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The use of science in environmental policy: a case study of the Regional Forest Agreement process in Western Australia

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This paper explores the notion of pluralism as it relates to the involvement of science in processes of environmental policy formulation. In particular, it focuses attention on the dominance of normal science within the Australian debate on commercial forest use, management, and conservation. It presents case study information from the Western Australian Regional Forest Agreement (RFA) process, a policy initiative designed to end a long-running conflict over public forestland. It then analyzes the use of science within this political process, along with the respective impacts of different voices within science on the RFA outcomes. The case study data highlight the vulnerability of reductionist science within complex political debates and support arguments for a widening of the scientific basis of policy processes to include alternative ways of understanding nature-society relations. The paper contends that such a broadening will make science not only more robust, but also more valuable as a problem-solving tool in future decision-making processes on land use, conservation, and broader sustainability questions. It also considers the obstacles facing pluralism.

KEYWORDS: environmental policy, forest management, policy reform, decision making, conservation, science policy, politics, human-environment relationship, conflict resolution, common property resources, sustainability

Introduction

Science has become a much-traded commodity within the media, commerce, and politics (Jasanoff, 1986; Salter, 1988). In fact, science and scientists are at the center of public life, assuming the role of society's principal problem-solving authorities (Cotgrove, 1982; Milbrath, 1989). Although science's absolute claims to autonomy and truth have increasingly come under attack, and critics have pushed it into a far more relativistic stance (Irwin & Wynne, 1996; Jasanoff, 1996; Felt, 2000), science continues to enjoy a preeminent social status and to play a central role within democratic processes. In the political realm, there is a discernible preference for input from the *hard*, normal sciences (after Kuhn, 1962). These sciences, which are closely linked to the political and economic status quo, are highly prescriptive in nature with a particular, yet largely undisclosed, set of policy preferences and outcomes (Lackey, 2004). In general, they are highly codified and quantitative and, therefore, often privileged to receive the objective label, which is favored in public and

political life (Deetz, 1996). In contrast, *soft* sciences are given the subjective label because of their more qualitative orientation, dealing with interpretations of an interpreted world (Giddens, 1984). As a result, these disciplines are commonly considered less credible and reliable and are drawn upon less frequently within policy processes (Deetz, 1996).

The centrality of science in public life is not disputed, because experts are needed to advise on policy for an increasingly complex world (e.g., Yankelovich, 1991; Waller, 1995; Lubchenco, 1998). The point of contestation in this regard, however, concerns the kind of science required to provide needed answers to today's messy social, ecological, and economic problems. In recent decades, there has been a noticeable trend toward a greater reliance by society on scientific rationalism to form the basis for the actions of government and public administration (Harmon & Mayer, 1994). This rationalism, also termed "technical rationality" (Schön, 1983), is promoted largely by what can be called the dominant sciences. Such sciences as economics posit themselves as

positivistic and linear in nature, promising full knowledge, and thus full mastery, over the social and natural world (while enacting a reductionist approach) (Schön, 1983; Özel, 2002). This characterization refers to the *hard*, normal sciences previously described and stands in contrast to other disciplines and schools of thought (e.g., ecology, ecological economics) that are often seen as unscientific. This paper casts doubt, however, on the capability of this orthodox strand of science to deal effectively with the issues of complexity and change. Its disciplinary myopia and rigidity may be at odds with inherently wicked problems—for instance those often encountered in natural resource management—thus preventing the holistic treatment of complexity and instead resulting in higher levels of uncertainty. For this reason, the extent to which dominant, rational sciences alone should be employed in policy contexts such as these need to be questioned.

This paper explores questions about the need for “scientific pluralism” within environmental policymaking. It also critiques calls for changes within science in light of growing environmental challenges and the need to inform and guide political debates and decision-making. To this end, it analyzes an Australian experience in forest policy. More specifically, case study data are introduced from the Western Australian Regional Forest Agreement (RFA), with the aim of providing insights into RFA stakeholders’ perceptions of the scientific credibility of this policy process. The Western Australian RFA sought to balance the conflicting claims of conservation and development on public forestland. In this context, science was called upon to diffuse an emotionally charged forest debate with facts and to give credibility to a political process. Against this background, the case study data provide detail on the use of science within a complex policy process and prompt a wider discussion on the use and usefulness of science within the political arena. Consideration is also given to demands for changes that could better equip science for future sustainability challenges.

Background on the Western Australian Regional Forest Agreement

In the 1960s, public disquiet arose over the use and management of Australia’s native forests. Back then, the intensification of industrial forest exploitation coincided with the emergence of new cultural and social values (Lothian, 1994; Worth, 2004). These attitudinal shifts led to calls for a new forest politic and forest management prescriptions, and resulted in an escalation of the conflicts between Australian state governments, the Australian Commonwealth government, conservationists, and the country’s timber industries. By the early 1990s, the forest debate was the country’s most controversial environmental issue, with strongly contested ecological, economic, and socio-political dimensions (see Carron, 1985; Australian Conservation Foundation, 1987; Dargavel, 1995; Mercer, 1995; Calver & Wardell-Johnson, 2004).

In an attempt to end the conflict, the Australian Commonwealth government initiated what came to be known as the Regional Forest Agreements (RFAs). These accords were designed to operationalize the 1992 National Forest Policy Statement (NFPS) by offering a mechanism

whereby the Commonwealth and the State governments could negotiate the long-term management and use of selected forest areas. Officials promised that these 20-year agreements would deliver resource security for an internationally competitive forest products industry, as well as comprehensive, adequate, and representative forest reserve systems and ecologically sustainable forest management (ESFM) (Commonwealth of Australia and Government of Western Australia, 1999).

RFAs were widely portrayed as “agreements backed by science, science and more science” (Commonwealth of Australia, 2000). A total of AUS \$115 million was spent on Comprehensive Regional Assessments (CRAs) (Commonwealth of Australia, 2000), which were scientific studies that sought to determine the environmental, heritage, economic, and social values within delineated forest areas. These studies were purported to have been the most detailed and comprehensive scientific assessments ever made in Australia (Commonwealth of Australia and Government of Western Australia, 1997). Such claims gave rise to the argument that RFAs were science-based, and that science provided the footing for sound decision-making on forest use and conservation measures (Hill et al., 1997; Forests Taskforce, 1998).

Government officials also promoted the scientific grounds of the Western Australian RFA. The public was assured that the State and Commonwealth governments had sought high-caliber scientific input via workshops, expert panels, and commissioned CRA research projects. More than 500 scientists and experts were reported to have been involved in the RFA process, producing a total of 38 CRA reports over a period of three years and providing advice to responsible ministers and to the Steering Committee overseeing the entire endeavor (WA Parliamentary Debates-Hansard, 1999). Nonetheless, despite these assurances, the science of the Western Australian RFA did become a point of contention. Questions arose over the scientific credibility and use of the underlying data and the bureaucratic censorship of dissenting perspectives (e.g., Horwitz & Calver, 1998). Growing disputes concerning the RFA’s science contributed to an erosion of public faith in forest management, resulting in the widespread rejection of the RFA process and the outcomes it delivered.

When the Western Australian RFA was finalized in May 1999, the agreement triggered an enormous public backlash, including petitions, mass protests, and rallies. Although the RFA was described as an extensive scientific process that could “not be overturned overnight” (WA Parliamentary Debates-Hansard, 1999), public pressure forced the Western Australian State government to repudiate the agreement only eight weeks after it had originally been signed. Because the changes to the initial RFA lacked discernible reference to the scientific process, the credibility of both the science and the process it was intended to buttress were damaged. In summary, it seems that the Western Australian RFA failed to gain public acceptance partially because of a lack of scientific credibility, even though science was said to have been underlying its entire development.

We examine this conundrum below in light of the well-entrenched scientific controversy about forest

management in Western Australia and its impact on the science of the RFA. More specifically, what follows gives insight into the bureaucratic institutionalization of rational forest science in Western Australia in the years preceding the RFA process. Subsequently, we present RFA stakeholders' perceptions of the credibility and acceptability of this scientific-cum-administrative alliance within the context of social and environmental change.

Comments on Method

The information presented in this paper is derived from a broader investigation of the Western Australian RFA (see Brueckner, 2004). Case study data was obtained from 59 interviews conducted with RFA stakeholders between 1999 and 2002. Research participants were chosen using snowball sampling to enable the inclusion of a wide range of stakeholders (see Goodman, 1961; Babbie, 1992). The investigation involved politicians, RFA process managers, conservationists, and timber workers, as well as forest industry representatives, scientists, and members of the general public. The interview data were triangulated with RFA-related literature and media content to identify stakeholders' perceptions of the RFA process and its outcomes.

This study adopted a discourse-analytic approach that followed other work in public policy development (see, e.g., Fischer & Forester, 1993; Dryzek, 1997; Meppem, 2000). Interview data were analyzed via visual coding and analytic deduction in the search for discursive themes and patterns. The analysis was done on the sentence level with the aims (a) to minimize author intervention and the risk of selectiveness, (b) to enable participants to tell their stories, and (c) to transfer openness and transparency to the reader.

Chosen data fragments were partitioned into word maps, also called rhetorical landscapes (Butteriss et al., 2001) or environets (Myerson & Rydin, 1996), to identify emerging themes and to create more manageable data categories. Data partitioning provided the basis for further questioning and analysis and allowed for a parenthetical presentation of the interview data. We then complemented and compared case study data with information from relevant RFA-related literature and media content.

The discussion below is a digest and offers a selection of themes pertaining to the science of the RFA. The different perspectives going into the RFA are presented in the form of a coherent meta-narrative, a synthesis of individual accounts of this policy process. Due to confidentiality constraints, however, individual RFA stakeholders cannot be identified, and only broad indications are provided of the respondents' backgrounds and organizational affiliations.

Scientific Dogmatism in Forest Management

Forestry in Australia is defined as embracing the science, art, and practice of creating, managing, using, and conserving forests and associated resources to meet social goals, needs, and values (Institute of Foresters of Australia, 2002). This definition indicates that forestry is anthropocentric in orientation, meant to maintain perpetual

human forest uses. Forestry is, at the same time, an applied natural science that invests confidence in the scientific management of forests. It is positivistic in nature with a strong adherence to quantifiable evidence. However, the profession's anthropocentric and positivistic character increasingly has come under attack

Over the last thirty years, conservationists and members of the non-government scientific community have raised doubts about the management of native forests in Western Australia by the State's Forest Department. Arguably, the forest debate intensified markedly in 1985, following the formation of the Department of Conservation and Land Management (CALM). Perceptions of a conflict of interest over its responsibility for both forest production and conservation made CALM's role in forest management controversial. Calls for more conservative management of public forestland came mostly from the environmental lobby, which saw forest management practices and the rate of timber extraction as unsustainable (e.g., Cameron & Penna, 1988; Conservation Council of WA, 1990). As forestry was perceived as serving primarily extractive forest uses, forest management became a symbol of commercial forest exploitation (Routley & Routley, 1975; Dargavel, 1995).

Both the Australian timber industry and professional foresters rejected these criticisms, arguing that forests were indeed being managed sustainably (Australian Conservation Foundation, 1987; Watson, 1990; National Association of Forest Industries, 2002). Conservationists' calls for more precautionary forest management regimes were largely viewed as emotive romanticism and countered with repeated demands for a more rational debate to overcome what were seen as ideological approaches to forestry (e.g., Spriggins, 1998; Tombaugh, 2000). Essentially, the forestry profession took the stance that the forest debate should be left to those who have the facts and the answers about how forests ought to be managed (Institute of Foresters of Australia, 2002). This attitude is also observable internationally (see Society of American Foresters, 2002).¹

Foresters are wrong, however, to suggest that conservationist claims are devoid of scientific basis. The green movement has had longstanding ties with the scientific community, a relationship that Yearley (1992) considers to be doubly bound "by epistemological affinity and common descent." This suggests that grassroots movements, too, rely on the authority of science to legitimate their claims and to exert legal-rational authority in the political arena (Yearley, 1991, 1992). In other words, there is more to the demands for precaution in forestry than what some observers regard as utopianism.

In Western Australia, the philosophical differences between CALM and the conservation movement became more entrenched over the years, intensifying further during the 1990s over aspects of forest management, but also over allegations of departmental corruption and scientific censorship (see Lowe, 1993; Schultz, 1993; Schoombee, 1998; Churches, 2000).

¹ Some observers have begun to recognize a discernible change in the identity of the Australian forestry profession in response to community pressure and changing public attitudes (see Kentish & Fawns, 1995).

Concomitant to the widening rift between conservationists and foresters was a growing division within the scientific community, leading to what Paehlke (1989) has described as the emergence of an environmental counter-science. The schism within the scientific community involved CALM staff and independent scientists from research institutes and universities in Western Australia. CALM scientists defended their silviculture management prescriptions that allowed a high level of commercial timber extraction, while critics challenged longstanding beliefs about forest use and management.

A number of Western Australian scientists expressed concerns about forest management in light of what they perceived to be insufficient knowledge of complex forest ecosystem functions (e.g., Wardell-Johnson et al., 1989; Wardell-Johnson & Nichols, 1991; Calver et al., 1996, 1998; Horwitz & Calver, 1998).² A common critique centered on the lack of good data on forest management issues and the resultant inability of CALM to assess confidently the impacts of forestry in Western Australia. Moreover, critics deemed CALM's forest research agenda as too narrowly focused on commercial tree species, suggesting that the department paid insufficient attention to broader conservation perspectives. Critics also held that CALM's interpretations were too optimistic and overly supportive of the forestry status quo concerning the large-scale management of highly diverse, complex, and vulnerable forest ecosystems. Against this background, non-CALM scientists called for further applied research and the establishment of guidelines for the consistent and codified operationalization of the precautionary principle within forestry, as well as greater openness between Australia's forestry departments and the wider scientific community.

The staff of CALM's Science and Information Division responded aggressively to this criticism and attacked what they viewed to be "emotive and unscientific approaches" to forestry (Abbott & Christensen, 1994). CALM staff asserted strongly that current scientific knowledge is "most complete" (Abbott & Christensen, 1996) and thus adequate for forest management. They claimed that no scientific argument effectively challenged the Department's practices, which were proven sound by the "unalterable fact that Western Australia's forests are one of the very few major ecosystems in Australia still retaining almost all of the original pre-European species and ecological processes intact" (Abbott & Christensen, 1994). Overall, suggestions contrary to CALM's official stance were seen as ideological, and scientific counterarguments were labeled as the work of prejudiced, anti-logging greenies based on subjective relativism and extreme biocentrism (Abbott & Christensen, 1994, 1996, 1999).³

Non-CALM scientists, therefore, held a palpable sense of unease concerning the optimism conveyed by their

government counterparts prior to the Western Australian RFA process. CALM's categorical dismissal of dissenting views within the wider scientific community added to the concern. As these scientific preludes were bound to have an impact on the science of the RFA process, the analysis below focuses on a range of aspects of the debate that illustrate the connections between administrative structures and institutions and the resultant divisions within forest science in Western Australia. Some of these elements relate to issues within the RFA process, while others are examples of substantive philosophical differences between departmental and non-departmental science.

Science and the Western Australian RFA

The Western Australian RFA process was coordinated by a Steering Committee comprised of government officials from the Commonwealth and the State and their respective departments and agencies, with CALM being the principal negotiator on behalf of Western Australia. The Steering Committee was entrusted with the scoping and commissioning of the scientific studies conducted for the Comprehensive Regional Assessment. In this context, CALM was also the key provider of research expertise and scientific data. This agency centrality, as is shown below, raised suspicion among conservationists and non-CALM scientists as to the RFA's independence and degree of politicization. In particular, there were concerns with respect to the scoping and timing of CRA reports and the quality and treatment of scientific research data.

Comprehensive Regional Assessment Reports

The government officials that headed up the CRA work in Western Australia intended to deliver the scientific basis on which the Commonwealth and the State governments could reach an RFA. Many of the constituent reports underlying this process were unique in that they represented the first attempt by the State to bring together the existing body of knowledge about forest ecosystems. The results were then assembled into a complete CRA document designed to aid public consultation and negotiations over forest use options (Commonwealth of Australia and Government of Western Australia, 1998a). Non-CALM scientists, however, criticized the assessment on the grounds of time committed, data quality, and independence.

Common to many of the CRA studies were comments by scientists about the timelines for individual research reports (including data collection and analysis) that on average were designed to last for only a period of six weeks. Critics considered this an "extremely brief contract time-frame" (Lamont et al., 1997), with substantially limited capacity to critically reflect upon, and digest, often complex data (Majer & Heterick, 1997). Non-CALM scientists felt that "not enough time was given" and that overall the time available to complete the reports was "utterly inadequate." It was widely held that additional time would have enhanced the quality of the CRA studies.

Many non-CALM scientists believed that this fast-paced schedule rushed the process and made it difficult "to ... have a good look ... [at] what needed to be done" and in turn made it "[im]possible to do anything new or ...

² The papers by Wardell-Johnson et al. (1989) and Wardell-Johnson and Nichols (1991) involved CALM scientist.

³ Similar debates relating to issues such as fire management, species conservation, and ecosystem heterogeneity still continue today (e.g. Wardell-Johnson & Horwitz, 1996, 2000; Abbott, 1998; Abbott & Burrows, 1998; Wardell-Johnson et al., 2004).

to do things properly.” This last concern was raised in relation to the scoping of the reports that, together with the establishment of timeframes for the CRA studies, was “something the Steering Committee ran.” In this regard, scientists queried “whether . . . [the] short-term desktop review[s],” upon which many of the studies were based, were “adequate for the topic[s]” being researched. In short, the non-government scientific community had questions about the adequacy of the data that underpinned the CRA. In the words of one respondent, “the data sets that were available are totally inappropriate really for the modeling process.” To several dissenting scientists, the scoping of projects, which effectively prevented additional data collection, was deliberate and based on the attitude that, “We don’t want a particular sort of information, we don’t want good data sets on this, we don’t want to know.” It was alleged that, “there was a guiding fear that if there are good quality data and they are in the public domain then the nature of the debate would change enormously.”

Non-CALM scientists involved in CRA research also took issue with the review of the scientific data, the treatment of research results, and their publication. In relation to peer review, many scientists involved in the CRA projects suggested “that there ha[d] been an inadequate review process.” It was held that “all . . . reports went through some sort of haphazard review, an unclear process of incorporating the material found within them.” Both researchers and reviewers expressed similar reservations. Research scientists suggested that the peer review was “a higgledy-piggledy mess in terms of . . . how [the] reports were going to be dealt with, how they were going to be reviewed, how they were going to be assessed and handled.” One reviewer felt that the submitted reports had been compiled too hastily and that work submitted for “review was clearly incomplete.” There was a sense that the “process itself seemed to leave too little time for the actual preparation of the reports and then for the proper assessment of those reports once they were submitted.”

Another issue of concern was data handling and data publication. Scientists expressed misgivings about how their “reports were dealt with and how they were incorporated into the process.” Respondents feared that “the people who were actually in control were not scientists” and “had no knowledge.” It was felt that bureaucrats “took facts, or what they thought were facts and figures, out of the report[s],” which on occasion meant that certain “recommendations that were in . . . [the original] reports were not included” in the final CRA document. A number of CRA studies appeared to be highly selective (e.g., Lamont et al., 1997; Majer & Heterick, 1997). Horwitz & Calver (1998) also observed that many of the scientific debates on aspects of forest management were ignored. As many of the concerns raised in the constituent reports were not included in the final CRA document, many scientists felt that “the coverage [of different viewpoints] was inadequate” as “certain scientific views that have been expressed about the ecology of the south-west forests . . . did not find their way into any of the RFA documentation.” Overall, the “process . . . was [perceived as] limited and controlled.”

Finally, many RFA stakeholders complained that a number of reports did not reach the public sphere until

close to the end of the formal review period, if at all. One respondent told me that “the working papers that were generated . . . some of those key reports were either never written or they were written very late.” As such, not all CRA reports informed the public consultation period in a meaningful way and some reports were unavailable altogether during the consultation process (e.g. Joint Commonwealth and Western Australian Regional Forest Agreement Steering Committee, 1998). Among members of the scientific community, the mired publication process was considered a fundamental weakness of the RFA. They believed that “the public needed to know what the processes were, why those reports were commissioned, what was important about each of the reports; in other words, the rationale for each report, and the public needed to have time to review and adequately assess all of these reports to enable the logic trail, the reason trail, and the paper trail to be followed from the commencement of the RFA process to the final decision.”

Directing attention away from the procedural aspects of the science component of the RFA, the section below focuses on a range of specific issues regarding forest management that were subject to scientific contention. The data will shed light on the philosophical positions within the forest debate and thus give a better understanding of the degree of polarization among the various protagonists.

Philosophical Differences on Forest Management and Conservation

Old growth forest logging was the single most contentious issue during the Western Australian RFA process.⁴ The debate focused chiefly on the two dominant commercially exploited tree species in Western Australia, namely karri (*Eucalyptus diversicolor*) and jarrah (*Eucalyptus marginata*). Nationally, the significance of old growth forest was recognized for its “high aesthetic” and “cultural” values, but also for its “nature conservation values” (Commonwealth of Australia, 1992). CALM, however, was said to have held “an explicitly stated philosophical view that old growth forest was an anthropogenic construct.” One respondent noted, “CALM fundamentally did not believe in a special value pertaining to old growth.” Indeed, CALM staff confirmed, “there is nothing particular about [Western Australian] old growth forests which is absolutely indispensable for biodiversity conservation.” Unsurprisingly, there were “a lot of arguments over the basis for the determining of negligible disturbance” between CALM and Commonwealth government negotiators who sought to determine the areas of jarrah old growth to be set aside for reservation purposes. For jarrah, “disturbance was used as a surrogate for old growth,” but this definition “left open the meaning of negligible disturbance.” Disturbance was largely seen in connection with human activities such as logging and mining, but also with the occurrence of disease (primarily *Phytophthora cinnamomi*). In this context, Commonwealth

⁴ According to the nationally accepted definition, old growth forest is “forest that is ecologically mature and has been subjected to negligible unnatural disturbance such as logging, roading and clearing. The definition focuses on forest in which the upper stratum or overstorey is in the late-mature to overmature growth phases” (Commonwealth of Australia, 1992).

officials suggested that CALM appeared to have “used phytophthora mapping strategically to determine the areas that were not old growth” so as to minimize the amount of forest that could be classified as old growth. In the end, a total of 24,300 ha of old growth were excluded on the basis of disease (WA Parliamentary Debates-Hansard, 1999). This decision was seen to have come about because of CALM’s stance on old growth forest.

Similar problems with CALM were encountered in connection with the accreditation of linear/informal reserves to be included in the protected forest management area. The National Forest Policy Statement made it clear that the use of “linear reserves should be avoided where possible except for riverine systems and corridors identified as having significant value for nature conservation” (Commonwealth of Australia, 1992). RFA scientists also suggested that “there is a very large body of literature available which all indicates that in terms of secure reservation systems linear reserves are not much good.” This is why the inclusion of informal/linear reserves was intended to be a last resort where formal reservation was not achievable. Yet, “[CALM] wanted to accredit a large contribution from those linear informal reserves” because—as conservationists argued—“there [was] no logging potential” (see also Conservation Council of WA et al., 1999). The RFA, as signed in May 1999, delivered a forest reserve system of approximately 1.5 million ha that included 12,898 ha of informal reserves on Crown Land and 137,886 ha of informal reserves in State Forest (State of Western Australia and the Commonwealth of Australia, 1999). The inclusion of “road, river, and stream reserves,” that were widely perceived to have “no real genuine environmental value,” struck many RFA stakeholders as an attempt to effectively minimize the extent of new conservation reserves. Especially, this view was hardened as “[t]he RFA . . . [did] not recognize the Valley of the Giants” (a well known tourist destination in the south-west of Western Australia) “as old growth but [recognized as old growth] the scrub on the side of the highway south of it.”

As a final point, the allowable cut for jarrah and karri has been the subject of heated debate in the state for many years, including during the RFA process (for a historical overview refer to Calver & Wardell-Johnson, 2004). In the early 1990s, acrimony arose in response to what some opponents described as an “aggressive philosophy to timber harvest within some high-level administrators of CALM” (McComb, 1994). Earlier timber availability forecasts predicted a long-term decline in the saw log yield for jarrah (see Forests Department, 1982; Department of Conservation and Land Management, 1987). In 1992, however, CALM proposed to amend past resource availability assessments with a temporary increase in the cut followed by a stabilization in the saw log yield (Department of Conservation and Land Management, 1992). “[I]n the jarrah forest ... they were proposing a massive increase in the rate of logging and a major change in the style of logging where they go from selective logging to almost clearfelling.” Critics (conservationists and non-CALM scientists) viewed the proposals as a “prescription to raze the forests.” Although the Environmental Protection Agency (1992) rejected CALM’s initial proposal, “logging was maintained at its 1983 level rather than being scaled

back as had originally been intended in the previous Forest Management Plan.” In other words, “an accelerated rate of logging in the . . . forests” prior to the commencement of the RFA process caused considerable public agitation. During the RFA process, the cut levels proposed for jarrah and karri as part of the forest use/management options presented for public discussion were all above known sustainable levels. This proposition gave rise to the community perception that the Public Consultation Paper “seemed to exclusively look at the needs of the timber industry” (Commonwealth of Australia and Government of Western Australia, 1998b).

Despite public demands for a reduction in cut, the finalized RFA document, as signed by the State and the Commonwealth, endorsed a level that produced a consistent and stable yield of saw logs, with the admission that this volume was left above sustainable levels until the expiration of the then-current Forest Management Plan (Commonwealth of Australia and Government of Western Australia, 1999). The fact that the “allowable cut [was] in excess of what” was considered sustainable made it difficult for the Western Australian government, however, to convince most people that “the RFA [was] giving” them ecological sustainable forest management. Despite scientific support for the reduction of logging levels, the decision to decrease the cut was postponed until 2004 to protect contracts and employment in the timber industry. The controversy surrounding sustained logging levels and the reserve design fueled an already tense forest debate, one aggravated further by the state government’s refusal to protect all remaining old growth forests under the RFA. The combination of factors ensured that the controversy intensified after the signing of the RFA, and this ultimately led to its amendment eight weeks later.

The interview responses presented above give the impression that the science of the RFA was tamed, meaning that dissent was ignored or vehemently rebutted, and that science overall was made compliant with a dominant scientific/political viewpoint. This imposition of CALM’s scientific stance instilled the feeling in RFA stakeholders that “science was used as a weapon.” According to a non-CALM scientist, a façade was constructed that “the process would be using science to provide [Western Australians] with . . . answers, and that was publicly acceptable, whereas in reality, the guidance, the levels of forest reservation and so on, were coming from elsewhere, and it was not coming from science.” This blurring of science and politics led stakeholders to believe that the “RFA process ha[d] not been about science,” and that “overall that the scientific arguments were rather unimportant.” Indeed, many stakeholders felt that the “scientific outcomes [of the CRA work] were not necessarily reflected in the outcomes of the RFA” and that the “nexus between what the science has found out and what actually happened was not particularly strong.”

This case study leads to the suggestion that CALM was defending more, or perhaps something other, than just a scientific argument. Members of Western Australia’s scientific community interpreted CALM’s position as being symptomatic of a profession/administration “in denial.” The issue of denial was raised because some stakeholders believed that there

was “no way in the world that they [CALM officials] would accept (a) that they have done things wrong in the past, that they have been over-exploiting the forest ecosystems for years, and (b) they can’t seem to come to terms with the idea that community attitudes and values have changed and therefore there are different expectations placed on the forest in the way it is to be used.” The term “denial” may also explain why CALM seemingly did “not want to know” about dissenting views, because it would have meant that “they might have [had] to change [their] current procedures” even though they “have been arguing that [they] do know and what [they] are doing is right.” Some interviewees saw this sort of closed-shop behavior to be “endemic in a lot of those sorts of professions.” In Australia, according to one respondent, forestry departments are staffed with graduates from “two universities,” who generally are “all buddies.”

Closed-shop professions, like any other tight-knit organization, are at risk of cultural cloning, breeding practitioners with systemic blind spots and myopias toward change around them (Emery & Trist, 1965; Emery, 1997). As a consequence, confrontation and fervent defense of culturally entrenched views can become the norm. Also, perceptions of crisis are rejected and ridiculed, and faults or errors of judgments are not admitted. This is akin to what Torgerson (2001) refers to as the limitations of the administrative mind. Administrations are also prone to strongly reject criticism, for they fear that any admission of errors or flaws would bring into question the *raison d’être* of the entire administrative complex. Thus, in the case of CALM, we can view the issue of denial as two-tiered. CALM exhibited features of a closed-shop mentality towards forestry and public relations during the 1990s and the RFA process, with its staff maintaining that “there is not really a problem” and that all that needs to be done is “to tweak the dials” and “to change the formula slightly.” This professional stance also received administrative backing from, or indeed may have been driven by, the administration. As a result, the scientific disagreements with the Western Australia RFA (and earlier quarrels) need to be seen in connection with a profession and an administration in denial, with its practitioners and managers responding systematically and apprehensively to challenges to their professional pride, identities, and egos.

Discussion: Lessons from the Science of the Western Australian RFA

The case of the Western Australian RFA can aptly be couched within broader debates about the appropriate use of scientific expertise on matters such as the sustainable management of natural assets. Complexities arising out of ecological, social, and economic collisions render controversies such as these messy, trans-scientific affairs. In this context, social science studies agree that effective conflict management requires holistic approaches that seek to address socio-econo-ecological complexities via trans-disciplinary integration (Kates et al., 2000; Lowe, 2001). Indeed, the socialization of science, or the integration of traditionally perceived trans-scientific issues into science, is more likely to enrich science and to make it more relevant and robust than it is to render science

obsolete, as some traditionalists fear. Yet, as the above data attest, these concerns are alive and well.

Fear and denial, combined with the economic and political ramifications of a new forest politic, resulted in a RFA process characterized by scientific exclusion and a sense of closure. CALM scientists made rigid distinctions between valid and invalid modes of understanding forest ecology. Reductionist departmental knowledge was elevated to the status of an accepted, scientifically-informed view. In contrast, alternative understandings outside the agency were seen as inferior. This division between acceptable and unacceptable modes of knowing within the RFA debate can be illustrated by what is known as the Möbius strip or topology (adopted from Booth, 2000). The strip, as shown in Figure 1, symbolizes the field of human knowledge that expands as the ribbon is stretched. Following this analogy, the outer side of the ribbon represents accepted modes of knowing (e.g., CALM science) distinct from the inner side of the ribbon that represents alternative modes of knowing (e.g., non-CALM science). Both sides are, and remain, separated by the outer edges of the ribbon, even if the ribbon’s ends (AC and BD) are joined together.

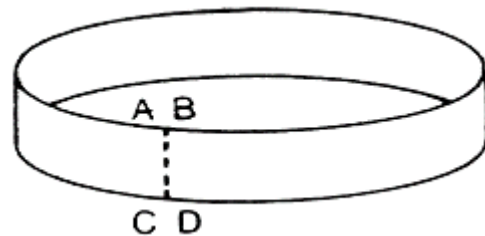


Figure 1. The Separation of Modes of Knowing
Source: Adapted from Booth (2000)

The RFA offered an opportunity for an open and exploratory debate on forestry based on a holistic and synthetic understanding of forest ecology. Metaphorically, there was a chance to make connections between the two sides of the ribbon, bringing together a plurality of perspectives of forestry as described by the scenario depicted in Figure 2. In this illustration, the ends (AC and DB) of the ribbon are connected with a twist, creating a singular surface, which brings together the inside and the outside. The duality between accepted and unaccepted modes of knowing is demolished, for they are now one. The dichotomies of objectivity and subjectivity, experts and non-experts, hard and soft science, become intertwined, rendering departmental reductionism only one of many modes of understanding the forest along a spectrum of different modes of knowing. Treating each of these different modes as valid enables a synthesis of knowledge and understanding, enhancing contextual sensitivity and thus improving adaptive capacity.

The RFA was intended to deliver an integration of knowledge, drawing from the best expertise available. In other words, this process could have made the connections between the different modes of knowing relevant to forest use and management. Yet, as occurred in the years prior to the RFA, this integration was restricted due to the domination of a single approach to forestry. As the

entrenched hierarchy of knowledge was maintained during the RFA process, only a scientifically incomplete endorsement of the status quo could be attained. Instead of breaking down barriers within the scientific community, the RFA seemed to have hardened them. This also meant that the boundaries between science and politics could not be discerned and led to the discrediting of the science of the RFA. As one conservationist poignantly remarked, “there are not too many scientists who will say ‘best science.’ They will say ‘RFA science’ very disparagingly.”

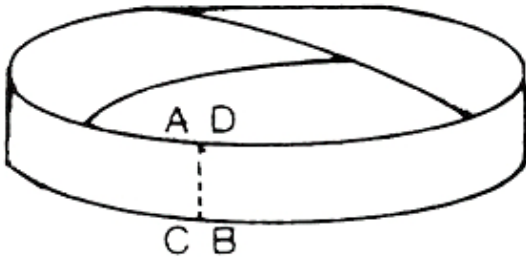


Figure 2. Connecting Different Modes of Knowing
Source: Adapted from Booth (2000)

Science is always at risk of being a mere reflection of social structures and dominant constructions of order and reality. This, in turn, jeopardizes its future relevance and trustworthiness in policy processes that are increasingly dependent on a mode of scientific practice that thinks outside rational squares. A new or more robust science, often called holistic, would therefore face a reduced risk of cooptation and corruption, as it would prevent the overly narrow political framing of complex policy issues. Realization of such an objective means the active involvement of an aware science in the political process.

The notion of an open science demands a widening of understanding and of the recognized expert realm. This could be understood as a broadening of Haas' (1992) “epistemic communities” or Funtowicz & Ravetz's (1991) “extended peer communities” to what might be seen as knowledge networks. Science's instrumental role in policy processes is that of reducing uncertainty. If science is to do so effectively, then uncertainty's underlying complexity ought to be matched with humanity's complete arsenal of tools of understanding the world. While “the path to action lies clearly in the best understanding of nature available” (Killingsworth & Palmer, 1992), incomplete approaches to seeing the world are unlikely to deliver such a comprehensive view. They are instead more likely to politicize science, as remaining uncertainty becomes a source of political power (Handmer et al., 2001). Therefore, the counterproductive barriers that exist among the sciences, as well as among scientists and non-scientists, need to be overcome. Single perspectives (modes of knowing) are inevitably segmented and incomplete, enabling only a limited understanding of the reality of the systems to which they are applied. In contrast, fused modes of knowing, or multiple perspectives, can lead to a broader, more complete understanding of a system's reality. These enriched perspectives can jointly form a more complete picture of reality, one that reduces uncertainty and the likelihood of unintentional consequences (see Cavaleri &

Obloj, 1993). This ought to be a priority, especially in the context of our growing understanding of risk, precaution, and irreversibility.

The notion of knowledge networks also recognizes the possible value of contributions by non-experts to our understanding of nature based on local knowledge and venerable experience. The insights of such individuals have been shown to add value to the work done by so-called experts (Holman & Dutton, 1978; Krinsky, 1984; Funtowicz & Ravetz, 1991; Renn, 1992; Laird, 1993; Bailey et al., 1999). As noted by Funtowicz & Ravetz (1991), “knowledge of local conditions may not merely shape the policy problems, it can also determine which data are strong and relevant.” This is not to suggest that lay-knowledge is necessarily scientific, but that it is another valid source of knowledge worthy of consideration. This is why the existence and validity of answers produced outside the traditionally recognized expert realm should not be denied or dismissed. Instead, their value and possible contribution to a given problem need to be acknowledged and considered.

Critical in this regard are questions as to when and how non-experts should, or may need to, become involved. Important also, echoing Yearley's (2000) concerns, is how the insights of non-experts, or “extended facts” (after Funtowicz & Ravetz, 1991), are to be treated, how their value can be determined, and how new or different knowledge should be incorporated into processes of political decision-making. In this context, Kleining & Witt (2001) propose a departure from the deductive-nomological, scientific protocol and advocate a path of ‘discovering’ data congruency (refer also to Wardell-Johnson et al., 2004). They suggest that, in the face of complexity and plural perspectives, the narrow scientific approach of deduction fails to deliver coherent prescriptions in science and much-needed input into political decision-making processes. In contrast, the discovery or exploration of common patterns among different perspectives, coupled with a requisite preparedness to change acculturated assumptions about the world, can lead to novel modes of understanding natural phenomena and thus aid the development of new, policy-relevant insights. This is what Anderson et al. (1998) describe as the expansion of the range of possibilities for viewing and managing the natural world, pointing toward the existence of numerous, if not infinite, scenarios. Many techniques exist for the political operationalization of pluralism, focusing, for instance, on transactive planning, collaborative learning, and various other forms of coordinated social action (for reviews of selected approaches refer to Babin & Bertrand, 1998; Ramírez, 1998; Vira et al., 1998). While these approaches offer potential solutions to different conflict situations, their effectiveness remains contingent on a genuine willingness of decision-makers to allow for an opening of perspective and the possibility for change. Such openings, in the case of the Western Australian RFA, were effectively prevented by systemic constraints on the scientific-cum-political alliances responsible for the RFA process.

The science of the RFA was necessarily limited by the imposed format under which it was conducted and by differential attention to scientific information depending

on its acceptability to RFA management. Overall, RFA science was characterized by the exclusion and marginalization of views dissenting from the narrow scientific and administrative perspectives of forest management. While it must be recognized that Western Australian forest science itself faced problems because of its lack of ontological and epistemological openness, the interconnections between forest science and rigid political and bureaucratic apparatuses compounded this situation. Unsurprisingly, the institutionalized access of science to politics and vice versa meant that enduring calls for a widening of perspective (e.g., more precautionary approaches of forest management) have reverberated largely unheard.

Systems such as these do not facilitate learning and change. Key actors generally resist the modification of existing attitudes and behaviors, and instead seek to control information, usually by resorting to highly constrained discourses and problem definitions that only serve the prevailing political system. The final outcomes are often what Walker (2001) describes as “garbage-can policies.” These bureaucratically-mediated ad hoc initiatives are threatened by the re-emergence and worsening of previously “solved” political problems, rapid changes in political direction, and external shocks. In this sense, more recognition needs to be given to the political nature of closed spheres of knowledge and the extent to which they add to the constrainedness of political processes.

Concluding Comments

This paper asserts that a great deal of work is required to make explicit the need to open up “closed bodies of knowledge” (Wynne, 1995). Despite progress in theoretical debates, more traditional scientists and policymakers maintain that such suggestions are direct attacks on scientific authority and robustness. In other words, variety and pluralism are still treated as impediments to the credibility of science, although they should be seen as lifelines that ensure its future relevance and trustworthiness.

The analysis presented here also points to systemic barriers affecting both science and environmental policymaking. In the case of the Western Australian RFA, these constraints, which resulted from scientifically sanctioned political and economic entanglements, were found to have limited the exploratory potential of the RFA process. The closed quality of this process draws attention to the positional weakness of any pluralistic model, especially as it relates to the relinquishment and sharing of power. To overcome these obstacles to the mobilization of multiple perspectives in science and policy, future research and praxis may therefore need to focus on identifying and making explicit the pervasive constraints that characterize natural resource conflicts.

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