Precautionary forest management : a case study from Western Australian legislation, policies, management plans, codes of practice and manuals from the period 1919-1999

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Summary

All available official policy documents (190) for the period 1919-1999 relating to forest management in Western Australia were examined. This period is defined by the proclamation of the *Forests Act of 1918* in 1919 and the *Forest Management Plan 1994-2003*. Our objective was to locate and compile definitive statements on 14 topics concerning the protection of forest values or precautionary forest practices.

The study demonstrated the progressive complexity of forest management over 80 years. Early emphasis was on re-establishing forests after logging and protecting these from wildfire. Nature conservation was officially addressed for the first time in the 1930s, becoming a dominant value by the 1970s and 1980s.

Statements from the 1920s onwards show a protective and prudential approach to conservation values within forest management. Our study indicates that strategic planning in forest management in Western Australia has a strong precautionary foundation, well in advance of the formulation of the precautionary principle.

Keywords
Planning, strategy, forest values, precaution, knowledge, government, administration

Introduction

This study examined the hierarchy of departmental documents published by, or governing, the Forests Department and the Department of Conservation and Land Management (CALM) from 1919 through to 1999, and includes Western Australian legislation and departmental policies, management plans, codes of conduct and guidelines. The *Forests Act of 1918* was proclaimed in 1919 and this Act represented the initiation of management of Western Australia's forests by professionally trained foresters (Bradshaw 1999). The *Forest Management Plan 1994-2003* (Lands and Forests Commission 1994) was the current forest management plan at the end of the study period and this represents the cumulation of eight decades of policy development.

The aim of the study was to select and compile statements relevant to precautionary forest management practices or avoiding damage or despoliation in forest management. We aimed to build a forest management history that shows, through direct quotations from departmental publications, the protection of certain forest values. The 14 values or practices we focused on are: *Disease Management*, *Nature Conservation, Fire Management*, *Forest Regeneration After Logging : Jarrah, Forest Regeneration After Logging : Karri, Water Quality and Production*, *Visual Amenity, Roading, Rehabilitation*, *Soil Management, Insect Pests and Weeds Management, Apiculture, Feral Animal Management* and *Wildflower Management*. These are listed from the category containing the largest number of documents through to the smallest category. They show a historical development of policy and practices from 1919 through to 1999.

Methods

For the purposes of this study, the concept of *precautionary* embodies *an awareness of the need to protect forest values, thus displaying foresight and care,* a general meaning rather than a specific meaning referring to *the precautionary principle.* Precaution involves anticipating the risk of forest damage and attempting to avoid damage by careful planning and management.

The library of the Department of Conservation and Land Management, which has the most complete collection of Western Australian forest management documents, was the basis of the literature review. Each publication was carefully read and statements meeting the following criteria were selected for the compilation.

- The quotation must be a definite statement.
- The quotation must state important goals or strategies.
- The quotation must prescribe or proscribe.
- The quotation must be concerned with the protection of forest values.

As a result of these criteria, the statements selected contain a strong emphasis. They contain such words as: *will*, *are*, *shall*, *is* or *must*. Discretionary statements with a less definite wording such as *should* or *may* have been excluded, with the exception of statements that provide supplementary explanations for definite statements.

The statements have been presented in separate categories of forest values or forestry practices and are presented in reverse chronological order, that is from 1999 to 1919. Certain statements have relevance to more than one section but have been placed in only one section to avoid duplication. For example, statements on regeneration burning have been included in the *Forest Regeneration After Logging* sections but not in the *Fire Management* section. The reader is advised to be alert for such linkages and to check whether statements have been included in a different section.

To indicate that the quotation is part of a longer or bigger paragraph the convention of brackets has been used to show an ellipsis. We have avoided misrepresenting the substance of the matter quoted; however, to gain a fuller understanding of the information the reader is advised to refer to the original documents. We have included several statements that summarise a history of forest management to provide a context for a new policy statement. And we have included the headings of paragraphs or sections, from which the quotations were selected, to provide further contextual information.

Once we had completed the compilation of statements, we measured the number of documents included in each of the categories of forest values or practices for each decade. We also measured the number of words for each category per decade.

Results

Figure 1 essentially summarises the history of the focus of forest management in Western Australia as represented in departmental policy documentation. It shows a history of policy development as well as historical responses to external and internal issues and developments.

Insert Figure 1 near here

From the 1920s through to the end of the 1960s, the predominant focus was on forest regeneration of jarrah (*Eucalyptus marginata*) and karri (*E. diversicolor*) and fire management. The proportion of documents relevant to these three forest practices is significantly less from the 1970s when the policy of 'multiple use' was introduced and other forest values or forest practices were more specifically addressed (Forests Department 1975). From the 1970s, the forest values or forest practices of *Water Quality and Production*, *Rehabilitation, Soil Management*, *Feral Animal Management* and *Wildflower Management* were addressed continuously (Fig. 1).

Legislation in the 1930s, 1950s and 1960s reveals that *Nature Conservation* was addressed earlier but this also grew in a significant and sustained way from the 1970s to the 1990s. However, policy consideration of two other forest values/practices, *Visual Amenity* and *Roading*, started a decade earlier in the 1960s.

The number of words produced in each decade for the study period is shown in Table 1. The results are similar to our discussion on the number of documents per decade. However, the statistics are understated because when a new edition of a code or annual report was issued the wording was sometimes similar to the previous editions. In these instances only the original edition was included and a direction was inserted, under a heading for the new edition, to refer the reader to the earlier edition.

Insert Table near here

The amount of material finally compiled is substantial, amounting to 619 996 words. This particularly reflects the volume of material published from the 1970s to the 1990s.

Discussion

The broadening of policy and plans in the 1970s to specifically address values and practices also reflects changes in community values, with increased awareness of other forest values. It also reflects a change in view of forest values - from the resource focused management of the forests to a specifically multiple facetted focus. Nonetheless, as our discussion shows and as Bradshaw (1999: 261) notes, forest regeneration was always viewed as a conservation practice "relative to the alternative of forest 'mining' or clearing for agriculture".

Figure 1 demonstrates policy responses to specific issues. In the 1970s *Disease Management* became a new and significant category and this reflects the identification in 1965 of *Phytophthora cinnamomi* as the causal agent of jarrah dieback disease and the need to address its management (Podger, Doepel and Zentmyer 1965). In the 1930s *Roading* was addressed because of the transition from log hauling via tramways to that of road haulage (Forests Department 1969). *Insect Pests and Weeds Management* were addressed in the 1920s and 1950s in response to particular problems with the Pinhole borer (*Atractocerus kreuslerae*, Pasc.) and Bullseye borer (*Phoracantha acanthocera* (Macleay)) (Abbott 1985). *Apiculture* differs, with policies issued in the 1930s and the 1950s through to the 1990s, indicating early consideration of other forest values besides regeneration. Soil legislation was issued in the 1940s as part of increasing awareness of soil conservation issues (Burvill 1979) but, as with other categories, there were no specific policy documents on *Soil Management* until the broadening of forest values in the 1970s.

The individual variations in policy treatment of forest values and practices show historical responses to particular issues. Table 1 shows another variation with the 1980s as the 'boom

period' for production of policy on all of the forest values and forest practices, reflecting the interest of the public in environmental matters and the high profile of native forests in environmental campaigns by activists (Bradshaw 1999). This variation also indicates the interplay between the Department and the community.

Quotations selected show that conservation values were addressed in general terms before specific policy treatment. One of the unfortunate consequences of the adoption of Principle 15 at the United Nations Conference on Environment and Development (held in Rio de Janeiro in 1992) was to convey the impression that a precautionary approach was novel. Indeed, Deville and Harding (1997) suggested that earlier examples of acting with precaution are *ad hoc* and lack 'institutionalization' in environmental decision-making. We believe that the great volume of material accessed during our study does demonstrate that forest management in Western Australia has been underpinned by a precautionary approach for many decades before this.

The *precautionary principle* has generated much controversy and has been extensively criticised (e.g. Foster *et al.* 2000, Holm and Harris 1999). This suggests that a precautionary approach, rather than adherence to a principle that is controversial, may represent a more robust procedure for taking uncertainty into account.

The Precautionary Approach : Examples from the Study

Incorporating Conservation Values

Statements selected show awareness of other forest values besides forest regeneration. In **1927** officers were instructed in the importance of fire management as a protective duty.

> "*The problem of fire control is intimately bound up with the question of reforestation and afforestation, and the ultimate success of the Department's efforts in these directions is entirely dependent on a strong measure of public sympathy and co-operation in tackling the fire problem.*
>
> *Of almost equal importance is the proper use of controlled fires in silvicultural and* ***protective operations****. The extent to which controlled burning is desirable and necessary is completely set out in the following pages* [...]."
> (Forests Department 1927: 24) [emphasis ours]

In **1956** we found the first mention of *hazard reduction* and *risk reduction* in the *Foresters' Manual Part III Fire Control (South-West – 1956)* indicating that fire management was viewed as a precautionary practice. Prescribed (fuel reduction) burning was introduced as a policy in 1954 (McCaw and Burrows 1989).

> "*776. Fire prevention, a most important branch of fire control, can be divided into the following sections and sub-headings which are dealt with in turn:-*
> ***(1) Risk Reduction***
> *(a) Education*
> *(b) Law Enforcement.*
> ***(2) Hazard Reduction.***"
> Forests Department (1956a: 8) [emphasis ours]

The **1956** manual also shows an all encompassing view of fire management.

> "*751. The result of nearly four decades of fire control experience and research*

is a policy introduced in 1954 which may be briefly summarised as follows:-

(a) Put all available funds into the roading of valuable forest areas to check annual losses by uncontrolled fires.

(b) Use prescribed burning and intelligent planning to the fullest extent possible to reduce the danger of severe uncontrolled fires.

(c) Use our well developed fire-fighting organisation to quell outbreaks in the dangerous summer months, but fight fires with discretion and with an eye to the cost of the operation.

(d) Train officers and men to think in terms of costs and collateral values on every operation involving fire protection.

(e) Train and trust the junior officer to use fire as a controlled weapon to accomplish sylvicultural ends and to guard against calamities."

Forests Department (1956a: 5)

The **1956** manual also shows the conceptual placement of fire management in a *protection system.*

> *"840. Each year the Forester carrying out spring controlled burning will mark on a plan those areas, such as wet gullies, that were not burned to schedule and arrange for their burning at a date later in spring.*
>
> *841. It is of paramount importance to make certain that those areas are burned before the main danger period as they constitute a weak link in* ***the protection system*** *and can lead to the escape of a fire that otherwise was confined."*
> Forests Department (1956a: 14) [emphasis ours]

And in **1973** officers were instructed in the *Foresters Manual : Fire Control* of the important connection between fire management and forest conservation values.

> *"1. The problem of fire control is intimately connected with the questions of reforestation and afforestation and the ultimate success of the Department's efforts in these projects is largely dependent on a strong measure of public sympathy and co-operation in attacking the fire problem.*
>
> *2.* ***Of equal importance is the proper use of controlled fires to regenerate and protect the forest and its associated flora and fauna*** *and to guard adjoining communities from wildfire.*
>
> *3. The eucalypt forests of Western Australia have evolved in a fire environment. Both flora and fauna have adapted to hot, dry, summers, the associated fires started by lightning and more recently by man. It is, therefore, natural and advisable to undertake hazard reduction by the intelligent use of fire of prescribed intensity and frequency."*
> Forests Department (1973: 3) [emphasis ours]

The *General Hardwood Working Plan* released in **1971** specifically identifies other forest values, together with forest regeneration, requiring protection.

> *"The initial survey has indicated that of the 3.3 million acres of jarrah forest, approximately 1.62 million acres are of sufficient quality and site productivity to warrant intensive multiple-use management, primarily for future timber production.*

> *The remaining area is considered more suited to extensive management for **such vital purposes** as catchment protection, salinity control, flora and fauna conservation and public recreation, as well as timber production.* [...]"
> Forests Department (1971: 8-9) [emphasis ours]

The **1971** plan also states an imperative for departmental officers to protect other forest values.

> "*In all operations **proper attention** will be paid to:*
>
> *1. Preservation of selected forest reserves on areas where no major trade operation has taken place.*
>
> *2. Continued attention to conservation of flora and fauna of the forest by proper management techniques including fire control and forest hygiene.*"
> Forests Department (1971: 36) [emphasis ours]

Setting a Strategic Focus

Statements selected also show that the Department worked with a long-term approach to forest management. In **1926** the importance of managing the forest for future water supply was stated.

> "*Part II.- Future Management.*
>
> *8. Objects of Management.*
>
> *(1.) To manage the forest so as to **maintain** a well regulated supply of pure water in the creeks and springs on the reservoir catchment areas.*"
> Stoate (1926: 15) [emphasis ours]

In **1950** the Department directed officers to fully consider their actions.

> "*An officer making recommendation under these headings must remember that present timber values are **not the only** guide and that considerable thought needs to be given to the area under consideration, as decisions made today may have **far-reaching affects** in the future.*"
> Forests Department (1950: 15) [emphasis ours]

In **1977** the Department placed management in a conceptual time frame.

> "*Multiple use has temporal as well as spatial over-tones.*"
> Forests Department (1977a: 31)

And in **1986** the Department stated its corporate objectives with a long-term perspective.

> "*Under a corporate plan formulated in 1985/86 the statement of mission for the Department of Conservation and Land Management is:*
>
> *To provide for the use of the natural environment without detracting from possible future use.*
> [...]
> *Primary objectives are:*
> [...]

Production
To provide and regulate the supply of renewable resources on a sustained yield basis in a manner that minimises impact on other values."
CALM (1986a: 8-9)

This statement anticipates the concept of 'ecological sustainability' that was given formal status in the 'Brundtland Report' in 1987 (World Commission on Environment and Development 1987).

Taking a Prudential Approach
Statements selected also show a prudential approach to forest management based on foresight and proceeding with care. In **1926** officers were directed to take a careful approach when planning fire management.

"*The whole of the Working Circle shall be considered as under Fire Control Measures.*

These measures will vary according to the conditions of the forest. Complete protection will be afforded to:-

(a) *Areas treated and regenerated, except that, where the crowns of the young crops have reached a sufficient height to be beyond damage by a light surface fire, instructions may be given by the Conservator for controlled early burning under such stands.*

(b) *Areas treated and awaiting final treatment pending seed years.*

[...]

The remainder of the forest will be burned systematically by light controlled fires. In view of the fact that the bush will carry a fire usually only every three years, approximately one-third of the country not afforded complete protection will be burnt each year."
Stoate (1926: 25)

And in **1927** foresters were instructed to proceed carefully.

"*When in doubt, it is better to err on the light side. It is always possible to go back and cut trees which should have been destroyed, but the converse is not possible.*"
Forests Department (1927: 20)

And the following statement issued in **1956** in a general working plan shows that conservation management was critically important in the management of the forests.

"*In the earlier Working Plans of 1928 and 1945 there was less knowledge of the forest statistics on which to base a Working Plan, and this planning in a different economic area, undoubtedly led to an over conservative policy which resulted in some 2 million acres of virgin forest being left to the ravages of fire, with the mistaken idea that it could remain as a static reserve for the future without even a Forest Ranger living within the forest.*

The appalling losses in this zone have only been brought to light over the past 2 years by

> *the application of modern assessment, based upon the study of air photographs, and the need for development, protection and utilisation of this forest is so strong that mere considerations of the theoretical productive capacity of the whole State Forest must be relegated to the background.*"
> Forests Department (1956b: 9)

In **1975** the aim for forest management was to be judicious and amendable.

> "*The future policy will emphasise the multiple-use management of State Forests and Timber Reserves. It will continue to provide for the renewable resources of publicly-owned forests to be utilised in the combination that will best meet the needs of the West Australian people. The aim will be to make the most judicious use of the land for some or all of the resources or related service over areas sufficiently large to provide latitude for periodic adjustments in use to conform with changing public needs and the development of the forest itself.*" Forests Department (1975: 12)

The careful approach to forest management extended to other practices such as roading.

> "*3. Keep road construction and maintenance to the level necessary for catchment protection.*" Forests Department (1977a: 49)

> "*11.3 The basic planning principle is to aim for the minimum number of well surfaced, low profile roads, consistent with fire protection requirements.*"
> CALM (1981a: 43)

Conservative policies are clearly an essential first step in conservation management.

Acknowledging Uncertainty
Statements selected show acknowledgment of uncertainty in forest management. The following statement from logging and silvicultural guidelines for the northern jarrah forest in **1981** show that the Department acknowledged a limitation to the current understanding of forest management.

> "*These guidelines are not regarded as 'the last word'. Nor is it expected that they can be universally applied. They are, however, <u>the latest state of the art</u>, based on the best information to hand at the moment.*" Forests Department (1981c: 1) [emphasis in original]

And in **1983** a prescription for rehabilitation after bauxite mining shows that the best possible result was the departmental aim.

> "*2.1 Because there is no past experience to draw upon in the management of forests regenerated after mining, and because of uncertainty as to how these stands will develop, this prescription is regarded as interim, and will [be] subject to regular review.*
>
> *Nevertheless, it is the best 'State of the Art' and must be strictly adhered to.*"
> Forests Department (1983: 7.1)

Incorporating Developments in Knowledge
Statements selected show that the Department worked from a position of incorporating knowledge developments into policy and practices. The following policy statement issued in **1976** acknowledges that changes in fire protection will come with developments in knowledge.

> "*Fire protection will continue using the most advanced techniques of fire prevention, detection, suppression and prescribed burning, and these techniques will be amended as knowledge is expanded in both technical and environmental fields.*"
> Forests Department (1976: 13)

A general working plan issued in **1977** shows the application of informed decisions for evaluating and developing forest values.

> "*(c) The selection of a priority or dominant use for an area with the practice of secondary uses which in some circumstances may not significantly interfere with the primary aim, but in others may impose a restriction on output from each competing use. This necessitates a social ranking of use priorities which can usually be done satisfactorily* ***with limited data and experienced value judgement****. The Forests Department has adopted this approach for the future management of State forests and timber reserves.*"
> Forests Department (1977a: 31) [emphasis ours]

And in the *Nature Conservation* section a statement from **1977** shows the application of knowledge and experience in the formation of values.

> "*A number of alterations to fire protection policy have resulted* ***from decades of fire research and practice****, which give greater emphasis to conservational, environmental and aesthetic values. These include:*
> [...]
> *d) attempts are not made to burn a high proportion of any one area. Prescriptions are set at limits which will ensure unburnt pockets comprising about 20-40% of the area. This policy was adopted in the light of research into the ecology of many forest animals; particularly the swamp dwellers.*"
> Forests Department (1977b: 22-23) [emphasis ours]

And a statement in **1980** on fire protection in a departmental manual shows that policy was built on a progressive accumulation of knowledge.

> "*7. Present fire control policy results from six decades of experience and research* [...]" Forests Department (1980a: 1)

Minimising Damage
Statements selected from **1972, 1976** and **1977** show awareness of the impact of forest management.

> "*Management of indigenous hardwood forest aims at producing the highest possible yield of useable wood, consistent with the maintenance of a protective forest cover for water catchments and a general forest environment.*"
> Forests Department (1972: 3)

> "*The Forests Department will manage the state-owned forests and timber reserves in Western Australia according to a policy that will ensure provision for the optimum social and material needs of the people. At the same time the policy will provide for the environmental well-being of the forests themselves.*
>
> *The policy involves the following objectives:*
> [...]
>
> *Forest Protection*
> *To maintain and add to the areas of permanently reserved forests; to protect these forests from fire, insects and other harmful agencies; to maintain and improve the health and vigour of the forest area.*"
> Forests Department (1976: 15)

In **1977** the working plan stated the following objective for the management of the forest.

> "*5.9.5 Conservation of the Physical Environment*
> [...]
> *5.9.5.1 Objective of Management*
> *To minimise the deleterious effects of land use and management on the soil, air and water components of the forest environment.*"
> Forests Department (1977a: 129)

In **1981** the Forests Department stated an emphasis on the minimising of damage in rehabilitation after mining.

> "*12.011 The strategy adopted to implement this policy requires minimisation of the area cleared for mining, realistic compensation payments, rehabilitation in accordance with land management objectives and the direction of open-cut operations into areas where the least land-use conflict will occur and where salinity problems are unlikely.*"
> Forests Department (1981b: 5-6)

And a manual for logging from **1987** shows an emphasis on minimising the spread of dieback with the delegation of duties for '7 way tests' for operations.

> "*This decision to delegate authority must not be taken to imply any relaxation of hygiene standards for operations on CALM land.*"
> CALM (1987b: 11)

Incorporating New Concepts

Another approach we used to track changing attitudes in policy and operations was to establish when new 'vogue words' were first mentioned in official documents.

The word *stewardship* was first used in forest policy in **1975** indicating an early conceptual understanding of conservation management.

> "*This statement will outline the current situation regarding those permanently dedicated State Forests and Timber Reserves which come within the* ***stewardship*** *of the Forests Department and formally establish management objectives according to the requirements*

> *that now exist. It will take into account a multiple-use concept of those forests managed by the Forests Department.*"
> Forests Department (1975: 2) [emphasis ours]

Our tracking showed that some terms were not used until international trends brought the words/concepts into usage. For example, *old growth* was first mentioned in a strategic plan in **1986**.

> "*Key Area : Hardwood Establishment : Objective 1. To regenerate all areas of logged old growth karri forest.*" CALM (1986c: 74)

The term *biodiversity* only appears in the management plan of 1994 (Lands and Forests Commission 1994), some 5 years after the neologism was first used (Wilson 1988).

In contrast, the term *ecosystem*, coined in the 1930s (Tansley 1935), was first used in documents in the 1980s. Since its first use in **1981**, the term has been frequently used in departmental documents.

> "*The overall objective for rehabilitation of bauxite mines in the western jarrah forest is :-*
>
> *'To regenerate* ***a stable forest ecosystem****, capable of maintaining or enhancing water, timber, recreation, conservation and/or other nominated forest values'.*
>
> *Specific goals (not listed in order of importance since priorities may vary with designated land use) are :-*
>
> *3.1 Water values : to prevent any adverse effect of mining on water quality.*
> [...]
> *3.4 Protection : To conserve the residual soils; to control dieback spread; and to control fire hazard.*
>
> *3.5 Landscape : To create a rehabilitated landscape visually compatible with the adjoining remnants of indigenous forest.*
>
> *3.6 Conservation : To recreate, in the long-term, floral and faunal characteristics compatible with the jarrah forest.*"
> Forests Department (1981a: 38) [emphasis ours]

The use of the term *ecosystem* indicates an all encompassing view of ecosystem management. A 1983 document states a departmental goal for the ecosystem.

> "*Water Production MPA - To establish a stable forest ecosystem...*"
> CALM (1983: 7.2)[emphasis ours]

In **1986** a corporate objective concerning ecosystems is stated.

> "*Establish and maintain a system of secure reserves which protect viable* ***representative samples of all the State's natural ecosystems*** *...*"
> CALM (1986a: 10)[emphasis ours]

And, also in **1986,** an operational objective for rehabilitation of disturbed land was issued in a policy statement.

> "*To regenerate, on disturbed land, self-regulating ecosystems, consistent with the purpose for which the land is to be managed.*"
> CALM (1986b: 1) [emphasis ours]

In **1988** a means of achieving a primary objective of ensuring that the conservation and land management responsibilities were underpinned by scientific principles was stated in a strategic plan.

> "*7.3.2 Establishing long term monitoring of ecosystems and individual species, and of recreation requirements and effects.*"
> CALM (1988b: 15)

The term *precautionary* was not specifically used except in two earlier documents that refer to fire control or reforestation.

> "*5. A 'Permit to Burn' shall be issued by an authorised officer, provided he is satisfied that proper precautions will be taken by the applicant to confine the fire within the boundaries of his own land or land occupied by him, and that there is no undue risk of the fire getting out of control. Such permit shall contain such conditions relating to the* ***precautionary*** *measures to be taken by the permit holder as may be considered necessary at the time by such authorised officer.*"
> Forests Department (1927: 27) [emphasis ours]

> "*621. Natural regeneration of the forest follows the opening of the canopy resulting from trade cutting, and treemarking therefore, is the first step in regeneration operations, apart from* ***precautionary*** *measures such as advance burning.*"
> Forests Department (1953: 5) [emphasis ours]

The term *precaution* came into general usage in the 1980s.

> "*13. The holder must take all* ***reasonable precautions*** *not to unnecessarily destroy or damage any tree or woody shrub on the 'mining area'.*"
> Forests Department (1981b: [21]) [emphasis ours]

> "*(viii) Where roads are constructed (or maintenance graded) near or across steams* [sic], ***special precautions*** *are needed to prevent erosion and siltation. Use bitumen mulch, silt traps and sumps or rocked walls within table drains.*"
> Forests Department (1981c: 12) [emphasis ours]

> "*The Northern Jarrah Forest is highly flammable by world standards and the most severe fire the State has experienced in recent times occurred in this Region (Dwellingup fires 1961). It is pertinent that* ***fire precautions*** *are adequate to preserve life and property as well as conservation and other forest values.*"
> CALM (1985: 27) [emphasis ours]

"*7. Method of Operation*
7.1 All ***standard hygiene precautions*** *to minimise the spread of* *Phytophthora cinnamomi* *will be observed.*"
CALM (1987c: 66) [emphasis ours]

"*4.7* *Useage* *Observe* ***environmental precautions****. Do not spray near rivers, streams, dams etc. Dispose of container correctly.*"
(1987c: 76) [emphasis ours]

"*An Operator will take any* ***precautions*** *nominated by a Forest Officer to prevent the introduction or spread of noxious weeds during his logging operation.*"
CALM (1987a: 25) [emphasis ours]

"*4.3.1* ***Dieback hygiene precautions*** *will be implemented for all fire suppression and fire prevention activities.*

4.3.2 ***Dieback hygiene precautions*** *will be implemented for all other necessary operations on the Reserve.*"
CALM (1988a: 7) [emphasis ours]

Use of the terms *caution* and *cautious* first occurred in the late 1970s and early 1980s.

"*b)* *The main requirement is the retention of an adequate vegetative cover of deep rooted perennials. This means* ***extreme caution*** *with respect to the possible introduction of dieback, the earliest possible regeneration of cut over stands and the artificial revegetation of areas denuded in the past.*"
Forests Department (1977b: 32) [emphasis ours]

"*The 25 year mining proposals are located entirely within the western high rainfall zone, though the eastern extremity abuts the intermediate rainfall zone. As mining approaches this area* ***caution*** *will have to be exercised in relation to potential increases in stream salinity. The land use plan does not provide for mining in the salt sensitive zone. Some 25 years are available to test techniques of safe mining in these problem areas.*"
Forests Department (197?: 1) [emphasis ours]

"*However,* ***caution*** *must be exercised towards the eastern perimeter of the high rainfall zone as the potential to yield salt can vary markedly. More intensive sampling in these areas in the future will provide data that may alter current plans.*"
Forests Department (197?: 3) [emphasis ours]

"*Timber Production MPAs*
[...]
Because of the sensitive nature of this area to salinity increases, current management will be ***cautious****. These MPAs are located on catchments which may be utilised for water supply in the longer term.*"
Forests Department (1980b: 12-13) [emphasis ours]

Although words with the root *sustain* were first used in 1926, this usage was in the sense of *sustained yield of wood products*, within the traditional and long-established concept of *sustainability*.

Working plans from **1929** and **1956** and a **1976** policy show statements of this sustained yield management objective.

> "*4. Objects of Management*
> *The purpose of this general Working Plan is to establish the sawmilling industry in the Jarrah forests of Western Australia on a* ***sustained yield basis.***"
> Forests Department (1929: 4) [emphasis ours]

> "*The main object of the Working Plan remains as it always has been, to stabilise the Timber Industry; to ensure continuity of operations, regular employment for the men engaged, and long life for the timber trade and the communities and industries dependent upon it; and at the same time, to bring the cutting of the forests to a* ***sustained yield basis.***"
> Forests Department (1956b: 19) [emphasis ours]

> "*The Forests Department will manage the state-owned forests and timber reserves in Western Australia according to a policy that will ensure provision for the optimum social and material needs of the people. At the same time the policy will provide for the environmental well-being of the forests themselves.*
>
> *The policy involves the following objectives:*
> [...]
> *Timber Production*
> *To regulate the removal of produce from the native forests to a level that can be* ***sustained*** *by the forest growth.*"
> Forests Department (1976: 15) [emphasis ours]

Legislation from **1984** also expresses the sustained yield concept.

> "*56. (1) A controlling body shall, in the preparation of proposed management plans for any land, have the objective of achieving or promoting the purpose for which the land is vested in it, and in particular management plans shall be designed –*
>
> *(a) in the case of indigenous State forest or timber reserves, to ensure the multiple use and* ***sustained yield*** *of that resource for the satisfaction of long-term social and economic needs;*
> [...]"
> Government of Western Australia (1984: 1915) [emphasis ours]

The concept of sustainable use in terms of tourism or recreation was first used in 1984, with acknowledgment of sustainable tourism values seen in a forest recreation framework.

> "*Several major environmental considerations have a constraining influence on recreation and other forest land uses in the Northern Region. The most important are:*
> [...]
> - *The need to prevent soil erosion, particularly on the steeper or more*

> *dissected portions of the landscape;*
> [...]
> *These factors were considered in assessing the capacity or capability of the forest to* ***sustain different types*** *of recreational use (refer to Table 6). That is, recreational activities which are likely to result in substantial environmental degradation have been directed away from the more sensitive portions of the landscape.*[...]"
> Forests Department (1984: 31) [underlining in original, bold emphasis ours]

The **1987** management plans for the northern, central and southern forest regions and the Shannon Park and D'Entrecasteaux National Park show a broadening of the sustainable objective to include recreation, tourism and aesthetic values.

> "*To cater for the widest range of recreational activities giving the most satisfying experience for users, through the planning and managing of activities and facilities on land controlled by the Department. This is to be done having regard to the preservation of natural land values, consistency of recreational activity with purpose of vesting, equity, and the capacity of the Department to manage the proposed activity.*
>
> *Specifically, the aim is to:*
>
> *Provide and allow for the widest range of recreational opportunities consistent with:*
>
> > *the purpose and vesting of the land;*
> > *the ability of the natural system to* ***sustain the activity without impairment;***
> > [...]"
>
> Department of Conservation and Land Management (1987e: 85) [emphasis ours]

> "*Protection of the natural values of the Parks is a fundamental concern of this plan. Thus, management and sustained use must not cause irreversible environmental damage or impairment of scenic beauty.*"
> Department of Conservation and Land Management (1987f: 43)

The concept of sustainability as embodied in *ecologically sustainable forest management* was not used explicitly until 1994, though it was implied as early as 1986, with the departmental annual report for **1985/86** showing an implied ecological objective for timber management.

> *Primary objectives are:*
> [...]
> *Production*
> *To provide and regulate the supply of renewable resources on a* ***sustained yield basis*** *in a manner that minimises impact on other values.*"
> Department of Conservation and Land Management (1986a: 9) [emphasis ours]

In **1986** a strategic plan for the Southern Forest Region also stated an ecologically sustainable objective for managing wildflower picking in State forests and concurrently managing the spread of dieback.

> "*3. Regional Strategic Goals*
> [...]

Wildflowers

To control wildflowers picking on appropriate land so that sustained utilization is achieved without disease spread and soil disturbance. [...]"
CALM (1986c: 5)

Whilst in **1989** a silviculture specification shows an implied ecologically sustainable objective for managing the jarrah forest.

"*2. Objective*
To regenerate, protect and ***sustain the multiple values*** *of the jarrah/marri forest on dieback affected areas.*"
CALM (1989b: 1) [emphasis ours]

An explicit statement of an ecologically sustainable management concept, which has been implied in departmental documents since 1986, comes in the Department's vision statement and production objective published in **1994**.

"*The Government's vision is based on the ecologically sustainable management of the State's publicly owned native forest estate which is maintained in perpetuity.*"
Lands and Forests Commission (1994: i)

"*Production Objective*
To manage the forest to produce the range of commercial values approved by Government, in a manner which is ecologically sustainable and provides a fair return to the State."
Lands and Forests Commission (1994: 3)

Sustainability became a vogue word following the publication of the Brundtland Report in 1987. From about then it was realised that sustainable yield is only one part of true sustainability, as it emphasises economic values. Social values began to be emphasised in sustainable use of the forest for recreation and tourism. These two concepts, when combined with ecological sustainability (maintenance of viable populations of species and of ecosystem processes) and intergenerational equity, constitute a more holistic concept of sustainability.

Conclusions

Our study shows that the key issue in the early decades was the forest growing back after logging, hence the proportion of material on regeneration; however, selected statements do show that conservation of other values was implicit in the regeneration of the forest. Some issues were not explicitly stated but were generally implicit in conservation statements. For example, biodiversity was not a explicit concept until the 1980s but selected statements show that the protection of conservation values was generally implicit in the regeneration of the forest rather than a specific goal.

The total number of documents examined is 190 and most of the material extracted is available at the Department of Conservation and Land Management's library. The compilation of statements should prove useful for forest historians. It provides a history in the Department's own words and contains a plethora of material awaiting scholarly study. We would welcome comments on errors of omission or inclusion.

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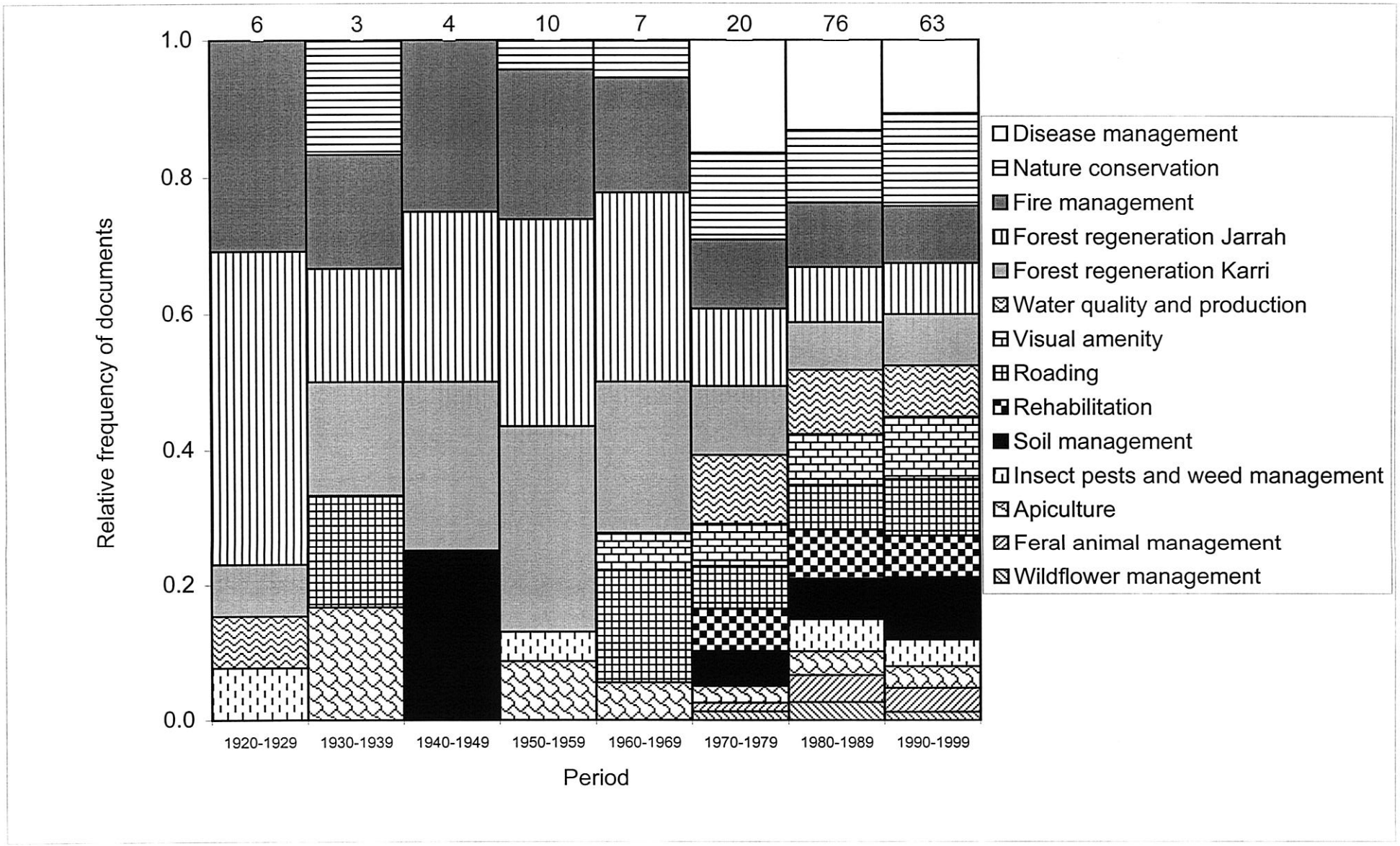
Table 1. Word count of documents for each forest value or forest practice category

Subject	Period							
	1920-1929	1930-1939	1940-1949	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999
Disease Management	0	0	0	0	0	10531	55509	25256
Forest Regeneration after Logging: Jarrah	6429	67	548	4486	8370	8864	18658	18073
Nature Conservation	0	357	0	343	117	4541	26634	20009
Fire Management	3883	957	171	5564	7352	10539	40279	32741
Water Quality and Production	328	0	0	0	0	4752	25477	9050
Forest Regeneration after Logging: Karri	2073	67	571	4580	10016	8428	15736	12343
Visual Amenity	0	0	0	0	71	1380	15539	9055
Rehabilitation	0	0	0	0	0	2320	23279	6435
Soil Management	0	0	1048	0	0	1881	12681	5759
Roading	0	57	0	0	484	1007	12284	9020
Insect Pests & Weeds Management	58		0	67	0	0	5303	2280
Feral Animal Management	0	0	0	0	0	64	4466	3215
Apiculture	0	55	0	298	142	340	3162	2812
Wildflower Management	0	0	0	0	0	220	2125	744

Figure 1. Relative frequency of documents for each forest value or forest practice category for each decade, with total number of documents per decade (on top line of figure).


6
3
4
10
7
20
76
63
1.0
0.8
0.6
0.4
0.2
0.0
Relative frequency of documents
1920-1929
1930-1939
1940-1949
1950-1959
1960-1969
1970-1979
1980-1989
1990-1999
Period
Disease management
Nature conservation
Fire management
Forest regeneration Jarrah
Forest regeneration Karri
Water quality and production
Visual amenity
Roading
Rehabilitation
Soil management
Insect pests and weed management
Apiculture
Feral animal management
Wildflower management