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The Norwegian Red List between science and policy

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ABSTRACT

This article explores how science and policy interact using the Norwegian Red List 2006 as a case example. The paper draws on concepts from the sociology of science, interviews with key informants, as well as analysis of a Norwegian newspaper debate about a controversial conservation issue.

The paper highlights how the relationship between science and policy can best be described as an interaction rather than simply a transmission of knowledge from one to the other. In addition, the study focuses on the active construction and communication of the science–policy relationship. Regulators, scientists and NGOs, it is argued, strategically define the relationship between science and policy as more straightforward than it really is.

The paper suggests that the shaping, simplification and communication of scientific knowledge is best understood as a social process that occurs in three stages, which may overlap to varying degrees. The shaping of scientific knowledge for policy occurs first within the scientific domain. The shaping, we suggest, is the result of both the broader institutional context and a more specific micro-level social context, but it is also the outcome of requirements inherent in the genre of science communication. In the second stage, regulators and actors in the public debate redefine and simplify scientific knowledge to make it better suited to the policy arena. In the final stage, scientists, regulators and NGOs actively seek to define science as objectively true, and independent of the policy arena. By doing so, they are able to strengthen their arguments, regardless of their position on particular issues. But they also contribute to shrouding the social nature of scientific production.

1. Introduction

Lists of threatened and vulnerable species, or red lists, are internationally accepted science-based tools that are applied widely for regulatory purposes and policy making in the field of biodiversity conservation. One of the most internationally acknowledged ways of developing a red list is through the use of the IUCN (International Union for Conservation of Nature) categories and criteria. Compared to other countries, Norway was relatively late to implement these criteria. The first Norwegian IUCN-based red list was published in 2006, and this replaced an earlier 1998 version that had been developed by the Directorate for Nature Management based on its own criteria.

This paper presents findings from a study of the development and use of the 2006 Norwegian Red List.

In Norwegian environmental regulation and policy, as most other countries, science is expected to provide knowledge that will facilitate decision-making and a rational management of nature. Science is widely understood to be the basis on which sound environmental policy can, and should, be built. This is recognized, not only in practical

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environmental governance, but also in a wide range of public documents that define the objectives for environmental governance.

The extensive use of scientific knowledge in policy making and development in the environmental field calls for studies that focus on the relationship between the social world of environmental science and the social world of policy. Studies of the relationship between the two have flourished in the last two decades and this, in turn, has led to a more widespread recognition that science is a situated and social activity. Thus, belief in absolute and indisputable scientific truths seems considerably less ingrained than before, and the concept of ''objective science'' is under constant scrutiny.

However, while public awareness of the relationship between science and policy has to some degree been influenced by sociology of science, it is still widely believed that science should be expected to deliver ''true'' and definitive answers to guide policy. Similarly, the use of science in environmental regulation and policy is often seen as relatively unproblematic, even today. The assumption of a simple relationship between science and policy has been discussed by several authors (e.g. Cozzens and Woodhouse, 1995; Jasanoff and Wynne, 1998; Sarewitz and Pielke, 2007). Van den Hove (2007) introduces the term *naïve vision* in order to emphasise the simplistic nature of a notion of the science–policy interaction where policy is seen as building on neutral scientific facts.

This paper examines the dynamic between the enduring ''naïve vision'' that surfaces in debates when science is used to back various positions, and the strategic awareness among different actors about the reality of how science and policy interact. The paper aims to investigate three principal aspects of the Red List understood as *a social process*: the process of shaping and adjusting scientific knowledge for use in the policy arena; the use of the Red List in regulation and public debate; and different actors' participation in defining how the relationship between science and policy should be understood. Although the study deals with only one Red List process, in Norway, there is good reason to believe that the social mechanisms that are identified in this paper are of a more general nature. Thus, the findings from this study will help us understand the science–policy interplay in other contexts as well.

2. Theoretical concepts and research questions

Jasanoff (1990, 1995) developed the concept of *regulatory science* to describe scientific activity that leads to knowledge applicable to both regulation and policy. Regulatory science, according to Jasanoff, is seen as an ideal type, distinct from other forms of scientific activity. Identified as scientific activity at the interface of science and policy, regulatory science can be undertaken by scientists or by regulators themselves and is different from other forms of scientific activities in terms of its content as well as its context. The purpose of regulatory science is to fill knowledge gaps that often exist in policy matters, and it thus aims at prediction rather than just description and explanation. Further, regulatory science is more likely to be adjusted to make it applicable to laws or regulatory practice. We find that the concept of regulatory science is a useful starting point for analysing the Norwegian Red List. The following analysis will build on this concept when addressing the relationship between content and context in the case of science made for policy.

Science and policy have different frames of reference, social norms, language and even paradigms and together these make up what is to be understood as the social worlds of science or policy. Star (1983) has described how science produced for other social worlds takes the form of *boundary objects*, and defines these as objects that have the ability to communicate knowledge between these social worlds.

All scientific work is characterised by some form of simplification of the real world (Star, 1983). Boundary objects are one product of such simplification, enabling communication of meaning from one social world to another. As Browker and Star (1999) suggest, boundary objects are: ''*(. . .) those objects that both inhabit several communities of practice and satisfy the informational requirements of each of them*''. These objects can be abstract or concrete, and dynamic and constant at the same time. They are dynamic enough to fit into different situations and constant enough to keep their ''identity'' across contexts where they are used. In this paper, we use the concept of a boundary object to aid a closer look at how knowledge is communicated from scientists to regulators and policymakers using the Norwegian Red List as a case in point.

The social worlds of science and policy interact in the process of communicating knowledge. A substantial number of contributors over the last couple of decades have analysed this interaction, and its effect on both the scientific knowledge and on regulation and policy. For instance, Lövbrand (2007) studied the Swedish scientific program, LUSTRA (Land Use Strategies to Reduce Greenhouse Gas Emissions), and described the interaction between scientists and regulators. Lövbrand found that: ''*Although most of the respondents in this interview study referred to the linear model (. . .) when describing the ideal relationship between carbon cycle science and policy, the everyday experiences of Swedish government officials and LUSTRA scientists point to a more complex relationship that ties into the pattern of reciprocal influence invoked by co-production scholars*'' (Lövbrand, 2007). Further, Lövbrand concluded that social relations shape everyday research practices and influence the interpretation of findings and their use in the regulatory domain.

Not surprisingly, the work of scientists is influenced by their social surroundings, but the respondents in Lövbrand's study still referred to a relatively simple linear model of the relationship between science and policy. Van den Hove argues that *the naïve vision* of the relationship between science and policy is inadequate in describing the reality for science in the social world of environmental governance (Van den Hove, 2007) and describes how, in the case of Lövbrand's research, there is, in fact, a co-evolution between science and policy. Such processes allow for the exchange and joint construction of knowledge to facilitate decision-making (Van den Hove, 2007). But what Van den Hove does not explain is how the naïve vision persists despite the fact that the interface between science and policy is a complex social process that influences how knowledge itself is constructed.

Gieryn (1999) describes the interface of science and policy as a ''culturescape''; a social landscape where constant *boundary work* is performed by different actors. This boundary work amounts to a constant social negotiation that aims to distinguish some forms of intellectual work as non-scientific – in other words, this means that the scientific community (actors, methods, stocks of knowledge, values and the way scientific work is organised) is ascribed certain characteristics that separate scientific activity from non-scientific intellectual activity (Gieryn, 1995). According to Gieryn (1999), boundary work takes the form of expulsion, expansion, and protection of autonomy. Expulsion occurs within scientific communities themselves when, for example, scientific work is defined as being either outside or inside mainstream science. In contrast, expansion occurs when scientific actors try to enlarge their area of autonomy, or else when actors within policy, regulation or other social fields try to challenge the right of scientists to define the truth. Similarly, protection of autonomy occurs when actors outside the scientific community, for example, draw upon the authority of science to legitimise their actions thus triggering a reaction from the scientific community who do not accept responsibility for such actions. As described, boundary work is therefore strategic action by those (diverse) actors who have an interest in drawing distinct boundary lines between science and non-science.

The aim of this paper is to investigate how scientific knowledge is influenced by its institutional and social context and by requirements related to communicative efficacy, as exemplified by the case of the Norwegian Red List 2006. In particular, we will take a close look at the role played by *the naïve vision* of the relationship between science and policy in the construction of the Red List as scientific knowledge.

3. Methods

To understand the processes involved in the development and use of the Red List, it was necessary to talk to key representatives of the different institutional actors involved. The analysis presented here is based on 16 semi-structured, qualitative interviews. Informants interviewed represented NBIC (the Norwegian Biodiversity Information Center) (three persons); scientific experts (three persons); regulatory agencies (five persons); environmental NGOs (three persons); and forest owners' organisations (two persons). The interviews were conducted using a semi-structured interview guide, including questions regarding the process of compiling the Red List, as well as its application. The interviews were conducted in largely the same way with all representatives, with only minor adjustments to the different informants' institutional contexts and frames of reference.

Interviews were recorded electronically and analysed using HyperResearch software. HR is a tool for the analysis of qualitative data that enables direct coding of sound files, without transcription. Digital sound file coding facilitates analysis of a topic across interviews. It saves time and resources, and by maintaining the focus on speech, nuances that are lost in transcriptions are easier to integrate in the analysis. We transcribed only the most important parts of each interview, and these transcriptions have provided the citations in this article.

In addition to the interviews, we conducted a document analysis of a newspaper debate about the highly controversial protection of Trillemarka, an old-growth forest area in South-Eastern Norway. The Red List figured prominently in this debate. The document analysis helped us understand how the Red List as a political factor continued to be developed and how this contributed to the Red List's impact on the policy arena. The document analysis was based on a screening of electronically published articles from the newspaper Nationen, where most of the public debate took place. All articles from December 2006 to February 2007 were screened and relevant articles analysed in depth, focusing on different arguments that were derived from the Red List in one way or the other.

4. Shaping scientific knowledge for policy

The assignment of establishing a Norwegian Red List based on the IUCN criteria was given to the Norwegian Biodiversity Information Center (NBIC) by the Directorate for Nature Management. Defined as a knowledge data bank, whose main objective is to make biodiversity knowledge accessible and to spread information about species and species diversity, the NBIC is a relatively new institution, established in 2005. NBICs mandate states that: *''it is [the] NBIC's task to determine the red list status for Norwegian species and nature types, and to manage and develop documentation related to red lists and to publish national red lists''* (Norwegian Biodiversity Information Center, 2008).

As part of the project of establishing a New Norwegian Red List, the NBIC created groups of experts from different Norwegian scientific institutions. Although the scientific work itself – the actual production of the Red List – took place in these expert groups, the institution ultimately responsible for the production of the List was the NBIC. Independent of the regulatory system and also independent of the complicated field of Norwegian research institutes (a potential minefield of conflicting research agendas and institutional loyalties), the NBIC takes its mandate from the Norwegian Ministry of Education and Research and not the Ministry of the Environment. This makes the NBIC a new type of institution in the field of Norwegian environmental policy, occupying a position of ''independence'' from both regulatory demands and scientific traditions.

The NBICs assignment was to establish a Norwegian Red List based on the IUCN criteria, a method developed to facilitate the management of threatened species. With this in mind, it is pertinent to ask whether such work should be regarded as scientific work or regulatory work. One of the informants stated:

> IUCN says quite clearly that making a Red List is to set regulatory priorities. In saying so they recommend a certain strategy on how to set these priorities. One should separate this from [actually] setting conservation priorities (Informant A – NBIC).

The making of an IUCN Red List is the first stage in setting conservation priorities. In Norway, this listing work was

undertaken by expert groups who made the first decisions on whether a species was to be classified as ''threatened'' or ''not threatened'', and later placed all species into one of the eight more specific categories provided by IUCN. The IUCN criteria set quite obviously influenced the outcomes. In addition, it is reasonable to presume that the NBIC to some degree influenced these decisions as well, by shaping the institutional context of the process. A key question concerns how the decisions made by the NBIC influenced the compilation of the Red List. In an attempt to answer this question it is necessary to examine the organisation and work of the expert teams.

The expert teams that compiled the Red List were created by putting together scientists from different universities and research institutes. In Norway, there has been a long tradition of close connection between scientific institutions and different ministries. Because of this, the NBIC gave close consideration to how the teams were composed:

> We tried to balance the expert teams to give the overall impression of independence. To a large extent this meant paying attention to sector attachment and geographic localisation (Informant C – NBIC).

It is clear that the goal of the NBIC was to exhibit the independence of the expert groups. This independence did not come without cost, as informants reported noisy discussions within the groups, for example related to the listing of relatively common species. However, problems would obviously have been even more serious if such discussions had not occurred, because that probably would have indicated the triumph of only one or a few experts.

The experts we interviewed reported substantial differences between groups in levels of co-operation within the group. While some groups had a lot of discussions down to the last species, others did not have any at all because most of the work was done by e-mail without any real group discussion. One of the experts said:

> NBIC could have given the teams more guidance. I have good knowledge of two teams, and if these are compared you will find that the procedure has been varying (. . .). One of the teams had many meetings and a dynamic process, while the work in the other group seems to be done by one person alone (Informant A – Experts).

The process of finding experts for the different groups was not undertaken entirely by the NBIC, as the team leaders themselves helped to find experts and form the group. Interviews showed that as part of this process, the search for scientists who had knowledge in ''regulatory relevant biology'' and who were ''species specialists'' (as opposed to general ecologists) was the key consideration of the search. The fact that the experts were identified in this way shows that we can indeed talk about regulatory science, i.e. about a process that facilitates shaping of science for regulation. It also demonstrates the direct influence of the team leaders on the composition of the groups, and thus on the outcome of their work.

The shaping of the scientific knowledge discussed here is mainly the result of the institutional and organizational context of the Red List. It is relatively obvious that the Red List also is influenced by larger societal trends related to conservation and the environment. However, the focus of this analysis is somewhat narrower, that is, how scientists are socially organised and how they encounter each other in a social space. It is in this social space, where the Red List is developed, that the moulding of scientific knowledge into a particular form occurs.

It seems reasonable to separate shaping of scientific knowledge for policy that is deliberate from shaping that is not. It is also reasonable to separate explicit shaping from the kind that is more subtle and ''hidden''. For example, the fact that the Red List is based on the IUCN criteria, and that this involves a degree of deliberate adjustments to regulatory needs, is one of the more obvious forms of shaping. On the other hand, the co-operation, or lack of it, in each expert team could reasonably be interpreted as a form of shaping that is not deliberate and is hidden to people who do not have inside information about the process. The same goes for the interests and priorities – scientific and otherwise – of the individual experts.

How does the shaping of knowledge affect the information transmitted between the fields of science and policy? Before attempting to answer this question, it is important to take a closer look at why such shaping occurs. Star (1983), as noted earlier, has described the production of scientific knowledge as a simplification of a complex, real world. Simplification quite often involves the creation of a boundary object which is used in order to facilitate the communication of knowledge from one field to another (Star and Griesemer, 1989).

The Norwegian Red List therefore may well be described as a boundary object, transcending the field of science and the field of policy. The Red List is developed by scientific experts, but can easily be communicated to other actors: you do not need to be a biologist to understand that ''critically endangered'' is more severe than ''vulnerable''. In this way, the Red List contains easily understood and structured sequences of categories that range from ''worst off'' to ''best off''. The categories are familiar and easily understood both in the field of science and policy: as such, they enable the transferral of information from one side of the boundary to the other. This is absolutely necessary to obtain the quality crucial to a boundary object, namely that of easily decipherable knowledge.

5. Simplification of scientific knowledge for policy

The complex reality of nature is necessarily simplified into scientific knowledge (Star, 1983). In the case of the Red List, this knowledge is simplified even further through the construction of a boundary object (centred around clear-cut categories) that is easily understood by scientists, regulators and policymakers at the same time. However, science seems to face a problem here, in that the basis for the simplification itself is incomplete:

> The problem with red lists is that they demand a lot of facts about distribution and abundance of species for the results to be quantifiable and taken seriously. Say that we have ten thousand insect species in Norway, and only some twenty

> experts, then you could not by any chance cover all the species. Normally you will only have a small piece of the facts necessary to describe distribution and abundance (Informant A – Experts).

Without having full knowledge of a problem, scientists will need to find ways to draw conclusions that do not fully comply with the rules of science itself. Lacking necessary information was described by several informants as a challenge to the scientific method, since it meant that the scientists would have to make more or less well-founded assumptions. Several informants stated that "faith in the expert judgement" is needed if the Red List is to be trusted, implying that experts bring more into the compilation process than merely stringent scientific methods. It is reasonable to call this a simplification in the production of knowledge, since the expert opinion is included as part of the method in itself. This methodological twist enables production of scientific knowledge according to principles that are laxer than those that govern "ideal" scientific production.

In addition, simplification occurred because the Red List was not founded on knowledge gathered with the purpose of making such a list, but rather on the compilation – or meta-analysis – of already existing scientific knowledge. There is nothing intrinsically wrong with meta-analysis, but it is clear that it is a simplified way to generate scientific knowledge. It also necessitates making assumptions based on data that are not only insufficient in quantity, but may also be less than ideally suited to the task.

This study shows that the creation of a working boundary object through simplification is important to enable the communication of scientific knowledge from the scientific to the policy arena. This was done in the case of the Norwegian Red List, and the creation of this particular boundary object demanded simplification in terms of scientific method as well as regarding the form of the message. Importantly, this simplification was not an easy task for the expert groups: *"Certainly we see that we have too little knowledge and that we will end up with quite subjective evaluations of for instance decline"* (Informant B – Experts). The different experts involved talked about the Red List process as something that moved toward a kind of borderland, towards something that was defined as "not science" but rather "subjective". One important question is how this scientific challenge is dealt with when the knowledge is communicated to other actors and in turn handled by them. But let us first look at how regulatory agencies and interest organisations deal with scientific knowledge related to the Norwegian Red List.

For regulators the Red List is a necessary and warmly welcomed document that provides insight into something that otherwise would remain opaque. Many aspects of nature, such as the great variety of species, are too complex to regulate without scientific knowledge accumulated over time:

> It is [important] to obtain knowledge about which species are threatened in Norway, and why these species are endangered. This will be used to take action and eventually help species recover so that they can be moved to lower Red List categories (Informant A – Regulators).

In this way a Red List comprises knowledge that is valuable because it makes it possible for regulators to do their job. Possingham et al. (2002), for example, noted that threatened species lists are one of the few tools at the disposal of regulatory agencies to limit the environmental impacts of development. This is also valid in the case of the Norwegian Red List:

> [Threatened species] is an argument that developers seem to acknowledge. It is easier to understand that threatened species are important to recognise, than to grasp the total biological diversity with in ecosystems and the value of one area compared to other areas (Informant C – Regulators).

The Red List becomes a source of legitimate knowledge to draw upon, and is thus a valuable tool for regulators. Therefore, the Red List will also be widely used, both for regulation purposes and at the political level. When utilising the Red List in different cases the regulators engage in communicating the knowledge that such a list contains. By doing so, regulators will influence how scientific knowledge is perceived, for example at the political level. As one of the informants put it: *"It is clear that the use of the Red List and "threatened species" in various specific cases makes it easier to have an impact on the agenda. It is possible to visualize it in a totally different way [compared to more general arguments]"* (Informant A – Regulators). The simplified knowledge that the Red List represents is an advantage because it works as leverage for the regulatory agencies presenting arguments in favour of nature conservation. Since arguments based on the Red List have a greater impact, and since the Red List is one of few tools available, it seems that arguments based on the list and the threat status of particular species will be adopted by regulators when confronting other actors. This does not mean that these will be the only arguments, but that arguments involving red-listed threatened species are likely to be essential.

In placing Red List related arguments at the core of their strategy, regulators actively select a piece of scientific knowledge to present to politicians and others. In doing so they engage in a process of simplification, not least through narrowing the scope of scientific knowledge about nature. As noted by Possingham et al. (2002) and by some of the experts interviewed in this study, this may backfire on the regulation itself:

> The Red List partly [works well] when used for practical purposes, but partly it also works badly. Let us say that you as a biologist know an area with both rare and interesting nature qualities, where you could not find any Red List species. This could leave you a bit empty-handed when trying to explain the nature qualities in that specific area (Informant A – Experts).

As the expert informant emphasised, the Red List is only one type of information needed to inject a conservation perspective in regulation and policy. If the Red List, which is a uniquely powerful document in this field, is given the stage alone this might bias decisions in ways that may not benefit nature conservation. It follows that a better understanding of the Red List's content and context is needed to enable regulation and

political decisions to be grounded in arguments that are more congruent with the totality of conservation needs.

Further, it is not only regulators who engage in the simplification of scientific knowledge: this study showed that this was also the case within media debates where the Red List played a part. Different actors participate in the media debate and this is done by sharpening arguments and simplifying meanings. Sarewitz (2005) pointed out that science in many cases makes environmental controversies worse. According to Sarewitz this has to do with diversity in scientific traditions or uncertainty regarding data used in scientific studies. This means that there is an arsenal of arguments to choose from in order to support almost any conceivable position related to a conservation issue. As we shall see, this is a perspective that is clearly relevant regarding the use of the Norwegian Red List in the public debate.

The most topical newspaper debate in Norway that has involved the new Red List was the debate surrounding the forest conservation issue of Trillemarka. This area is one of the relatively few remaining areas of old-growth coniferous forest in southern Norway, and so has been the focus of conservationists and environmental management agencies for decades. There has been a strong demand for protection, but an equally strong resistance from local government, land owners and the forest industry. The controversy reached a climax in 2007 and 2008, following a lengthy process of impact analyses and public hearings – and obviously heated debate. A large portion of the area was finally protected by the Government in December 2008. During the debate, it was evident that scientific knowledge, or the act of invoking the scientific community, was used as a source of legitimising a variety of arguments. In almost every single contribution to the debate, expressions like ''expert knowledge'' or ''confirmed by experts'' were used to bolster specific arguments. One of the conservation NGOs involved, for instance, said: *''Let us hope that the government ground their policy decisions (. . .) in expert knowledge about the many species going extinct in our nature* (Nationen, 11.12.06). The NGO in this case was referring to expert knowledge as something trustworthy that sound policy should be built on, and through this they sought credibility. The forest owners tended to focus more on the difference between the old and the new Red List, emphasising the fact that some species found in Trillemarka were effectively ''delisted'' in the new one (partly due to the implementation of the IUCN criteria set). The Red List therefore served much the same purpose for the forest owners as for the conservationists.

Further, in the debate surrounding the issue of Trillemarka, the number of threatened species identified in the area was at the core of the dispute. During the debate, the concept of ''Red List species'' was drawn upon by representatives from both sides (conservationists and forest owners/local authorities). In reducing the red list categories down to two ''super-categories'' – listed and not listed – the debate ended up centred on how many ''Red List species'' existed in Trillemarka. The concept of ''Red List species'' is not clearly defined in the Red List itself, and is not part of the IUCN criteria or categories derived from them.

Significantly, the concept of ''Red List species'' was later used in a press statement released by the Government, regarding the final decision to protect Trillemarka: ''*129 Red List species have been found in this forest area. The large size of the protected area will guarantee the protection both of Red List species and their habitat*'' (The Norwegian Government, 2008). The fact that it appeared in such an official statement indicates that the concept of ''Red List species'' (in reality a gross simplification) had entered the highest political agenda and made an impact there. The newspaper debate, the regulatory agencies' use of the Red List in their efforts to protect Trillemarka, and the Government's active promotion of the term ''red list species'', clearly shows that many actors in different positions engage in both the shaping and simplification of scientific knowledge.

6. Communicating simplicity

A number of theories and models have been developed to attain a more comprehensive understanding of the relationship between science and policy, and how these fields interact. Gieryn (1999) developed the concept of boundary work to describe how different actors take part in defining science as science. This boundary work occurs in a culturescape, or social landscape, where different actors draw ''mental'' borderlines between different activities. Drawing these borderlines is a strategic action that has advantages for many actors as the science and non-science issues are separated. For example, one of the informants at the NBIC said the following: ''*It is important to stress that the Red List is a product that is entirely independent of interests regarding use or conservation*'' (Informant C – NBIC)''. Here, the red List was seen as part of a ''disinterested'' field of true science, untouched by petty ''interests''.

But as we have seen, the Red List is not independent. Rather it is dependent upon both its context and the demands placed on its content; if it had not been for this dependency it would have been all but useless to regulators and policymakers. Following informants in this study there are two different stories told about the Red List: The story of how the red list is shaped to fit policy, and the story of how it is constructed as totally independent.

For regulators it is important to have trustworthy scientific knowledge, not only because they need it to develop management strategies, but because it is vital to their argument when they confront other actors. ''*(. . .) the decision that regulatory agencies should not develop the Red List themselves is based on very thorough deliberation, because the result is more neutral when it is done by someone who is independent. For this reason the assignment was given to NBIC (. . .). Regulators are present on the board of NBIC, but it is [the] NBIC's own product and they bear the responsibility*'' (Informant A – Regulators). The first Norwegian Red List was developed by one of the regulatory agencies itself (the Directorate for Nature Management). Because the new list was made by NBIC, regulators now have a more legitimate and ostensibly neutral scientific structure on which to base their own actions. In doing so, their actions will appear more impartial, and help them avoid becoming part of environmental disputes. Hence it is of great importance to the regulators that the Red List is perceived as independent.

It was not only representatives from the NBIC and regulators who talked about the crucial independence of the

Red List: in fact almost all informants mentioned this as one of the key qualities of the new list. One of the representatives from an environmental NGO stated: "*The Red List is developed by NBIC, and not [...] by regulators. They have been working towards a high degree of expertise and expert decisions (...) NBIC has done a really neat piece of work*" (Informant A – Environmental NGO A). Further, representatives from forest owners' organisations emphasised the importance of independent expert decisions: "*We support the work done by NBIC, and think it is important that they do a good job. In fact we are pretty pleased with them in light of the mandate they had. Best possible expertise is an important fundament for Red Lists, which is valuable to us*" (Informant A – Forest owners NGO A). Representatives from both kinds of organisations (conservation and forestry) gave the impression that they regarded the Red List as a solid piece of expert work, and both parties articulated the importance of expert-based Red Lists to their own work.

In the analysis of the newspaper debate it became clear that there are good reasons for the organisations to support expert-based Red Lists, since such lists function as a way to legitimise their arguments. It is in the interest of environmental NGOs, and forest owners as well as regulators and the experts themselves that the Red List stands out as trustworthy science. Consequently they will all engage in defining it as such.

In the case of the Norwegian Red List 2006, active boundary work carried out by all actors contributed to reinforcing the idea of a simple relationship between science and policy. Boundary work in this case was not done out of ignorance, but rather as a strategic action necessary to influence the political agenda. Science needs to be communicated as *scientific* in order to be valued at the policy level. In this light, it is a paradox that most informants in this study had a more complex understanding of the relationship between science and policy. However, these insights were downplayed in order to utilize the Red List for purposes that were seen as legitimate, whether as part of regulation, policy development or interest group activity.

7. Implications for environmental policy

We have seen that the process of developing the Norwegian Red List comprised adaptation to policy requirements as well as a simplification of scientific method. This is a complex social process with many different aspects, including both deliberate choices that shape the organizational context and un-planned, un-controlled processes that result from the social dynamics in each expert group. The Red List process, as regulatory science, results in the creation of a boundary object (the Red List) that enables communication of information from the scientific field to the policy arena. The process of simplifying knowledge is carried further when regulators – for a variety of reasons – choose to communicate some parts of the knowledge while leaving others unmentioned. Various other actors in the public debate, like conservation NGOs and land owners, do exactly the same and thus contribute to this form of simplification. Finally, the social process of *boundary work* veils the simplification that has taken place, because the Red List is often actively constructed as solid scientific knowledge, in order to support different arguments. Thus, the *naïve vision* of a simple relationship between science and policy persists, whereas the interface is in fact a complex web of social actions that has decisive impact on both processes and results.

Scientific knowledge, political mobilization, debates in the media, and regulatory advice all inform policy decisions. The three-stage model outlined here helps to build an understanding of the dynamic of the interface between science and policy. Understanding the processes and the interface itself is important at the policy level, because as this paper has shown, what is communicated by different actors in public does not always reveal the underlying dynamics of the context and content of scientific knowledge that is generated for policy purposes.

The fact that the Red List is communicated and interpreted as a strong and exclusive scientific tool for environmental regulation and policy, might obscure other issues that are equally, or perhaps even more, important to the conservation of nature. Nature consists of far more than species and other easily identifiable categories, and it is important for regulators and policymakers to acknowledge that there is a need for a lot more knowledge about the different aspects of nature to ensure a solid foundation for decision-making.

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