scientists**: other scientists that are cited or appear directly or indirectly in the article that do not correspond to the above mentioned cases.
C0121C			**Field of Science** 1. Forest Science 2. Nature Conservation Science 3. Natural Science 4. Social Science 5. Other Sciences 6. Not recognizable	In the statement, is information given that reveals to which field of science the scientists belong too? If more than one scientist is considered then refer only to the first author: e.g. (Krott and Krumland 2005 consider only Krott).
C0122		Politicians Government		All actors that elected to form part of the government. E.g. President, Prime Minister, Mayors, Senators, etc.
C0123		Politicians Non Government		All actors that are involved in politics but not elected by the public. E.g. presidents of political parties.
C0124		Administration	1. Forest administration 2. Environmental administration 3. Other administration	All actors that form the administrative body of the government. E.g. Ministers, public representatives, national forest services, national environmental services, etc…
C0125		Judiciary		All actors that form part of the judiciary arena. E.g. Supreme Court Judges, Lawyers.
C0126		Media		Speaker is journalist or other member of the media (newspapers, TV, radio, etc).

C0127		Development Consultants		All actors that act as consultants to development countries. E.g. experts of international organizations like the GTZ that work together with actors from developing countries giving them technical or other type of support.
C0128		Forest Enterprises		All actors that belong to a forest enterprise including the sectors of wood and paper industry.
C0129		Other Enterprises		All actors that belong to other enterprises that do not relate to forest.
C0130		Forest Non-Governmental Organizations		Nongovernmental organizations that deal exclusively with forest related subjects. E.g. Forest Ethics.
C0131		Other Non Governmental Organizations		All other nongovernmental organizations. E.g. Greenpeace, Amnesty International, Friends of the Earth.
C0132		European Union Commission		All actors that represent the European Union Commission
C0133		European Union Parliament		All actors that represent the European Union Parliament
C0134		Food and Agriculture Organization (FAO)		All actors that belong to or represent the FAO
C0135		United Nations (UN)		All organizations that depend on the United Nations, e.g. IPCC intergovernmental Panel on Climate Change, International Fund for Agricultural Development (IFDA), United Nations Forum on Forestry (UNFF), World Commission on Environment and Development, World Conservation Monitoring Centre, etc.
C0136		World Bank (WB)		All actors that represent or belong to the World Bank.
C0137		International Monetary Fund (IMF)		All actors that represent or belong to the International Monetary Fund.
C0138		World Trade Organization (WTO)		All actors that represent or belong to the World Trade Organization.
C0141		International Development Banks		All international banks that deal with developing countries. E.g. European Bank for Reconstruction and Development, Inter-American Developmental Bank, Asian Developmental Bank, etc.
C0146		Other Organizations	1. Non-forest organization 2. Forest organization	All other organizations that do not fall into the previous categories.
C0147		Single persons or Communities	1. Forester 2. Non-forest person	Persons or communities that do not belong to any union or organization; they are single individuals or communities that express their opinion. E.g. indigenous groups
C0148		IPCC		Intergovernmental panel on climate change

C0149		Other actors		
C0150		Not Recognizable		When the speaking actor cannot be recognized according to his/her affiliation.
C0301A	Causer of Problem	Scientists	1. Author 2. Self citing scientists 3. Other scientist(s)	Identify the scientists either as the author of the article or as other scientists that speak directly or indirectly in the article. **Author**: would be the scientists that wrote the articles **Self-citing scientists**: refers to scientists that are cited in the article that are also the authors of the article: e.g. Krott wrote the paper and cited himself in the same article, then he would appear as a speaker once as the author of the paper and a second time as a self-citing scientist. IF SELF-CITING SCIENTISTS APPEAR skip categories C0121B,C, and D. **Other scientists**: other scientists that are cited or appear directly or indirectly in the article that do not correspond to the above mentioned cases. IF OTHER SCIENTISTS appear, continue with CATEGORY C0121B, C, and D.
C0301C			**Field of Science** 1. Forest Science 2. Nature Conservation Science 3. Natural Science 4. Social Science 5. Other Sciences 6. Not recognizable	Only fill out if in category C0121A option 3 was marked. In the statement, is information given that reveals to which field of science the scientists belong too? If more than one scientist is considered then refer only to the first author: e.g. (Krott and Krumland 2005 consider only Krott).
C0302		Politicians Government		All actors that have been elected to form part of the government. E.g. President, Prime Minister, Mayors, Senators, etc.
C0303		Politicians Non Government		All actors that are involved in politics but have not been elected by the public. E.g. presidents of political parties.
C0304		Administration	1. Forest administration 2. Environmental administration 3. Other administration	All actors that form the administrative body of the government. E.g. Ministers, public representatives.
C0305		Judiciary		All actors that form part of the judiciary arena. E.g. Supreme Court Judges, Lawyers.
C0306		Media		Causer is journalist or other member of the media

C0307		Development Consultants		All actors that act as consultants to development countries. E.g. experts of international organizations like the GTZ that work together with actors from developing countries giving them technical or other type of support.
C0308		Forest Enterprises		All actors that belong to a forest enterprise including the sectors of wood and paper industry.
C0309		Other Enterprises		All actors that belong to other enterprises that do not relate to forest.
C0310		Forest Non-Governmental Organizations		Nongovernmental organizations that deal exclusively with forest related subjects. E.g. Forest Ethics.
C0311		Other Non Governmental Organizations		All other nongovernmental organizations. E.g. Greenpeace, Amnesty International, Friends of the Earth.
C0312		European Union Commission		All actors that represent the European Union Commission
C0313		European Union Parliament		All actors that represent the European Union Parliament
C0314		Food and Agriculture Organization (FAO)		All actors that belong to or represent the FAO
C0315		United Nations (UN)		All organizations that depend on the United Nations, e.g. IPCC intergovernmental Panel on Climate Change, International Fund for Agricultural Development (IFDA), United Nations Forum on Forestry (UNFF), etc.
C0316		World Bank (WB)		All actors that represent or belong to the World Bank.
C0317		International Monetary Fund (IMF)		All actors that represent or belong to the International Monetary Fund.
C0318		World Trade Organization (WTO)		All actors that represent or belong to the World Trade Organization.
C0321		International Development Banks		All international banks that deal with developing countries. E.g. European Bank for Reconstruction and Development, Inter-American Developmental Bank, Asian Developmental Bank, etc.
C0326		Other Organizations		All other organizations that do not fall into the previous categories.
C0327		Nature		Nature or the Forest itself
C0328		Society		Society in general (mankind)
C0329		Single persons or communities	1. Non-forest person 2. Forester	Persons or communities that do not belong to any union or organization; they are single individuals or communities that express their opinion. E.g. indigenous groups

C0330		IPCC		Intergovernmental panel on climate change
C0331		Other Actors		The causer is another than the previous categories
C0332		Not Recognizable		When the causer cannot be recognized according to his/her affiliation
Referring to the characteristics of the statements of the speakers				
D0003	Assessment of Statement	1. Positive		If the Speaking actor is referring to the issue in positive terms
		2. Negative		If the Speaking actor is referring to the issue in negative terms
		3. Ambivalent		If the Speaking actor is referring to the issue in terms that cannot be classified as positive or negative
D0009	Communication Instruments of Speaker	Myth		The Speaker refers to the issue relating myths to reality
D0010		History		The Speaker uses historical background to refer to the issue e.g. past events which concern a particular topic
D0011		Paradigm		The Speaker makes use of a specific example/model to illustrate the issue
D0012		Religion		The speaker utilizes references to religion, religious objects, with the objective to illustrate the issue
D0013		Education		The speaker makes use of education tools to make the issue clear
D0014		Technology		The speaker uses technological references or processes to illustrate his/hers point of view. E.g. actor refers to how machines have changed the environment
D0015		Metaphor		Figure of speech, where a comparison is made between two seemingly unrelated objects. E.g. "the great desert that is the city today", "Scientific revolution", "mechanical philosophy".
D0016		Symbol		The use of an object/concept to relate the message to the public. E.g. an image of a bird covered by oil, catch phrases like "eco-colonialism"
D0017		Description		The speaker describes the situation of the events sometimes with numerical value.
D0018		Not Recognizable		

9.2. ANNEX II COMMUNICATION SURVEY

"Communicating and Cooperating in Forest Science"
Thank you for your interest in participating in this survey.
Your history in communicating and cooperating is of great interest for us.

Please give IUFRO and the Task Force an idea of your experience.

The survey takes approximately 20 minutes to answer and is completely ANONYMOUS.
With regards

IUFRO Task Force Communicating Forest Science

Q1. Have you carried out forestry related **SCIENTIFIC RESEARCH** in the last 5 years?

- ☐ Yes (Please continue with question 2)
- ☐ No (Thank you for your time, survey ends here)

(if **NO** scientific activity)

Thank you for your interest in our survey

Our survey targets people who have carried out scientific activities in the last 5 years, and you have answered that you have not.
We would like to thank you for your interests

Q2. Which is the HIGHEST educational or professional QUALIFICATION you have obtained? (please choose one)

- ☐ Bachelor degree or equivalent
- ☐ Master
- ☐ Ph.D. or higher qualification
- ☐ Other (please name):

Q3. In which main **AREA** of **SCIENCE** have you obtained your highest educational or professional qualification? (Multiple answers are possible)

- ☐ Forest science
- ☐ Natural science (non-forest science)
- ☐ Social science (non-forest science)

Q4. Which is your main **RESEARCH AREA**? (please choose one)

- ☐ Silviculture
- ☐ Physiology and genetics
- ☐ Forest operations
- ☐ Inventory
- ☐ Forest products
- ☐ Policy
- ☐ Economics
- ☐ Protection
- ☐ Forest fire
- ☐ Climate change
- ☐ Biodiversity
- ☐ Other (please name):

Q5. At which **TYPE** of **ORGANIZATION** are you currently employed? (please choose one)

- ☐ Public university/ college
- ☐ Private university/ college
- ☐ Public research institution
- ☐ Private research institution
- ☐ Public company
- ☐ Private company
- ☐ Other governmental organization

- ☐ Non-governmental organization
- ☐ International organization
- ☐ Other (please name):

Q6. Which **POSITION** do you currently occupy in the organization you mentioned previously? (please select the highest position that you occupy)

- ☐ President / Director
- ☐ Dean or head of department/ division
- ☐ Professor
- ☐ Senior researcher
- ☐ Postdoctoral researcher
- ☐ Doctoral student
- ☐ Scientific assistant
- ☐ Other (please name):

Q7. How many people work in your organization? (Including researchers and administrative personnel) (E.g. if you work in a department in a university, do not consider the department but the entire university.)

- ☐ 1 - 9
- ☐ 10 - 49
- ☐ 50 - 99
- ☐ 100 - 499
- ☐ 500 – 999
- ☐ 1000 – 4999
- ☐ More than 5000
- ☐ Don't know

Q8. In which **COUNTRY** is your organization located?
(If your organization is located in more than one country, please choose the country where you spend the most time working.)

Name of the country:

Q9. What is your **NATIONALITY**?
(If you have more than one nationality, please choose one)

Name of the country:

Q10. What is your **GENDER**?

- ☐ Female
- ☐ Male

Q11. What is your **AGE**?

- ☐ 30 or below
- ☐ 31 – 35
- ☐ 36 – 40
- ☐ 41 – 45
- ☐ 46 – 50
- ☐ 51 – 55
- ☐ 56 – 60
- ☐ 61 or above

Q12. How do you **DISTRIBUTE** your 'work time' as a percentage with regard to the following **ACTIVITIES**? (Please fill in all activities with values from 0% to 100%, making sure your answers total 100%)

ACTIVITIES	**PERCENTAGE**
Research	**( ) %**
Teaching	**( ) %**
Writing scientific publications	**( ) %**
Conference	**( ) %**
Fund raising	**( ) %**
Administration	**( ) %**
Communicating in the mass media	**( ) %**
Other	**( ) %**
Total	**100**
Please name the "other" activity which you spend time on. (Only in case you have filled in a value other than 0% in "Other activity".)	

Q13. In the hypothetical situation that your institution faces a difficult situation, such as a **BUDGET REDUCTION** which troubles your research activities, which of the following actors would you approach for **SUPPORT**? (3 answers are possible)

	International	**National**	**Local/Regional**
Government	☐	☐	☐
Research organization	☐	☐	☐
Non-governmental organization	☐	☐	☐
Company	☐	☐	☐
Media	☐	☐	☐
General public	☐	☐	☐
Other	☐	☐	☐
None	☐		

Q14. Have you communicated scientific information to the **PUBLIC** in the last 3 years?

☐ Yes (Continue with question 15)
☐ No (Go to question 17)

Q15. To **WHOM** have you communicated scientific information? (Multiple answers are possible)

☐ General public/ Everyone
☐ Students/ School children
☐ Teachers/ School administrators
☐ Government or politicians
☐ Industries
☐ Forest scientists
☐ Non-forest scientists
☐ Research organizations
☐ Non-governmental organizations
☐ Media
☐ Other (please name):

Q16. How **FREQUENTLY** in the **LAST YEAR** have you used the **INTERNATIONAL**, **NATIONAL** or **REGIONAL/LOCAL COMMUNICATION CHANNELS** listed below to communicate scientific information to the public? Please select one of the following answer possibilities: (1)doesn't apply; (2)never; (3)less than once a month; (4)several times a month; (5)once a week; (6)several times a week; (7)every day

	International	National	Regional/Local
Television			
Newspaper			
Radio			
Magazine			
Internet			
Lecture/ Training			
Meeting/ Conference			

Q17. Please select in the table below, for all level, how **FREQUENTLY** you read, hear or watch each of the **LISTED MEDIA**. Please select one of the following answer possibilities: (1)doesn't apply; (2)never; (3)less than once a month; (4)several times a month; (5)once a week; (6)several times a week; (7)every day

	International	National	Regional/Local
Television			
Newspaper			
Radio			
Magazine			
Scientific Journals			
Internet			

Q18. Do you read, hear or watch the following media? Please select for each media **one** option: yes (**Y**), no (**N**) or don't recognize the media (**D**).

MEDIA	Y	N	D
Jeune Afrique	☐	☐	☐
West Africa News	☐	☐	☐
Al-Ahram	☐	☐	☐
La Nacion	☐	☐	☐
O Globo	☐	☐	☐
The Times of India	☐	☐	☐
Singapore Times	☐	☐	☐
People's Daily	☐	☐	☐
Le Monde	☐	☐	☐
BBC	☐	☐	☐
International Herald Tribune	☐	☐	☐
El Pais	☐	☐	☐
Deutsche Welle	☐	☐	☐
Time Magazine	☐	☐	☐
Newsweek	☐	☐	☐
CNN	☐	☐	☐

Q19. Have you ever **TRIED** to contact the mass media in order to communicate scientific information to the **PUBLIC**?

☐ Yes, my information was communicated.
☐ Yes, my information was NOT communicated.
☐ No

Q20. Have you ever communicated in the mass media through **JOURNALISTS**? (e.g. interview with journalists)

☐ Yes
☐ No (go to question 23)
☐ Don't remember / Don't know

Q21. Which **TOPICS** have you communicated through the mass media?

☐ Forest protection
☐ Climate change
☐ Forest fire
☐ Biodiversity
☐ Illegal logging
☐ Forest products

- ☐ Forest operations
- ☐ Forest policy
- ☐ Other (please name) :

Q22. What **BENEFITS** did you expect when communicating to the public through the mass media? (Please only choose 3 answers)

- ☐ Dissemination of knowledge
- ☐ Attracting possible funding
- ☐ Satisfaction or enjoyment
- ☐ Positioning the role of science
- ☐ Opportunity for others to contact you for collaborative purposes
- ☐ Getting your name known
- ☐ Other (please name):
- ☐ No benefits
- ☐ Don't remember / Don't know

Q23. Does your institution have a **PRESS OFFICE** or a **PUBLIC RELATIONS DEPARTMENT**?

- ☐ Yes
- ☐ No
- ☐ Don't know / Don't remember

In your organization, is there either an INTERNAL or EXTERNAL PERSON in charge of public relations or press releases? (E.g. when your organization does not have a public relations department but there is someone in charge of PR, then answer yes.)

- ☐ Yes
- ☐ No
- ☐ Don't know / Don't remember

Q24. Has your institution published any **PRESS RELEASES** related to your research?

- ☐ Yes
- ☐ No (go to question 26)
- ☐ Don't know / Don't remember (go to question 26)

Q25. Did you personally contribute to any of the **PRESS RELEASES**?

- ☐ Yes
- ☐ No

Q26. From which of the following **SOURCES**, as a percentage, do you obtain **BASIC INFORMATION** for your research activities? (Please fill in all sources with values from 0% to 100% making sure your answers total 100%)

Sources	**Percentage**
National forestry journals (print form)	**() %**
International forestry journals (print form)	**() %**
Internet	**() %**
National conferences	**() %**
International conferences	**() %**
Government	**() %**
National research organizations	**() %**
Books	**() %**
Contact with colleagues	**() %**
Mass Media	**() %**
Other	**() %**
Total	**100**
Please name the "other" source/sources of basic information that you use. (only in case you have filled in a value other than 0% in "Other" source.)	

Q27. Please state, how **IMPORTANT** the following **ACTIVITIES** are for succeeding in science.
(from 1=very unimportant to 5=Very important)

Activity	Very unimportant	Unimportant	Neither unimportant nor important	Important	Very important	Doesn't apply
Writing scientific publications for journals	☐	☐	☐	☐	☐	☐
Attending conferences	☐	☐	☐	☐	☐	☐
Teaching	☐	☐	☐	☐	☐	☐
Obtaining a post-graduate degree	☐	☐	☐	☐	☐	☐
Developing partnerships with other actors	☐	☐	☐	☐	☐	☐
Developing partnerships with scientists from other countries	☐	☐	☐	☐	☐	☐
Writing research proposals	☐	☐	☐	☐	☐	☐
Delivering reports for research projects	☐	☐	☐	☐	☐	☐
Other (please name):	☐	☐	☐	☐	☐	☐

Q.28 In the last 10 years, how many articles have you **SUBMITTED** to international and/or national forestry journals and how many of these articles have been **ACCEPTED** for publication? (if submitted is NONE, go to **question 31**)

International Forestry Journals		**National Forestry Journals**	
Submitted	Accepted	Submitted	Accepted
☐ None	☐ None	☐ None	☐ None
☐ 1 - 3	☐ 1 - 3	☐ 1 - 3	☐ 1 - 3
☐ 4 - 6	☐ 4 - 6	☐ 4 - 6	☐ 4 - 6
☐ 7 - 9	☐ 7 - 9	☐ 7 - 9	☐ 7 - 9
☐ 10 - 12	☐ 10 - 12	☐ 10 - 12	☐ 10 - 12
☐ 13 or more	☐ 13 or more	☐ 13 or more	☐ 13 or more

Q.29 In the last 10 years, how many articles have you **SUBMITTED** to national and/or international forestry journals **together with scientists from other countries** (written together) and how many of these have been **ACCEPTED** for publication? (do not answer if in question 28 submitted is none)

International forestry journals		**National forestry journals**	
Submitted	Accepted	Submitted	Accepted
☐ None	☐ None	☐ None	☐ None
☐ 1 - 3	☐ 1 - 3	☐ 1 - 3	☐ 1 - 3
☐ 4 - 6	☐ 4 - 6	☐ 4 - 6	☐ 4 - 6
☐ 7 - 9	☐ 7 - 9	☐ 7 - 9	☐ 7 - 9
☐ 10 - 12	☐ 10 - 12	☐ 10 - 12	☐ 10 - 12
☐ 13 or more	☐ 13 or more	☐ 13 or more	☐ 13 or more

Q.30 Please select the NAMES of the **COUNTRIES** to which your THREE most important scientific PARTNERS, with whom you have collaborated in writing the previously mentioned publications, belong. (do not answer if in question 29 submitted is NONE)

Country

Partner 1:
Partner 2:
Partner 3:

Q.31 Please **CHOOSE** from the following **FACTORS** those which have **INFLUENCED** your research activities in the last 5 years? (Please choose 3 answers)

☐ Available financial resources

- ☐ Policy discourse
- ☐ Current topics in science
- ☐ International debates in media
- ☐ National debates in media
- ☐ Needs of productive sector
- ☐ Focus of organization
- ☐ Personal interest
- ☐ Other (please name):

Do you have any comments that you would like to share with us? If so, please use the space below.

YOU HAVE REACHED THE END OF THE SURVEY!
Thank you for sharing your experience.

The results of this survey will be available through the Task Force Communicating Forest Science.

9.3. ANNEX III: INCOME CLASSIFICATION OF COUNTRIES

Income Classification of Countries According to the World Bank 2004

Economy	*Code*	*Region*	*Income group*
Argentina	ARG	Latin America & Caribbean	Upper middle income
Australia	AUS	..	High income: OECD
Austria	AUT	..	High income: OECD
Belgium	BEL	..	High income: OECD
Bolivia	BOL	Latin America & Caribbean	Lower middle income
Brazil	BRA	Latin America & Caribbean	Lower middle income
Cameroon	CMR	Sub-Saharan Africa	Low income
Canada	CAN	..	High income: OECD
Central African Republic	CAF	Sub-Saharan Africa	Low income
China	CHN	East Asia & Pacific	Lower middle income
Congo, Dem. Rep.	ZAR	Sub-Saharan Africa	Low income
Congo, Rep.	COG	Sub-Saharan Africa	Low income
Costa Rica	CRI	Latin America & Caribbean	Upper middle income
Croatia	HRV	Europe & Central Asia	Upper middle income
Czech Republic	CZE	Europe & Central Asia	Upper middle income
Denmark	DNK	..	High income: OECD
Ecuador	ECU	Latin America & Caribbean	Lower middle income
Egypt, Arab Rep.	EGY	Middle East & North Africa	Lower middle income
Estonia	EST	Europe & Central Asia	Upper middle income
Ethiopia	ETH	Sub-Saharan Africa	Low income
Finland	FIN	..	High income: OECD
France	FRA	..	High income: OECD
Germany	DEU	..	High income: OECD
Ghana	GHA	Sub-Saharan Africa	Low income
Greece	GRC	..	High income: OECD
Greenland	GRL	..	High income: non OECD
Honduras	HND	Latin America & Caribbean	Lower middle income
Hong Kong, China	HKG	..	High income: non OECD
Hungary	HUN	Europe & Central Asia	Upper middle income
Iceland	ISL	..	High income: OECD
India	IND	South Asia	Low income
Indonesia	IDN	East Asia & Pacific	Lower middle income
Ireland	IRL	..	High income: OECD
Israel	ISR	..	High income: non OECD
Italy	ITA	..	High income: OECD
Japan	JPN	..	High income: OECD
Korea, Dem. Rep.	PRK	East Asia & Pacific	Low income
Korea, Rep.	KOR	..	High income: OECD
Malaysia	MYS	East Asia & Pacific	Upper middle income
Mexico	MEX	Latin America & Caribbean	Upper middle income
Myanmar	MMR	East Asia & Pacific	Low income
Nepal	NPL	South Asia	Low income
Netherlands	NLD	..	High income: OECD
New Zealand	NZL	..	High income: OECD

Niger	NER	Sub-Saharan Africa	Low income
Nigeria	NGA	Sub-Saharan Africa	Low income
Norway	NOR	..	High income: OECD
Panama	PAN	Latin America & Caribbean	Upper middle income
Peru	PER	Latin America & Caribbean	Lower middle income
Philippines	PHL	East Asia & Pacific	Lower middle income
Poland	POL	Europe & Central Asia	Upper middle income
Portugal	PRT	..	High income: OECD
Puerto Rico	PRI	..	High income: non OECD
Russian Federation	RUS	Europe & Central Asia	Lower middle income
Slovak Republic	SVK	Europe & Central Asia	Upper middle income
Slovenia	SVN	..	High income: non OECD
South Africa	ZAF	Sub-Saharan Africa	Lower middle income
Spain	ESP	..	High income: OECD
Sweden	SWE	..	High income: OECD
Switzerland	CHE	..	High income: OECD
Thailand	THA	East Asia & Pacific	Lower middle income
Uganda	UGA	Sub-Saharan Africa	Low income
Ukraine	UKR	Europe & Central Asia	Lower middle income
United Kingdom	GBR	..	High income: OECD
United States	USA	..	High income: OECD
Uruguay	URY	Latin America & Caribbean	Upper middle income
Vanuatu	VUT	East Asia & Pacific	Lower middle income
Venezuela, RB	VEN	Latin America & Caribbean	Upper middle income
Vietnam	VNM	East Asia & Pacific	Low income

9.4. ANNEX IV: JOURNAL IMPACT FACTOR FOR THE PERIOD 1993-2003 FOR FORESTRY JOURNALS

Average journal impact factor for the ten year time frame selected. Source ISI Web of Science

Journal name	Average
Tree physiology	1,816
Agricultural and forest meteorology	1,621
Journal of vegetation science	1,507
Trees-structure and function	1,084
Canadian journal of forest research- revue canadienne de recherche forestiere	0,996
Holzforschung	0,897
Forest ecology and management	0,872
Forest science	0,839
Iawa journal	0,558
Agroforestry systems	0,545
Forestry	0,525
Wood science and technology	0,523
Natural areas journal	0,507
Wood and fiber science	0,494
Journal of forestry	0,473
Forestry chronicle	0,401
Silvae genetica	0,397
Forest products journal	0,356
Forstwissenschaftliches Centralblatt	0,314
Allgemeine Forst und Jagdzeitung	0,235

9.5. ANNEX V: TOTAL NUMBER OF ARTICLES PUBLISHED BY THE SELECTED JOURNALS THROUGHOUT 1994-2003

	Canadian Journal of Forest Science	Forest Ecology and Management	Journal of Forestry	Forest Science	Forestry
1994	310	203	271	46	27
1995	219	184	192	62	36
1996	246	231	176	53	34
1997	258	232	148	59	39
1998	186	329	198	64	33
1999	212	286	216	62	33
2000	206	340	216	60	45
2001	230	343	144	64	41
2002	211	409	112	73	54
2003	250	521	114	84	45

CURRICULUM VITAE

Persönliche Daten:

Name:	Alejandra Daniela Real Toro
Geburtsdaten:	22.05.1976 in Valdivia, Chile
Familienstand:	Verheiratet
Staatsangehörigkeit:	Chilenisch

Schulische Ausbildung/Studium:

1993	Windsor School Valdivia, Chile Abschluss: Abitur
1995-2001	Hochstudium an der Fakultät für Ökonomie und Betriebswirtschaft der Universität Concepción, Chile Abschluss: Diplom-Volkswirt(1999) und Betriebswirtschaftsingenieur (2001)
2001-2004	Aufbaustudium an der Fakultät für Forstwissenschaft und Waldökologie der Georg-August-Universität Göttingen Abschluss: Master of Science in Tropical and Subtropical Forestry
2004-2009	Promotionsstudium an der Fakultät für Forstwissenschaft und Waldökologie der Georg-August-Universität Göttingen

Berufliche Tätigkeiten:

seit 06/09	Mitarbeiterin an der Corporación Nacional Forestal, Santiago Chile.
04/04 - 01/09	Promotion zum Thema „Discourses and Distortions: Dimensions of Global and National Forest Science Communication“ (Disputation am 30.01.2009), gefördert durch „Beca Presidente de la República“ – Chile
04/04 – 02/08	Studentische Hilfskraft am Institut für Forstpolitik und Naturschutz der Georg-August-Universität Göttingen

Sprachen:

Spanisch (Muttersprache), Englisch (fließend in Wort und Schrift), Deutsch (fließend in Wort und Schrift).

Software:

MS Office, SPSS, Unipark Survey Software.