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Perspective

Cross-cultural Conflicts in Fire Management in Northern Australia: Not so Black and White

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ABSTRACT

European ("scientific") and Aboriginal ("experiential") perspectives on fire management in northern Australia are often contrasted with each other. For Europeans, management is portrayed as a science-based, strategically directed and goal-oriented exercise aimed at achieving specific ecological outcomes. In contrast, landscape burning by Aboriginal people is more of an emergent property, diffusely arising from many uses of fire that serve social, cultural, and spiritual, as well as ecological, needs. Aboriginal knowledge is acquired through tradition and personal experience, rather than through the scientific paradigm of hypothesis testing. Here I argue that, in practice, science plays only a marginal role in European fire management in northern Australia. European

managers often lack clearly defined goals in terms of land management outcomes, and rarely monitor the ecological effects of their management actions. Management is based primarily on tradition, intuition, and personal experience rather than on scientific knowledge, and there is often a reluctance to accept new information, particularly when it is provided by "outsiders." In these ways, the processes by which European land managers acquire and utilize information are actually similar to those of indigenous Australians, and can be considered characteristic of a management culture. In this context, the conventional European vs. Aboriginal contrast might be more accurately described as a conflict between scientists on one hand and land managers in general, both black and white, on the other. That is not to say that science has all the answers and that researchers always deliver useful research outcomes. Cultural tensions between Australia's colonists and its original inhabitants rank highly on the national agenda, particularly in relation to land access and ownership. For the effective management of such land, another difficult but rewarding challenge lies in reconciling tensions between the cultures of science and management, black and white.

KEY WORDS: Aboriginal burning, adaptive management, Australia, cross-cultural conflict, fire ecology, land management, management culture, performance indicators, science culture, strategic goals, traditional fire ecology and management.

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INTRODUCTION

Fire is a dominant land management issue in the tropical savanna environment of northern Australia, with up to half or more of regional landscapes being burned during the dry season (May-October) each year (Press 1988, Andersen 1996, Russell-Smith et al. 1997). Most of the fires are lit by people: by people of (colonial) European origin who wish to protect life, property, pastoral resources, and their concept of a "natural" environment, and by (indigenous) Aboriginal people wishing to maintain traditional practices. Aboriginal people have led a nomadic existence in northern Australia for up to 50,000 years, extensively burning the landscape each year during this time (D. B. Rose 1995). The Aboriginal population of northern Australia has declined markedly since European settlement early this century, and is now concentrated in permanent settlements (Keen 1980). However, much of northern Australia is Aboriginal land (for example, about half of the entire Northern Territory; Pearce et al. 1996), and fire management continues to play an extremely important role in Aboriginal culture.

This paper is about cross-cultural issues relating to the acquisition and use of knowledge relating to fire management in northern Australia. Much has been said and written about contrasts between European and Aboriginal relationships to land and the environment in Australia (Jones 1980, Redford 1991, Braithwaite 1992, Rose 1996), and fire management is often used to highlight these differences (Jones 1969, Stevenson 1985, Lewis 1989, Head 1994, D. B. Rose 1995). Similar cross-cultural tensions over land management occur in African savannas (Fairhead and Leach 1996), and Aboriginal fire management has many similarities with that of indigenous North Americans (Lewis and Ferguson 1988). My experience with different fire management cultures is as an ecologist with 10 years of involvement in a large fire experiment at Kaplaga in Kakadu National Park. One of our fire treatments was designed to simulate traditional Aboriginal burning patterns, and the others represented a range of European management practices (Andersen et al. 1998). Kakadu National Park is managed by a Board with majority Aboriginal representation, and our experiment was overseen by a management committee that included the two senior traditional custodians of the region, as well as the district's Park rangers. Three members of our research team, including the manager of our research station, were Aboriginal. I have discussed fire management with land managers, both black and white, from throughout northern Australia, in numerous forums.

In Table 1, I have summarized conventional contrasts between European and Aboriginal systems of fire management. European fire management is viewed as a task-oriented activity, usually driven by a particular "problem" that needs to be "solved," with management goals relating directly to specific outcomes such as protection of life and property, or biodiversity conservation. By contrast, Aboriginal fire management is an emergent property arising from diffuse social, cultural, spiritual, and ecological activities. The desired ecological outcomes of traditional burning are often difficult to define, at least for Europeans. One of the best documented accounts of traditional burning practices is that of Haynes (1983) in the Maningrida area of north-central Arnhem Land. He notes that some fires are lit purely for utilitarian purposes, relating to protection of desired resources,

hunting, ease of walking, and signaling. However, the dominant reason for burning was described as a desire to "clean up the country," and an informant is quoted: "We simply have to use fire like this to control our space" (Haynes 1983: 210). Similarly, the Yanyuwa people of the southwestern Gulf Country describe burning as an important way of demonstrating continuity with their ancestors, and express a fear of becoming "weak" if their country is not burned in a particular way (Bradley 1995). In other words, fire management often is not directly motivated by an obvious ecological "problem" that needs to be "solved." This distinction between European and Aboriginal land management has been summed-up by Tilmouth (1994), who describes the European philosophy as one of land belonging to people (and therefore people having command of it; Holling and Meffe 1996), contrasting with the Aboriginal perspective of people belonging to the land and being part of it (see also Pearce et al. 1996).

Table 1. Conventional contrasts between European and Aboriginal perspectives on fire management in northern Australia.

Fire management issues	European	Aboriginal
Objectives (desired ecological outcomes)	clear, well defined	often unclear, not well defined
Knowledge acquisition	scientific enquiry	tradition, beliefs, and personal experience
Knowledge dynamics	challenge old, create new	preserve old, resist new
Biodiversity	central concern	meaningless abstraction

In European management, the knowledge base is continually developed through the scientific method, which aims to create new knowledge, often by challenging old knowledge, through the paradigm of hypothesis testing. The creation and sharing of information is a global activity, such that much knowledge is imported from "outside" experiences. Western science and Aboriginal culture represent contrasting systems of knowledge (Pearce et al. 1996), with knowledge being acquired by Aboriginal people almost exclusively through tradition and direct personal experience. Traditional explanations of major biophysical phenomena are based on "dreamtime" mythology (comparable to the Genesis mythology of Christianity), rather than on natural biophysical processes. Aboriginal people place great emphasis on protecting their knowledge, which is a major source of status for tribal elders, and there is considerable resistance to the acceptance of new knowledge from outside sources that are not seen to have comparable experience (Pearce et al. 1996).

Finally, in European land management, biodiversity is often a central concern, even on production lands. However, the western concept of biodiversity conservation is not understood or accepted by Aboriginal people (B. Rose 1995). As an unfamiliar abstraction, the term "biodiversity" is not only meaningless, but also many of the contemporary concerns relating to it, such as much of invertebrate ecology and the whole field of genetics, lie outside traditional Aboriginal experience.

There can be no disputing the fundamental philosophical differences that exist between European and Aboriginal cultures in terms of people's relationship to land, and that such philosophical differences extend to fire management. Beyond this, however, I contend that the conventional contrast between European and Aboriginal

systems of fire management in northern Australia is really a false one. This is primarily because, in practice, European systems of fire management are not based on science. Rather, the processes adopted by European managers to acquire and utilize knowledge in relation to fire are similar to those traditionally used by indigenous Australians (although the management actions themselves are not necessarily similar). The real contrast is between the scientific culture of ecologists on one hand, and the experiential culture of managers, black *and* white, on the other.

INTEGRATING SCIENCE AND FIRE MANAGEMENT

Recently, a considerable body of literature has developed on the science of ecological land management (Christensen et al. 1996, Mangel et al. 1996, Dovers and Mobbs 1997). Current best practice centers on the maintenance of whole ecosystems, adopting the principles of "adaptive management" (Holling 1978). Adaptive management is a highly structured, strategic approach to minimizing the risks associated with ecosystem management, given the inevitable lack of complete ecological understanding. Management is not about applying absolute "truths," but about conducting "learning experiments" to improve understanding (ecological models) and thereby future management.

Adaptive management begins with the establishment of clear and unambiguous management objectives, and the formulation of performance indicators as benchmarks against which the effectiveness of management can be assessed. Careful consideration is given to the full range of management options, based on prevailing ecological models, and specific plans are developed for monitoring management effectiveness. Management tactics are continually refined according to feedback from previous management actions. Management and science are integrated through a focus on ecosystem dynamics (Holling 1993, Stanford and Poole 1996), with such a focus serving to clarify problems, enhance communication, eliminate poor options, and identify key knowledge gaps (Walters 1997).

What is the level of our understanding of fire ecology in northern Australia, upon which management actions are based? Although fire is widely used by land management agencies for conservation objectives right across northern Australia, surprisingly little is known about the ecological effects of different fire regimes (Duff and Braithwaite 1990, Andersen 1996). Much of our "knowledge" of the effects of fire is really little more than speculation based on vegetation patterns, or on the superficial appearance of burned country (Andersen and Braithwaite 1992). There are very few controlled studies of the ecological effects of any particular fire, let alone of the impacts of different fire regimes. In particular, we know very little about the long-term effects of different fire regimes on fundamental ecosystem processes, such as nutrient cycling and plant regeneration, or on faunal communities (Andersen et al. 1998). We do not know the relationship between ecological responses to a particular fire and the responses to a *regime* of fires of that type (Gill 1977), and we are unsure of the interactions between fire and other environmental factors, such as rainfall.

This scientific uncertainty provides an unwelcome backdrop to competing demands on savanna lands, ranging from the aspirations of Aboriginal landowners for traditional burning practices, to the constant dismay expressed by tourists over landscapes constantly charred by prescribed fires. In the face of close public scrutiny, it is difficult for fire managers to have to admit that they are not really sure what effects their fires are having on the ecosystems they are managing. According to the scientific paradigm, the information required to resolve this uncertainty is best obtained from controlled experiments (Walters 1997). Our experiment at Kapalga (Andersen et al. 1998) was designed to avoid the limitations characteristic of previous fire experiments around the world, such as unrealistically small plot size and a failure to measure a range of key ecological responses. Experimental units were 15-20 km^2 water catchments that were subject to one of four fire regimes over five years, with each regime replicated at least three times. Detailed measurements were taken of fire behavior, and a wide range of ecological responses was investigated, encompassing nutrients and atmospheric chemistry, the biology and water quality of temporary streams, vegetation dynamics, insects and other invertebrates, small mammals, and vertebrate predators.

FIRE MANAGEMENT WITHOUT SCIENCE

Adaptive management provides a model for coupling science and management, with management likened to an ongoing series of experiments. Given the substantial scientific uncertainty over ecological impacts of different fire regimes, the adaptive management paradigm is an especially appropriate framework for fire management in northern Australia. Despite the fact that most relevant agencies publish strategic plans outlining management objectives and outcomes, it is my experience that the principles of adaptive management are generally not followed in the fire management process (Andersen 1999).

Strategic objectives

Problems start with the setting of strategic objectives. Government agencies responsible for fire management must serve a variety of stakeholders, each with their own land use objectives. There will therefore be a range of land management objectives, and these will often compete with each other. Unless competing objectives are prioritized and made spatially explicit (e.g., protection of life and property is paramount in and around human settlement), then adaptive management has failed to be achieved at the first step, and confusion will then permeate throughout the entire management process (Holling and Meffe 1996). Moreover, applying "compromise" management actions aimed at serving several objectives simultaneously runs the risk of serving none of them effectively.

Most land management agencies in northern Australia are guilty of at least sometimes setting unprioritized, competing objectives. Even when two or more objectives appear to be harmonious, this may not stand close scrutiny. For example, Kakadu National Park has the "twin" objectives of promoting traditional burning practices and conserving biodiversity (Kakadu Board of Management and Australian Nature Conservation Agency 1996). The extent of harmony between these objectives depends on exactly what is meant by "conserving biodiversity" (see below). In the case of conflict, it is not made explicit which objective prevails and on what basis.

An effective objective needs to be more explicit than a vague motherhood statement (Hansen et al. 1993). For example, within the general concept of "biodiversity conservation" there are several quite different potential objectives (Braithwaite 1985). Are we talking about the maintenance of patterns of biodiversity that prevailed immediately prior to European settlement? Or are we aiming to recreate biodiversity patterns that occurred prior to any human occupation, i.e., the pre-Aboriginal environment? Alternatively, given that national parks are often refuges for various components of the fauna that have suffered severe contractions elsewhere in their ranges (Woinarski and Braithwaite 1990), perhaps it is more appropriate to *maximize* biodiversity in the national park system through management intervention, or to engineer landscapes especially suitable for rare and endangered species.

Ambiguity often also arises because of confusion between strategic objectives and operational goals. The latter relate to management tactics (actions) that serve strategic objectives. However, such actions are often presented as strategic objectives in themselves. For example, the primary "policy objective" of the Bushfires Council of the Northern Territory is presented as "to reduce the total area burnt by wildfire in the Northern Territory" (Bushfires Council N.T. 1993: 4). Objectives relating to fire control are valid in the context of protection of life and property (which is one of the responsibilities of the N.T. Bushfires Council), but in conservation areas, the control of fire itself is meaningless without being directed at a desired ecological outcome (i.e., the real objective). There is a real danger of operational "objectives" becoming self-serving, and losing sight of what they are ultimately aimed at. For example, I know of a situation in which a relatively new Park ranger followed up a burning operation early in the dry season by burning the patches that had been "missed." All that he had been told was that the management objective was to "burn early," and he was unaware that one of the reasons for this was that such fires left unburned patches as refuges for biodiversity!

Performance indicators and feedback through research and monitoring

As previously stated, most land management agencies publish strategic plans that outline management objectives and proposed actions. However, it is common for such plans to lack explicit performance indicators, and this is inevitably accompanied by a lack of monitoring programs. In other words, the effectiveness of management is never assessed.

When performance indicators *are* made explicit, they usually relate to operational goals (i.e., the implementation of actions) rather than to strategic objectives (i.e., achievement of desired ecological outcomes). For example, the Western Australian Department of Conservation and Land Management (1997) identifies two performance indicators in relation to fire management, one relating to prescribed burning (target reductions in fire fuels) and the other to fire suppression (target mobilizations of suppression forces). When this occurs, monitoring programs become fixated on the implementation of management prescriptions, rather than on the ecosystem under management and the effectiveness of management in meeting strategic objectives. Such management "pathology" short-circuits the entire adaptive management process and puts at risk the ecosystem being managed (Holling and Meffe 1996). Thus, even in conservation areas, where fire management should be all about the management of biodiversity (Braithwaite 1985), attention is usually focused on the management of fire itself (i.e., achievement of particular burning patterns). The true measure of success of conservation management is the state of biodiversity, which typically is not monitored at all.

A focus on management prescriptions rather than strategic objectives inevitably leads to a marginalization of research (Holling and Meffe 1996). In adaptive management, research plays a key role in improving ecological understanding and identifying alternative management options. If, however, current management prescriptions become viewed as objectives themselves, research such as the Kapalga fire experiment becomes largely irrelevant, as it is perfectly clear what is required for "successful" management. There is a danger that this has occurred with the widely held "objective" of early dry-season burning in northern Australia, as such burning practices occur largely in the absence of monitoring of their effects on biological diversity, or research on alternative management prescriptions.

ACQUISITION AND USE OF INFORMATION IN FIRE MANAGEMENT

The flow of information between researchers and land managers is notoriously ineffective, and the relationship between them is often an unhappy one (Andersen and McKaige 1998). Scientists are frequently guilty of inadequate consultation during the planning and implementation of research projects, and are often perceived as being reluctant collaborators, as setting their own research agendas, and as failing to produce research outcomes that are useful to end-users. On the other hand, managers are often viewed by scientists as being insular, narrowly focused, and reluctant to seek or accept research advice (Mattson 1996). From a researcher's perspective, I see the widespread failure to embrace adaptive management as contributing greatly to tensions between researchers and managers, including a lack of acceptance of research by many management staff.

If fire management in northern Australia has not embraced ecological science, then what system of information has it used to guide its actions? I perceive the following:

1) *Strategic objectives are ambiguous.* As previously mentioned, most land management agencies have stated objectives, but they are often ambiguous. Problems include a lack of prioritization of potentially competing objectives, inexplicit definition, and confusion with operational goals.

2) *Knowledge is acquired through tradition, beliefs, and personal experience.* The flow of information from the scientific community to land managers is generally poor, and the situation with fire management is no exception. The sources of information used by most fire managers in northern Australia are the same as those used by pastoralists, the other primary land managers in the region (Winter and Williams 1996): (i) tradition - information passed on from predecessors; (ii) beliefs - relying on "gut feeling" and "intuitive" understanding of the environment; and (iii) personal experience - based primarily on the visual appearance of the country under management.

3) *Old knowledge is preserved, new knowledge is resisted.* Land managers are often reluctant to change past practices and embrace new information. The "we do it this way because we have always done it this way" syndrome can be an extremely powerful one (Kaufman 1960, Kennedy 1988), and such pressures to conform are not conducive to good science (Glass 1965, Mattson 1996, Hutchings et al. 1997). My experience is that this applies to fire management in northern Australia, where there is considerable reluctance to seek new knowledge or to take on information that lies outside the accepted information channels of tradition, beliefs, and personal experience. Existing information is not actively questioned and there is little attempt to draw on the global

knowledge base. Researchers are often viewed with considerable suspicion, especially if they are from other institutions (Gunderson et al. 1995). In short, direct personal experience is much more highly valued than is scientific research.

4) *Biodiversity is misunderstood.* Although the concept of biodiversity is frequently expressed as a primary concern of land management, it is routinely misunderstood to refer to high-profile species (particularly birds and mammals on rare and endangered lists) that have always been the focus of popular conservation efforts (France and Rigg 1998). Biodiversity is actually about the multitude of species (mostly small, inconspicuous and little known), the genes within them, and the communities they form, that are responsible for the proper functioning of ecosystems (Wilson 1988). The term biodiversity is a salute to "the little things that run the world" (Wilson 1987), rather than further glorification of high-profile vertebrates.

CONCLUSION

Scientific research plays only a marginal role in European fire management in northern Australia. Much of this can be attributed to the contrasting cultures of science and management (Mattson 1996, Andersen and McKaige 1998), one theoretical and ideal, the other practical and checked by reality. In management, the cultural emphasis is on doing things, and day-to-day management activities are often so pressing that there seems little opportunity for strategic planning. That is not to say that scientists have all the answers for resolving land management issues (Endter-Wada et al. 1998, Policansky 1998). Nor is it true that scientists have all the technical solutions and always adhere to the scientific method themselves; indeed, it is clearly not the case. For example, there is no agreement among ecologists on how "biodiversity" might be most effectively monitored, and scientists are frequently guilty of biodiversity advocacy rather than objective analysis.

European land managers in northern Australia base their actions primarily on information gained from the time-honored sources of tradition, belief, and personal experience. Indeed, the processes by which European managers acquire and utilize information are, in many ways, similar to those used by Aboriginal people (Table 2). The real cultural contrasts in the acquisition and use of information relating to fire management in northern Australia are between the culture of science on one hand, and the culture of management, black *and* white, on the other (Table 3). This is not to denigrate the rich cultural heritage of Aboriginal Australians, who have been successful custodians of the Australian environment for millenia, and who possess an enormous, but largely untapped, knowledge of the Australian biota. Rather, it is recognition that an experiential system of knowledge is inadequate to cope with the ecological complexities associated with large human populations, technological development, and intensive land use. Such scientific vs. experiential clashes are not unique to northern Australia, but are being played out in land management debates throughout the country and the rest of the world (Charles 1982, Clark 1986, Mattson 1996, Walters 1997).

Table 2. Actual system of acquisition and use of knowledge in relation to fire management that is typically adopted by European land managers, compared with the traditional Aboriginal system.

Fire management issues	European	Aboriginal
Objectives (desired ecological outcomes)	often ambiguous, not well defined	often unclear, not well defined
Knowledge acquisition	tradition, beliefs, and personal experience	tradition, beliefs, and personal experience

Knowledge dynamics	preserve old, resist new	preserve old, resist new
Biodiversity	accepted, but misunderstood	not understood or accepted

Table 3. Science - management contrasts in the acquisition and use of knowledge in relation to fire management in northern Australia.

Fire management issues	Science	Management
Objectives	clear, well defined	often ambiguous, not well defined
Knowledge acquisition	scientific enquiry	tradition, beliefs, and personal experience
Knowledge dynamics	challenge old, create new	preserve old, resist new
Biodiversity	central concern	misunderstood or not understood

Reconciliation between European Australians and Australia's original inhabitants has an enormously high national profile, particularly in relation to land access and ownership. It is a key part of the nation's social and cultural development. However, another cultural reconciliation is required for the effective management of such land. This is the reconciliation between the cultures of scientific research and management, both European and Aboriginal.

RESPONSES TO THIS ARTICLE

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