

A HISTORY OF INVENTORY AND THE ASSESSMENT OF VALUE IN WESTERN AUSTRALIAN FORESTS

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Declaration

I declare that this dissertation is my own account of my research and contains as its main content work that has not previously been submitted for a degree at any tertiary education institution.

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ABSTRACT

This thesis provides an account of the assessment and management of forest values, and the factors that have shaped those values in the South West of Western Australia since European settlement. The phases of forest exploitation in this State include discovery, intense exploitation, awakening conservationism, environmentalism, and a developing synthesis between humans and their environment. This phased history has been one of learning by all stakeholders, from ignorance about Australian forest and its timbers, to scientific management and professionalization, social, cultural and political turmoil, commercial excess and eventually the emergence, consideration and elevation of social values in addition to commerciality. This history and the place of forest inventory in reflecting and acknowledging these values in forest management, was investigated through document review, firsthand knowledge of the researcher, information from key informants, and a survey of forest stakeholders to reveal and analyse contemporary societal values regarding these forests. The result is an in-depth description - achieved through an intertwined analysis of forest inventory and community values over the history of European settlement in Western Australia - of the emergence of commercial forest value and subsequently other broader societal values, such as biodiversity conservation, ecosystem management and recreation, as well as the growing conflict between these values. The influence of these values over this period has been to transform the management and policy framework from one firmly located in the physical sciences to one now also drawing on the social sciences, thereby involving the far greater complexity of a political environment with its sometimes conflicting values. The analysis undertaken in this thesis suggests a future requirement for the discipline of forestry, beyond that of physical attribute inventories and tree growth rates and volume tables, to a continued embracing of community involvement, both as a source of data and for guidance in negotiating and resolving conflicting goals. The survey instrument developed in this study to access contemporary societal values has great potential for wider application as a tool for identifying the broad suite of social values relevant to forest management as well as providing essential input to conflict resolution when required.

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List of Acronyms and Abbreviations

ACF	Australian Conservation Foundation
AHP	Analytic Hierarchy Process
API	Aerial photographic interpretation
BLF	Builders Laborers Federation
CALM	The Department of Conservation and Land Management
CAR	Comprehensive, Adequate and Representative reserve system
CCWA	Conservation Council of Western Australia
CEAM	Cumulative Effects Assessment and Management
CFM	Collaborative Forest Management
CFMF	Continental forest-monitoring framework
CRA	Comprehensive Regional Assessment
CSFN	Campaign to Save Native Forests
CTRC	Conservation Through Reserves Committee
FDAR	Forests Department Annual Report
FMIS	Forest Management Information System
GPS	Global Positioning System
GIS	Geographic Information System
GWP	General Working Plan
IFA	Institute of Foresters Australia
MAVT	Multi-attribute value theory
MCA	Multi-Criteria Analysis
MPA	Management Priority Area
MUMC	Melbourne University Mountaineering Club
NFI	National Forest Inventory
PC	Phytophthora cinnamomi

RFA	Regional Forests Agreement
SFM	Sustainable Forest Management
SWFDF	South-west Forests Defence Foundation
UNEP	United Nations Environmental Programme
Wafa	Western Australian Forests Alliance

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About the Author

The author's background is an integral part of this thesis because in a number of places personal observations are included as evidence. These observations are made from a position of over 50 years as a professional forester.

Bushwalking and camping has been a major hobby; first with the Scouts, then with the MUMC (Melbourne University Mountaineering Club). The MUMC also introduced me to rock climbing and to bushwalking in Tasmania. I was secretary of the MUMC in my second year at Melbourne University.

Between year 11 and year 12 at high school in Victoria, I had a summer holiday job with the Forests Commission at Connors Plains in Gippsland. Working with people outdoors, and this included several weeks when two of us were the first to 'man' the new and not quite finished Mt Skene fire lookout tower, convinced me that forestry was the way to combine work and my enthusiasm for the outdoors. During university vacations, the holiday jobs I had with the New South Wales Forestry Commission near Batlow and ACT Forests near Canberra did nothing to reduce my enthusiasm for a forestry career. In fact, the 3 weeks spent chipping fire breaks near Pierce's Creek outside Canberra during one of these periods inspired me to ensure that I passed my exams and would not in future have to do this kind of labouring work for a living.

Two years were spent at the Australian Forestry School in Canberra in the late 1950s learning about trees and forestry. The time spent on field trips visiting forests and forest administration in Queensland, NSW, Victoria and South Australia amounted to about one year of the two years of the forestry school course. The variety of the forests visited was an excellent introduction to the variety of both eucalypt and other native forests and pine plantations in Australia as well as an insight into the way of life of a forester.

As a forestry graduate, my first appointment was 11 months of general forestry work with the Forests Department of Western Australia. This was my introduction to Western Australia itself and to earning a living as a full time forester. The work included designing roads, land inspections for potential pine plantations, prescribed burning,

supervising forest workmen, and fighting bushfires. I was fortunate enough to work in both jarrah (*Eucalyptus marginata*) and karri (*E. diversicolor*) forests during this time.

I then spent nearly 26 years working in forest inventory, broken only by 12 months study leave acquiring a Master of Forestry at the University of Michigan in the United States. My experience of the Master of Forestry course I took in the United States in 1965-1966 was that it was an excellent one for a forester with my timber management background. Sustainable forest management, forest economics, research methods, aerial photos and weather were all well covered.

While at the University of Michigan, my research project was to do with forest management and I had brought the details with me from work I had carried out near Manjimup, Western Australia, dealing with the number of plots needed to achieve a given sampling error when measuring the marketable timber in a given sawmill permit area. It was fully focused on the sustainable forest management of the timber industry. The head of the Forestry Department of the School of Natural Resources at Michigan was Professor Kenneth Davis. He was an experienced field forester in Montana before he came to Michigan, and later went on to Yale. His book *American Forest Management* (Davis, 1954), focused on sustainable management of productive lands for timber production. He wrote and lectured clearly and was a master of his topic. This course suited me very well as sustainable management for timber was an emphasis of forestry in Western Australia in the 1960s, and subsequently I learnt a lot from him.

At the same school of Natural Resources at the University of Michigan in 1964-1965, a course in Forest Recreation was offered by Professor Grant Sharp. I looked down on it as a soft option. I didn't see why you needed a course in forest recreation. It was a simple topic. With my involvement in camping, hiking and rock climbing since my scouting, Melbourne University Mountaineering Club, private and family outings, I had experienced a great variety of outdoor recreation in natural settings including forests. You don't need a university course to organise it. A bushwalking club system with suitable rules such as existed in Sydney and Melbourne was all that was needed. Such was my thinking, so I took little interest in the Michigan forest recreation course. However, the deer count at Saginaw forest made me aware of sustainable management of a non-timber forest product and the welcoming atmosphere and the hospitality to a

foreign student like myself were superb. The academic year at Michigan was altogether a wonderful experience.

With more experience since then in preparing management plans for national parks in Western Australia, I realised that there is much more to forest recreation than bushwalking and a club system with suitable rules. What was more pertinent to my study at Michigan was that I had been present at a manifestation of the beginning - that was the mid-1960s - of the increasing interest in the USA of the use of forests for far more than just their marketable timber.

Although the main thrust of forestry in Western Australia in the 1960s was sustainable management for marketable timber, professional foresters knew that there were many other values that were of interest. Volunteers were co-opted in the 1960s to survey recreation use in State forest. Although not opposed by the Forests Department, the survey was not part of the official Forests Department program and was carried out on weekends. Later, that survey and an approved program dealing with managing the jarrah forest for many values resulted in two internal Forests Department publications on multiple use management: *A perspective for multiple use planning in the northern jarrah forest*, and *Land use management programme: northern jarrah forest management priority areas* (Forests Department Western Australia, 1977b; 1978). Professional foresters in Western Australia were at the forefront of awareness and planning for the many values of public forests in the 1960s and 1970s.

Towards the end of my direct association with forest inventory I studied part time for and was awarded another Masters degree, this time in environmental science at Murdoch University in 1983. The thesis component of this research was titled "Firewood and Mining Timber in the Eastern Goldfields" (Williamson, 1983).

After my 26-year involvement in forest inventory, with the formation of the Department of Conservation and Land Management in 1985, I was put in charge of the section dealing, amongst other things, with the preparation of management plans throughout the state for land managed by the new department. This included tropical areas in the north of Western Australia, the reserves in the Pilbara and the reserves in the wheat belt and inland parts of Western Australia as well as the areas covered by the former Forests Department in the South West. It was a chance for me to see parts of Western Australia

from the tropical north to the temperate south. Western Australia is the second largest area¹ of land on earth managed under the same government and has some very interesting and different landscapes across its vast territory.

¹ The largest area of land on earth managed under the same government is Sakha, which is part of eastern Russia.

Chapter 1 Knowledge Foundations of Forest Valuation & Management

1.1 The Rise of Forestry

To the relatively small world population before the 18th century, forests were able to readily supply human needs such as for building materials and hunting. Early inventories of forest information, dating back to the beginning of forest management, towards the end of the Middle Ages, aimed at assessing the total growing stock only (Loetsch and Haller, 1964). This information was satisfactory during the 18th and the early 19th centuries when the demand for firewood was much greater than for sawn timber (Schreuder et al., 1993). However, from around 1800, a concern emerging in Central Europe was a shortage of fuel. This was followed by two centuries of an increasing demand and collection of high quality quantitative information (Brack, 1997), and an age of scientific management emerged, requiring increasingly comprehensive and accurate forest data, clarification of forest management concepts, and finally, forestry professionals who could transform data and objectives into knowledge and performance management.

1.1.1 The Development of Inventory

During the nineteenth century, forest inventory techniques evolved into what could be recognised as modern forestry science. Until that time, simple visual estimation was the only established method of inventory and quite adequate for a trained forester and small stands of forest, although subsequent methods were developed for extrapolation to entire forests. Visual estimates were considered reasonable and inexpensive and were used up until the 1940s in some areas including parts of Europe (Schreuder et al., 1993; Loetsch and Haller, 1964).

During that time also, more scientifically robust sampling techniques appeared, resulting in, amongst other things, the widely adopted linear strip survey method developed in Europe by Av Ström in 1830 who described the technique as an aspect of random sampling (Matérn, 1982). From about 1850, linear strip line surveys became common practice and tree volume tables were compiled for individual species as a

methodology of forestry, which correlated simple-to-measure parameters (e.g., diameter and height or length) and the tree volume to the basal area (Carron, 1968; RIB, 2005). Such surveys were however, not to be adopted in Western Australia until 1917. By the 1940s, sophisticated inventory methods were well established in Western Australia and worldwide, incorporating multi-phase and multi-stage methods with mathematical rigor (e.g., Schumacher and Chapman, 1942). Forestry sampling methods at this time were in advance of mainstream statistical textbooks with techniques such as unequal probability sampling practices (Bitterlich, 1947; Spurr, 1952).

In the 1950s, textbooks of statistically based survey methods responded to the increasing demand for multiple resources and other information to aid large timber industry developments. Then, from the 1970s Geographic Information Systems (GIS) became widely available and have been applied as one or more phases of forest inventories, including remote sensing technologies (aerial and satellite), and advanced sampling (Sandoval et al., 1994; Schreuder et al., 1993).

Strip line surveys as an inventory technique are still used for many circumstances (Wood and Wiant, 1990), but have become more elaborate and have included, for example, double sampling, centroid sampling, and unequal probability schemes such as point, line intercept and point-Poisson sampling (Schreuder et al., 1993). These have found their way into Australian public forest management (e.g., Wood and Wiant 1990; 1992). From around 2000, statistical techniques also evolved to go beyond forestry and encompass broader ecological systems (e.g., Patil, 2001; Gregoire, 2001) as discussed in following chapters.

Inventory has also represented a quantifiable measure of policy considerations of the day as a multivariate indicator of what was considered important by forest managers. Inventory, while an objective and factual record of the physical attributes of the forests and intended as an instrument of policy and management, has also taken on a value *per se* with scientific status. In this context, it has sometimes been regarded as an instrument of the commercial exploitation of the forests, as have other symbols of the status quo such as forestry professionals and public institutions, as discussed below.

In Western Australia as elsewhere, “classical” forest inventory evolved to address the need to know where the trees were, their species and their extent, what condition they

were in and what threatened them, how much commercial timber they contained, and how fast the trees were growing. All this in an attempt to determine how much commercial timber they could continue to produce. Classical forest inventory was a necessary input and the cornerstone of supply-side management of the commercial timber industry, which in turn provided a useful commodity for society.

These developments were all consistent with Lorenz et al. (2005, p. 139) that “*any forest assessment system must have clearly defined objectives, must rely on a statistically sound survey design and must be subjected to strict procedures of data quality assurance*”. The applications of these methods of the physical sciences to Western Australian forests are explored in successive chapters.

1.2 The Assessment of Value

For most of this history, the scientific inventory or measurement of the physical attributes of forest resources entirely satisfied forest management and policy needs, and indeed social requirements. Conventional inventory assessments and related measures of forest value were concerned with the commercial value, namely logging, and later wood chipping, and water conservation. For those purposes, the valuation process needed to be concerned largely with the physical attributes of forests. The evolution of those valuation practices is set out in the following chapters at least for the first 150 years of forestry in Western Australia, and remains a vital element in commercial management for forests.

“*The quality of inventories remains the most crucial element in all value-based approaches to include forest assets in accounting and thereby performance measurement*” (Hogg et al., 2009, pp. 246-247), apparently revealing a commercial rather than an ecological conceptualization of forest value. Similarly “*the quality of forestry data profoundly affects the quality of forestry planning and decision-making*” (Duvemo and Lämås, 2006, p. 327). However, the scope of what is meant by forest value has evolved greatly, and even today, forestry professionals are grappling with the concept of value within the context of broader community participation: “*...forests are valuable, but it seems that as a profession we are still struggling to quantify the true magnitude of this value...part of the reason that forests do not get counted as valuable*

as we know they really are maybe due to the current metrics and tools used for valuation” (Brack, 2010, p. 18). Moore (2006) discussed the difficulty of evaluating a tree, or even establishing standards for doing so, and Turner (2011) considered valuation of a forest reserved for recreation, without recognising other social values.

The means for rigorous estimation of the commercial value of a forest resource did not exist at the time of settlement and the ‘modern’ most widely recognised valuation method, the ‘Faustmann model’, did not appear until 1849. It provided a mathematical model for optimisation of management decisions regarding when to harvest a forest rotation (FOPER, 2014). Furthermore, the relatively low esteem held for Australian timbers, at least for the first fifty years of settlement, would have made considerations for more specialist knowledge seem superfluous. The meaning of forest valuation and management in themselves were, and often remain, ambiguous.

In terms of the Faustmann model, the objective has been to maximize the net present value of a forest as a harvest. This model factors in the discount rate with the growing cycle to give an optimum commercial yield when the cycle equals the discount rate. However, for slow growing hardwoods, the appropriate discount rate itself may be uncertain, and may be ambiguous. For example, it has been suggested that forest valuers need two separate discount rates when valuing a forest: a relatively high one for timber products where the revenue occurs in the future and a low one for carbon products where only the costs occur in the future (Brack, 2010). Numerous other factors can also intervene as discussed by Amacher et al. (2009). However, the discount rate itself is a commercial construct that is market linked and tax adjusted in which ‘long-term’ equals five years (Manley, 2010, p. 21) and where the market expects a return on investment within ten years. The Faustmann model also is sensitive to changes in the objectives, policies and values such as with emissions trading schemes (Manley, 2013).

Foresters have tended to value trees and forests in terms of scientific variables that can be quantified. For example, Albrecht (2001) referred to tree valuation as a process that can be measured on a cardinal scale of monetary units: *“people fail to treat trees as assets that have a monetary value just like a building or a motorcar and it is for this reason that arguments to protect trees are lost...the purpose of assigning a monetary value to amenity trees is to provide a means of objective, repeatable and consistent valuation”*. However, Albrecht (2001) appeared to be unaware that some social values

might not be amenable to cardinal measure. Foresters and ecologists alike have tended to regard forest management as a scientific discipline in which humans are a separate aspect and even an obstacle (Grumbine, 1994), and if they are to be involved at all, it is to the extent required for forest managers to address the politics (Grumbine, 1997). Brack (2010, p. 20), himself a forester, advocated that it was time to change the whole basis of the valuation of forests, and that “*the view of the forest value has been blocked for too long by the wood in the trees*”.

1.2.1 Social Values

In Western Australia, following settlement in 1829, the dominant value of forests was for commercial timber production and water catchment protection, until the 1960s when other values such as amenity, recreation and aesthetics became of increasing community relevance and policy significance. Social values² held by the broader community evolved to become a major ingredient shaping forest management and challenging (and continuing to challenge) forest policy, as well as forcing the creation of new institutional arrangements. This, to some extent, echoed the response of forest use in other states of Australia and by other countries of the developed world including the USA, Canada and Europe. Here, community is defined as people living in the same place (i.e. proximate to the forests of the south west), having an interest in these forests, and/or sharing a common system of government (in this study the Australian Government) (as per the Oxford Dictionaries @ <http://www.oxforddictionaries.com/>).

For the first 130 years after settlement in Western Australia, these broader social values towards forests were hardly present. Although the concepts of environment and the familiar causes of conservation were not foreign in those years, only a few scattered individuals expressed concern for non-commercial values - a reality bemoaned by Charles Lane-Poole (1922). From the 1960s, however, societal values changed and transformed the policy and management environment for Western Australian forests. Traditional commercial values, previously unchallenged and largely commonly held by all stakeholders, came to be seen by many as a threat to alternative or even higher values. Forest policy and management were increasingly conceived of as having a social

² For the sake of brevity, forest ‘social values’ will refer to non-extractive activities and reserves, recognizing that within these there is a great variety of incompatibility such as between some cultural, ecological and tourism values.

dimension involving conscious consideration of the norms, values and beliefs in the community (Bengston, 1994; Mather, 2001; Lane and McDonald, 2002; O'Brien, 2003; Cashore, 2009).

The consideration of the range of social values has represented a fundamental shift in thinking about forest management. This has involved a move away from 'multiple use' and 'ecologically sustainable' approaches to resource management, where values such as recreation, biodiversity and timber are achieved primarily by designating particular areas for them, toward a more overt concern for the relationship between these broad goals of management and the values, beliefs, norms and needs of society (Lane and McDonald, 2002).

Social values (and paralleled by ecological values) are far less amenable to measurement and assessment using objective, quantitative approaches, even though they may be a critical element of scientifically based management. Therefore, the evolution of social values regarding forests has tested measurement, management and policy frameworks, which initially sought to add these values into the conventional framework as a further quantifiable dimension of sustainability. New forestry paradigms have subsequently been required to include information collected using methods extending well beyond classic approaches to forest inventory of measuring stand volume as well as embracing broad-based and inclusive consultation, increasingly dominated by non-commercial values and consideration.

These emergent social values conceived for forests almost inevitably implied conflict due to value conflicts arising (where a resource or natural area is simultaneously valued in numerous ways and through various interests), which often implied mutually exclusive policy and/or action (Trainor, 2006). A new lexicon was required to articulate these concepts. In particular, Trainor (2006, p. 3), for environmental considerations, described "*realms of value*" within which there may be comparable and commensurable concepts but which are incomparable and incommensurable between realms. For example, within the realm of commerciality, forests could be assessed in terms of cut sustainability, the cost of silvicultural systems and market values. However, within the realm of amenity the forest values may be assessed in terms of natural beauty, biodiversity and cultural significance-factors. These measures seemingly cannot be compared alongside, or at least on the same scale as, those in the realm of

commerciality. On the other hand, despite some recreation and amenity planning, forest industries have tended to consider environmentalism as a nuisance as noted by Edenhoffer and Hayter (2013, p. 377): “*over the last several decades environmental imperatives have been an increasing concern, environmental non-government organizations are a powerful lobby and, stimulated by an array of environmental policies, the greening of the economy, an insistent, if still problematic trend*”.

The conservationist message (international and domestic) has taken its toll on the established timber industry by the turn of the 20th century as observed by Dargavel (2005, p. 40): “*Forestry was forced to change, and when it did not do so sufficiently its organizations were replaced politically until it did*”. Consequently, foresters needed new skill sets to plan and manage within such an environment that now included more than physical science. Assessments were needed of social values themselves, however defined. Furthermore, it should not be presumed that the values paradigm can be constructed by a dichotomy between physical sciences and social values. Endter-Wada et al. (1998) considers that this is a false dichotomy and that forest valuation and management policies require an integrated approach. These issues are discussed extensively in the following chapters.

First, however, an explanation of how social values are considered in this thesis is required. The concept of value has a rich history in the social sciences, with no universally agreed definition. Most scholars begin with Milton Rokeach’s (1979) definition, that values are core conceptions that guide not only action, but also choices, attitudes and attributions of causality. There is broad agreement that values are core human attributes and that they are often enduring. Beyond this, definitions vary according to the discipline of enquiry. Philosophy, anthropology, sociology, ecological economics and environmental science all consider the term in different ways (Reser and Bentrupperbaümer, 2005; Song et al., 2013).

Some commonalities are evident, however, beyond this multitude of uses and resultant lack of clarity. The environmental literature typically classifies values as either assigned or held. The focus of this thesis is ‘assigned values’: “values that people attach to things, whether they are goods such as timber, activities such as recreation, or services such as education” (Lockwood, 1999, p.382). ‘Held values’ are much more abstract and are closely aligned with Rokeach’s (1979) intent. They are much more abstract – as

principles or ideas “that are important to people, such as notions of liberty, justice or responsibility” (Lockwood, 1999, p.382).

Brown (1984) described held values as fundamental underlying ideals that help prioritise modes of conduct or desirable qualities, such as loyalty, bravery, fairness, and beauty. Held values are believed to influence assigned values through their role in subjectively evaluating objects (Brown, 1984; Lockwood, 1999; Brown and Weber, 2012). Assigned rather than held values have been suggested as more useful for examining values, specifically in relation to specific sites (McIntyre et al., 2008; Seymour et al., 2010). The idea of assigned values having a ‘geography’ (Davies, 2001, in McIntyre et al., 2008) is based on the recognition that they are place-based. The spatial context of assigned values implies that value can be ascribed at a number of scales from narrowly site specific to much broader ecosystem, regional, national or global levels (McIntyre et al., 2008).

Knowing about assigned values is important for natural resource managers, including forest managers, because these values influence peoples’ concerns and aspirations for a place, and their behavior at that place, now and in the future. Peoples’ responses to proposed changes in policy and management are also influenced by the values they assign to natural resources and places.

1.2.2 Forests Reconceptualised

As part of this forest history, the concept and definition of an Australian forest was itself critically reviewed, including, for example, concepts and definitions as reported at and described in the Forest and Wood-Based Industries Conference (1974), Specht et al. (1974; 1995), the National Forest Inventory (first published in the Resource Assessment Commission's Forest and Timber Inquiry (Resource Assessment Commission, 1992)), the National Forest Policy Statement, and in the current State of the Forests report (National Forest Inventory, 1998).

The notion of a forest in Australia evolved since the time of European settlement: from *“an informal concept in the 19th century through several definitions in the 20th century; and from discursive descriptions of species under headings of structure, to quantitative definition of only those forests potentially commercially harvestable”* (Hnatiuk et al.,

2003, p. 176). The first formal and authoritative description of Australian forests was by Diels (1906), who provided detailed botanical classifications of these ranging from tropical and sub-tropical forests to savannah and a number of other types.

Initial presumptions were that classifications such as rainforest, savannah woodland, mallee scrub and grassland were self-explanatory (Diels, 1906). During the early settlement years, the then non-scientific term 'forest' in parts of eastern Australia until at least 1868 was: “*A tract of open, well-grassed land with occasional trees or stands of trees*” (Ramson, 1988). Later scientific work demonstrated that the early views were the most appropriate - woodlands and commercial forests were not separate entities based around commercial values, as had been advocated at the Forest and Wood-Based Industries Conference (1974). The United Nations Environmental Programme (UNEP) acknowledged that the definition of a forest is not straightforward and varies widely - Lund (as cited in UNEP, 2014) reported more than 800 definitions worldwide depending on usage and policy.

A scientifically robust and nationally agreed National Forest Inventory definition of forest based on the National Forest Policy Statement has now been established for Australia, and has provided the basis of extensive inventory work by the States and Territories: “*Australia’s forests are defined as vegetation that has a height of 2 metres, crown canopy cover of at least 20% and a minimum forest area of 0.2 hectares. Forest cover is identified by remote sensing techniques explained in detail in Australia’s National Inventory Report 2009, Volume 2. Australia’s forests are largely dominated by eucalypts and occur within a range of tenures, with differing social, economic and ecological values*” (Australian Government, 2014, p. 1).

1.2.3 Professionalization

Inventory or stocktaking in itself did not provide sufficient knowledge to ensure sustainability, but has been a necessary part of that knowledge. Stocktaking had to be converted into a detailed understanding (scientific knowledge) of how each ‘stock’ of interest behaved, including a knowledge of the threats it encountered and how, in the case of forests, it regenerated and grew. For forests, the main threats have been fire, disease, insects, cutting, and clearing-mainly for agriculture, industry and urban expansion. Following the essential first step of inventory, the development of scientific

knowledge of risks and threats and how to minimize their impacts enables sustainability of the resource and its values to be planned. This detailed scientific understanding forms the second key element after inventory for resource management, and requires corresponding professional skills.

At the time of settlement, forestry was not generally regarded as a specialist profession. Inventories needed only to be at the rudimentary level, and would have been undertaken, on an *ad hoc* basis by explorers and others, and, in early Australian settlements, were needed primarily to determine only whether individual (low capacity) sawmilling operations would have ready access to sufficient feedstock. Interpreting these data were considered obvious and straightforward.

Since then, forest management and policy has become highly specialised and multi-disciplinary, with respect to both supply and demand. On the supply side, forestry has adopted new technologies that have greatly improved data collection and forest surveys, risk management and planning, while in terms of demand, the emergence of social values have transformed the political environment within which foresters needed to respond. For example, Dargavel (2005, p. 42) reports: *“the management of both the natural forests and plantations became far more sophisticated during the 1990s as advanced planning methods were developed, and research led to intensive methods for plantation management. More disciplinary skills were needed and recruited into multi-disciplinary teams that include, but are not restricted to foresters.”*

1.2.4 Forest Management Objectives

For almost one hundred years, the forests in the South West of Western Australia were harvested without any concern for regrowth or the perpetuation of a cycle that was presumed in any Faustmann model of asset valuation. Realisation grew that preservation of value, however defined, for future generations required State regulation and professional management. Where the objective included the preservation of other values, in addition to commercial interests, then the challenges and ambiguities multiplied accordingly.

“Forests are more about people than trees”. This was one of the first pronouncements by Bruce Beggs³ when he became Conservator of Forests in 1972, and is a clear pronouncement of an emerging political issue. It demonstrated that by that time the Forests Department was very well aware that forests could provide much more than timber and that recreation and nature conservation could be added to timber conservation in public forests. Beggs was Conservator of Public Forests, which his department - the Forests Department of Western Australia - managed on behalf of the community. Therefore, it seemed reasonable that the expectations of the community should have been considered in the management of those public forests.

Forestry today is about a multitude of things including conservation, recreation, risk management, and politics. This transformation has been driven by interaction between farmers, saw-millers, politicians, non-government organizations, the general public and their expectations, as well as international trends. All of these have been evident in the evolution of forest management in Western Australia. Therefore, to complete the management and policy framework, knowledge is now required about the social values and expectations that stakeholders (society, landowners, loggers, tour operators, conservationists, etc.) attribute to the resource, its uses, preservation and sustainability. Some but not all of these values relate directly to the physical attributes being inventoried.

Some other values may find proxy measures amongst the physical attributes, while understanding others will not be able to be satisfactorily drawn from any conventional physical forest inventory in a way that provides meaningful guidance to forest policy or management. These values, measured or unmeasured, have become very real parts of the management framework, and accordingly have changed the requisite skill-set of forestry professionals. They have frequently been in tension with traditional elements, as represented in Figure 1.1, which represents a balance between stakeholder rights, and the roles of scientific management, information and values, although the concept of a ‘balance’ is itself contestable as will be discussed in subsequent chapters.

³ Bruce Beggs was conservator of forests in Western Australia from 1972-1983.

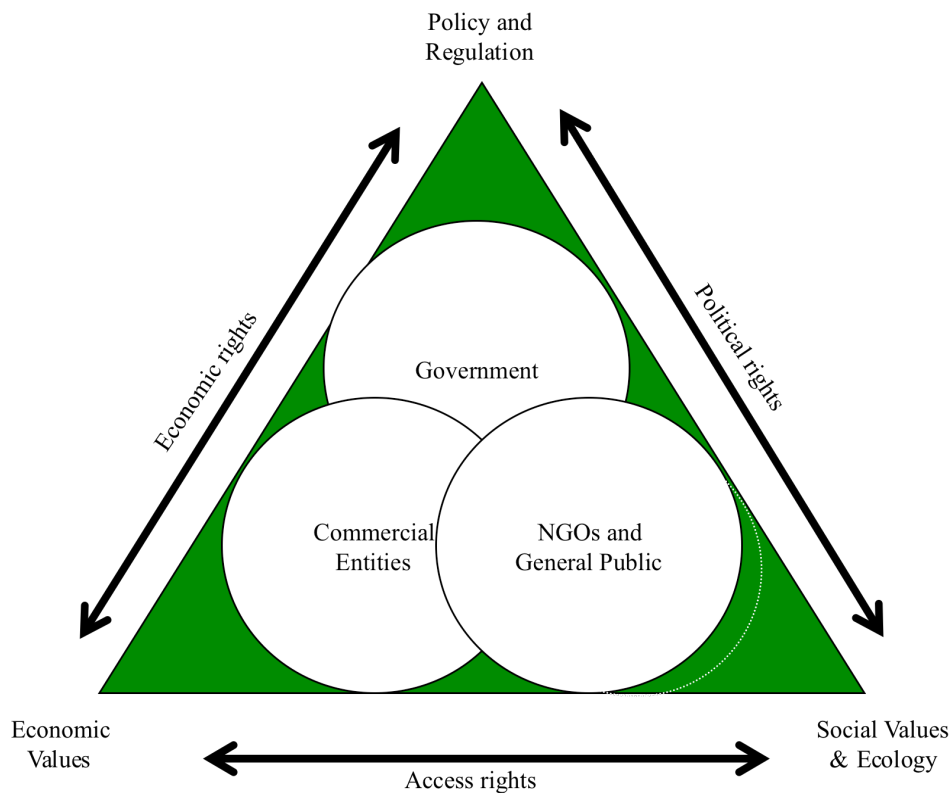


Figure 1.1: Conceptual Framework of a modern Forest Management Environment.

Thus, forest inventory should provide the scientific information needed to manage a forest estate for the values that have been attributed to it. To the extent that inventory (or measurement) does not capture a value attribute of importance to stakeholders, this does not imply that inventory is in principle irrelevant, but rather broadening may be needed to encompass the need for assessment drawing on multiple forms of knowledge beyond more traditional inventory-based approaches. Here assessment is defined as accessing the range of kinds of knowledge required to manage forests sustainably. For example, broader assessments (beyond forest inventory) reliant on multiple forms of information informed Australia's regional forest agreement processes (R. Ford, University of Melbourne, pers. comm., 2015).

The measurement and management of forest values including social values, and how these can be effectively assessed or inventoried and put on a policy or professional footing, is a management challenge. Without this, the only remaining avenue for unmeasured or unassessed values to influence the management and policy processes

may be through the frequently fickle political framework. This thesis explores this challenge through the history of public forests in the South West of Western Australia.

1.3 Thesis Outline

The title of this thesis - *A History of Inventory and the Assessment of Value in Western Australian Forests* - needs some explanation. As discussed above, *Forest Inventory* refers to the information needed to support the forest policy objectives for the area, and reflects that policy. Forest inventory throughout much of the history of forest management has included gathering of information about the extent, species, condition and values of the forest, its growth rate and stand dynamics, as well as threats such as disease, pests including invasion by exotic species. The amount of detail is determined by the particular policy requirements for the area. Forestry has to do with land management, and most forest inventories need a geographic location (a map) to convey its full importance. The focus of this thesis is the South West of Western Australia, because it is here that commercial stocks of timber are available. Elsewhere in the State, the rainfall is generally too low to support forests of commercial value, although some species of smaller stature such as sandalwood and cypress pine are commercially harvested there.

Values concern the values held about forests by stakeholders. The extent to which these forest values are included in forest policy, forest management, or forest inventory depends on the extent to which those in the community supporting those values are heard, listened to, or can have their views accepted. Forests, while traditionally managed for commercial purposes, could equally be managed in terms of another value chain. When forests are managed for more than one major value, the realm of multiple use forestry and management priority areas has been entered. The more forest values that are to be managed, the more comprehensive a forest inventory and policy needs to be. However, the link between information about forests and policy may not be direct, causal or linear, often political and social concerns of the day mediate, temper and intervene in this relationship.

This thesis studies the evolution of commercial and social values and the forests of Western Australia (Fig 1.1) for the period from European settlement (1829) to 2010. For

this almost 200-year period, this thesis considers how commercial and community values, and key players, have influenced, and have been influenced by forest exploitation, forest management and forest inventory. For these purposes, a definition has been developed here for forest inventory for public forests as: *The collection of information about a forest that is needed to manage it according to the reasonable expectations of the community.* ‘Reasonable expectations’ here mean that: *the expectations are environmentally sound, socially acceptable and economically feasible.* The thesis also, crucially, goes beyond conventional inventory to address social values, and develops an assessment methodology for social values so they can be explicitly included in decision-making.

1.4 Research Objective

The study is concerned with the age of exploration, through the nineteenth century, to the early 21st century. The focus is on the public native forests of Western Australia and the evolution of values and expectations about those forests. The concept of inventory is considered and whether this can be complemented with an assessment of community expectations in a way that is useful to management and policy. The study also comments on what changes to management methods and professional skills, if any, are required for forestry to retain its relevance and fulfil a broadly accepted role. Some contend that foresters have always been comfortable with such roles: “*One of the strengths of the foresters' education is the attempt from our professors of old to provide a social context for forest management*” (Perley, 2003, p. 11), while others (e.g., Dargavel, 2005) have espoused the view that forestry has been too cosy with the timber industries and has changed only when it was forced to do so.

In summary, this study explores how the assessment of forest values over the two hundred year history of forestry in Western Australia has been increasingly informed by measurements made beyond the objective, quantitative rubric of forest inventory with its central interest in timber values. Of particular focus in this thesis is the subject matter and scope of measurement, and related knowledge development, how these have changed and as such, how can forestry as a profession adjust to and embrace these changes.

1.5 Thesis Scope and Structure

This study deals with the public forests of Western Australia. This chapter has sought to identify the concepts that have governed the management (or neglect) of these forests for almost two hundred years: notably the development and application of physical inventory of the forest and then on community consultation and survey. During this time, the very concept of a forest in Australia has gone through evolutions as has the scientific and management understanding of these assets. The concept of forest value has perhaps gone through the greatest transformation of any aspect of these forests. These issues will be explored and discussed in the following chapters.

The ordering of the remainder of this thesis closely reflects the five phases proposed by Botkin (1995) for the history of exploitations of the New World, and is mirrored by the history of forests in Western Australia, namely:

- (i) Discovery.
- (ii) Intense exploitation - associated with mining and land use conversion, or at least high grading of forests with little thought for the ecological (or social) consequences.
- (iii) Awakening conservation - associated with the first attempts at rational, scientific-based management of wild, living resources often with single or limited utilitarian purposes.
- (iv) Environmentalism - associated with the growth of public awareness of environmental issues.
- (v) An eventual synthesis (partly speculative by Botkin (1995) but also by Perley (2003) and Brack (1997)) between humans and their new environment (becoming 'native' to a place) - associated in the current age with a number of trends in science, management, values and metaphysics.

Chapter 2 - Discovery and Early Forestry (Discovery to 1850) - reviews the discovery of the South West of Western Australia by European navigators, the consequential settlement that was established at the Swan River settlement (now Perth) in 1829, and

the colonial attitudes and exploitation of the forests of the South West prior to mechanisation in the timber industry in the mid-nineteenth century. The value assigned by the colonial society to the forests at that time was minimal and even negative. The earlier use and understanding of the forest by aboriginal people over the previous 40,000 years, including their use of controlled fire, is also acknowledged. Information for this chapter was largely sourced from written materials held in the WA State Library.

Chapter 3 - Forests as a Valued Resource (1850-1919) - addresses the commercialisation and unregulated exploitation of the forests leading to both an economic success for the early settlement and growing concerns regarding resource sustainability. The influence of experts and public enquiries, documented from extensive reviews of royal commissions and government-led reviews, is reported. The findings from these inquiries and ongoing pressure from influential experts contributed to the formation of the Forests Department in 1919, following the passing of the Forests Act in 1918 (Government of Western Australia, 1918). Both actions subsequently placed the forests and the associated timber industry on a scientific footing. Despite some individual protests, the broad public at that time continued to regard the forests as a purely commercial opportunity but otherwise of low value. As a commercial opportunity, however, the forests were considered to be of great value with substantial economic potential. Information for this chapter, again, was largely sourced from written materials held in the WA State Library.

Chapter 4 - Forest Inventory and Scientific Management (1919-2010) - discusses the development of a managerialist culture and capability within the Forests Department and the increasingly sophisticated forest inventory methods and the emergence of a forest management philosophy. Included are descriptions of forest inventory associated with the development of scientific forestry in this period including the development of the forest management information system (FMIS) and the forest working plans and management planning. This discussion covers in detail the period from 1920 to the amalgamation in 1985 of the Forests Department Western Australia, the National Parks Authority and the Wildlife section of the Department of Fisheries and Wildlife to form the Department of Conservation and Land Management (CALM). Additional information on planning and policy changes and associated changes in forest inventory

in the period 1985-2010 is provided towards the end of the chapter. The Regional Forest Agreements, which institutionalised the requirement for social data, are briefly described. Information sources for this chapter included departmental files, public inquiries, newspaper articles and the author's professional experience.

Chapter 5 - Emergence of Community Values and Activism - addresses the transformation in the valuation of forests as held by the broad community. Particular attention is paid to the 1960s and 1970s as a time of rapid transformation that saw a fundamental split between the concept of value and that of commerciality, and the awakening of concern for the environment with the rising national and international activism during that time. These developments not only saw the emergence of social values of forests into the political mainstream, but also a reappraisal of the meaning of value itself. Information sources for this chapter, similarly to the previous one, included departmental files, public inquiries, newspaper articles and the author's professional and personal experiences.

Chapter 6 - Community Expectations of Public Forests - A Survey Tool - describes the author's original survey work undertaken to determine contemporary attitudes to public forests. This study sought the values and views of stakeholders who are interested in being involved in decisions about managing publicly owned forests in Western Australia. The virtues of a one-on-one survey that includes interviews are described. Those surveyed included young people and indigenous people as well as environmentalists, academics, timber industry representatives, foresters, rural residents and others.

The major innovation of the survey was that each person surveyed was required to indicate the level of support for each of 176 items describing a comprehensive range of activities associated with public forests in Western Australia. Most of those activities were presented in terms that a layperson could readily understand. The activities were then grouped into more generalised sets. This contrasts with other surveys for forests in other parts of the world, which have required an indication of support for generalised sets of values without a detailed indication of what those sets contain. A generalized approach runs the risk that those surveyed do not always understand what the generalised terms mean (e.g., use, non-use, recreation, aesthetic values) nor what in detail those sets consist of, and so the responses may not give clear consistent guidelines

for forest management. The approach outlined in Chapter 6 could reasonably form the basis for regular repeat surveys to assess and monitor changes in community expectations regarding public forests.

Chapter 7 - Forestry at a Crossroad - considers the bi-polar characteristics of the traditional forester's role in a public policy space that is heavily influenced and even dominated by social values, which have little to do with the former concepts of scientific forest management for sustainable logging. The policy environment now poses a challenge to the role of forestry. Whether forestry will adapt to this is a question being raised by foresters and social scientists alike in other jurisdictions, such that there is now, amongst other things, suggestions for reform of foresters' training.

Chapter 2 Discovery and Early Forestry (“Discovery” to 1850)

The major component of the forests in Australia, the eucalypts, began to appear in the geological record in the Palaeocene about 65 million years ago (Bevege, 2010). The ancestors of the contemporary Noongar people, the aboriginal people of the South West of Western Australia came to know the forests well and to respect them. More recently, the forests became superficially known to the navigator-explorers from the northern hemisphere. More recently still, the early European settlers also came to know the forests through observation, use and inventory.

Figure 2.1 shows the locations of the places in the South West of Western Australia mentioned in this chapter and thesis. Figure 2.2 illustrates the region of South West Western Australia (also see Figure 2.1) relative to the rest of the country as well as locations outside this region mentioned in this chapter and thesis.

2.1 The Earliest Inhabitants

Even before navigators from Asia or Europe sighted the coast of the ‘Great South Land’, Australia’s first known human inhabitants were living here at least 48,000 years ago as evidenced by aboriginal artefacts found in Devil’s Lair Cave near Margaret River in Western Australia (Dortch, 1976). As hunter gatherers, their knowledge of the forest would have been extensive and their names for the local trees have been perpetuated in many of the present day common names used in the South West of Western Australia including those for the well-known eucalypts, jarrah (*Eucalyptus marginata*), marri (*Corymbia calophylla*), and karri (*Eucalyptus diversicolor*).

Hallam (1975) has written extensively on the importance of the use of fire by the hunter-gatherer people and Ward (1997), with his study of *Xanthorrhoea preissii* (then known as blackboys and now both as Balga and grass trees), has also shown that the Noongars, the aboriginal people from the South West of Western Australia, regularly burnt the jarrah forest at two to four year intervals (Ward, 2010) possibly to provide fresh growth to attract their prey and to make hunting easier. The inventory of the areas

to be burnt would have been inscribed in their memories from the previous season's hunting. A recent publication has described how aborigines successfully managed the land to keep it healthy and to keep themselves in harmony with it, including an astute management of regular burning of the bush (Gammage, 2011).

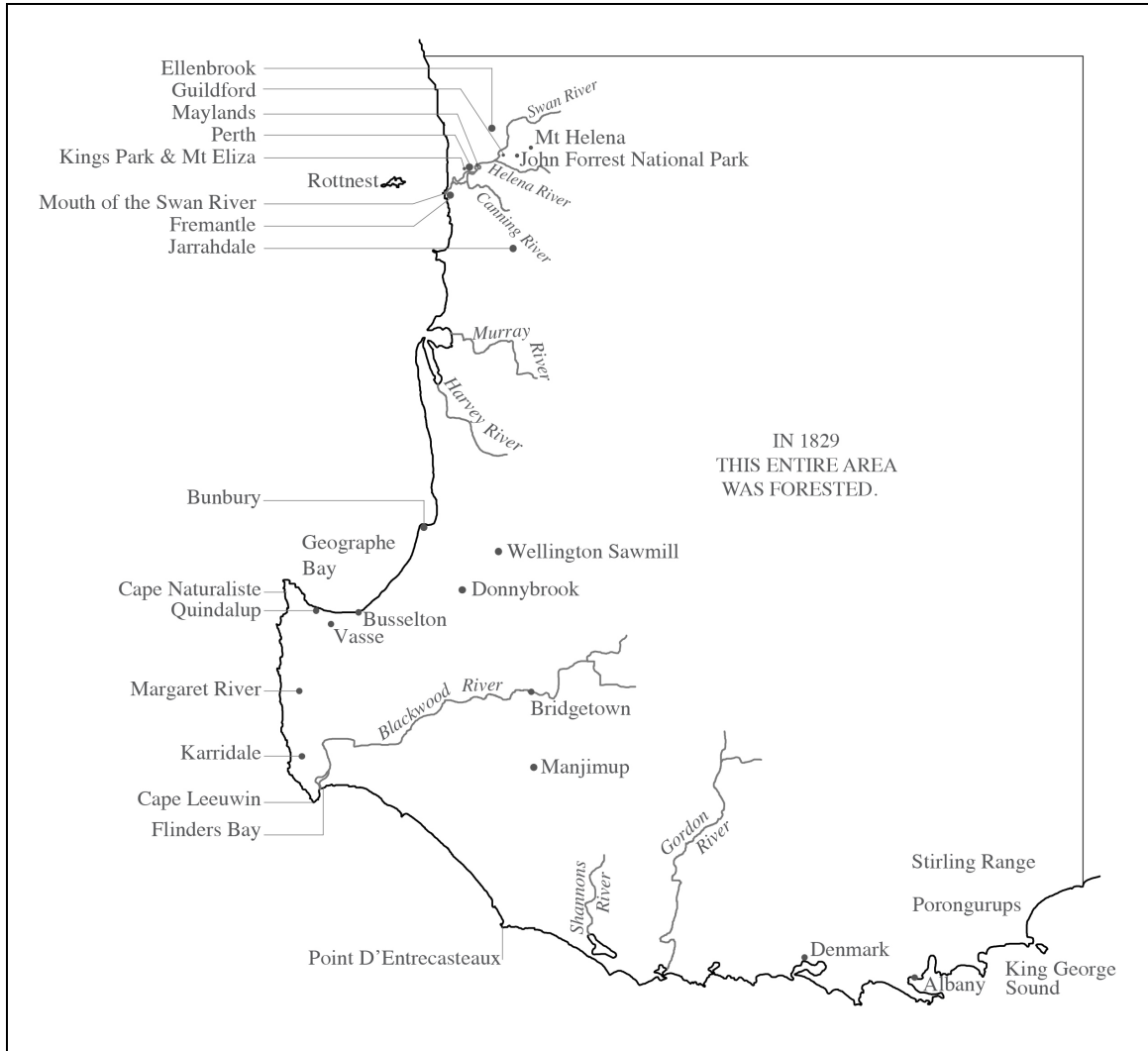


Figure 2.1: Localities in the South West of Western Australia as mentioned in this thesis.

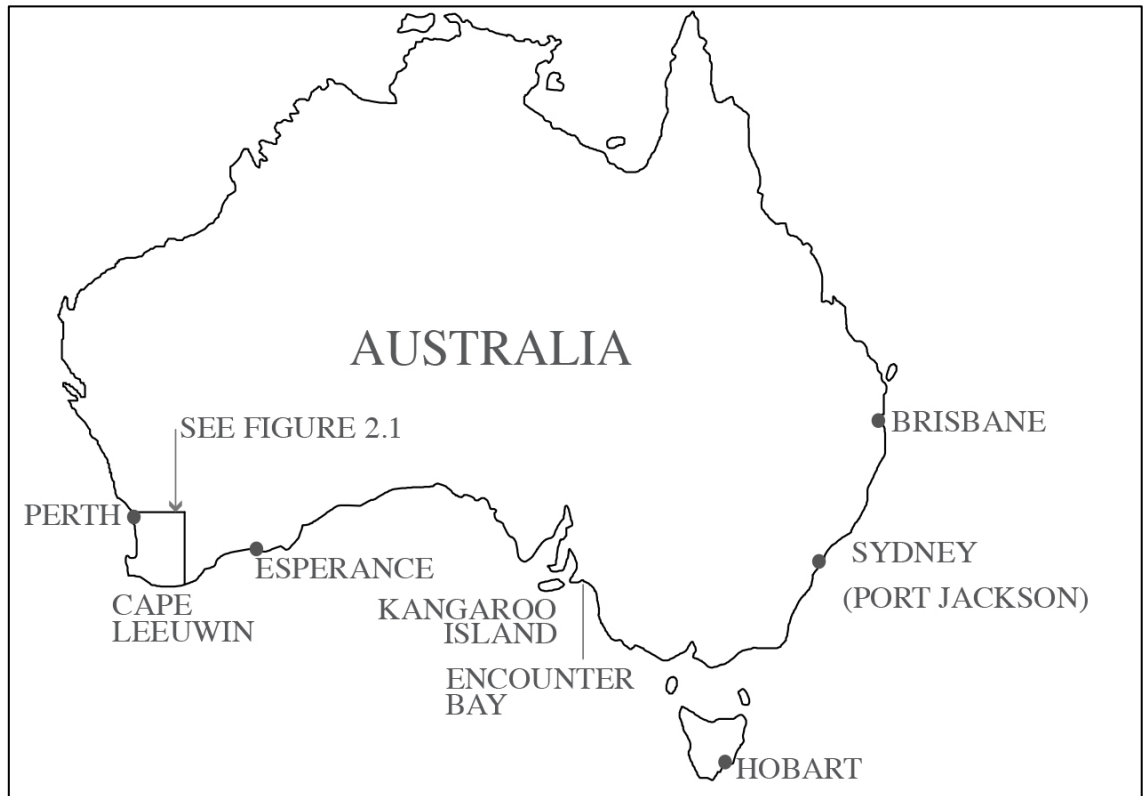


Figure 2.2: Localities outside the South West of Western Australia as referred to in this thesis.

2.2 Navigators and Explorers

Fortune-seeking, trade, military advantage, the possibility of establishing colonies, and (partly) scientific curiosity, drove a succession of landings on the Western Australian coast and the first contact with the South West forests by northern hemisphere observers in the 17th century. A controversial claim has been that the Chinese Admiral Hong Bao's fleet made landfall near Bunbury, about 200 kilometres south of Perth in 1422 (Menzies, 2002)⁴. If the Chinese did make landfall near Bunbury as Menzies suggested, there is nevertheless so far no evidence of any description by them of the forests nearby. It seems that none of the early explorers gave major consideration to the forest assets that they would have seen, perhaps because timber assets would have been perceived quite differently at that time due in part to the technological and logistical difficulties of extraction from a dry continent.

⁴ Menzies claim is strongly contested by many historians. See Finlay (2004).

Voyages by the Portuguese, Dutch, French and English in the 1600s, 1700s and 1800s, inspired both by the Enlightenment's search for scientific discoveries and the colonial appetite of nations who wished to control the trade that they hoped would follow from any new discoveries, resulted in the first documented sightings of the coasts and forests of the New World. The Dutch ship *Leeuwin* in 1622 rounded the Cape since named after it and proceeded eastwards as far as King George Sound. Francois Thyssen in the *Gulden Zeepaard* sighted the coast near Cape Leeuwin in 1627 and examined the coast eastwards naming it Nuyts Land. No comments about forests were recorded from either of these voyages (Battye, 1924). Vlaming landed at Rottneest in December 1696 and, in January 1697, on the mainland and discovered and explored the Swan River upstream for several days. He noted black swans (the first sighting of black swans by Europeans) and smoke from aboriginal fires but "*found neither good country nor seen anything of note*" (Battye, 1924, p. 41), suggesting that he also attributed little value to the forests that would have dominated the landscape at that time.

2.2.1 Scientific Expeditions

The French Admiral D'Entrecasteaux made the first scientific expedition to the region in 1791. Hamelin Bay near Augusta, Cape Naturaliste near Dunsborough, and Geographe Bay were named after Captain Hamelin and his ships *Naturaliste* and *Geographe*, which carried Nicholas Baudin on a scientific expedition in 1801. Leschenault Inlet, where Bunbury stands today, was named after Baudin's naturalist Jean-Claude Leschenault de la Tour. The Baudin expedition was followed in the same year by Lieutenant Lewis de Freycinet and his vessels the *Casuarina* and *Uranie*. The French and the British navigator-explorers from 1772 to 1827 made 12 voyages that sighted or landed on the South West coast of Western Australia and had the potential to discover the forests there. Not all those actually landed and explored the coast beyond, and of those who did, very few made favourable comments about the trees they saw. Despite these expeditions being essentially scientific and these locations being heavily forested, the forests attracted little if any comment.

However, three who did land and made positive comments were the Frenchman Milius from the *Naturaliste* concerning the trees near the Swan River in 1802, and the New South Wales government botanist Fraser, and his leader, Captain Stirling, in 1827 who

gave a glowing account of the potential for agriculture and of the forests beyond the Swan River: “*wood is here abundant for the use of Ships*” with potential for export to Asian markets, while in a later visit in 1838 he described the karri forests to be “*of the finest description for shipbuilding*” (Stratham-Drew, 2003, pp. 83-85, 108, 350).

The judgement of Fraser and the reports from Stirling on the quality of the timber, at least for ship building purposes, would require endorsement from Lloyd’s of London (UK)⁵ many years later before they were to be considered creditable. Furthermore, these general impressions were not supported by any survey or statistics regarding the extent of the forests and it is not possible to glean the degree to which they were impressed by timber resources versus perceived agricultural potential. The account relating to the agricultural potential also proved to be unreliable. The English Captain George Vancouver, who commanded the ships Discovery and Chatham, was sufficiently impressed by the landscape to take possession of it in the name of his king, although there is little evidence that it was the timber assets that attracted him, rather he was impressed by the qualities of King George’s Sound as a harbour.

If the navigator-explorers had seen the giant, statuesque trees of the karri forest then it seems likely that this would have been both recorded by them and noted by Battye (1924) and Marchant (1982). Table 2.1 shows a chronology of those early events. It could be considered that the fact that Battye and Marchant as secondary sources did not note many comments about trees and forests by the European navigator-explorers, may have been an indication that neither Battye nor Marchant were themselves interested in the subject⁶.

⁵ Lloyds of London. For ship and cargo insurance since 1688. Retrieved from <http://www.lloyds.com/lloyds/about-us/history>. (14.3.2011)

⁶ Battye (1924) refers to timber on seven pages although neither Battye (1924) nor Marchant (1982) make specific reference to forests or the environment.

Table 2.1: Discovery and Exploration of Forested Coasts of Western Australia

Year	Event
48 000 B.P.	Aboriginal (Noongar) drawings or artefacts in the Devils Lair cave near Margaret River in South West Western Australia.
1422 A.D.	Chinese Admiral Hong Bao may have landed near Bunbury.
1606	Those on the <i>Duyfken</i> were the first Europeans to sight Australia (in Torres Strait between north eastern Australia and New Guinea-far from the forests of the South West of Western Australia).
1622	Those on the <i>Leeuwin</i> were the first Europeans to see the South West coast of Western Australia-from Cape Leeuwin to present day King George Sound
1627	Those on the <i>Gulden Zeepard</i> saw the coast beyond Cape Leeuwin then sailed eastwards.
1696-1697	Vlaming landed on Rottnest Island, named it, and explored the Swan River.
1772	St Alouarn on the <i>Gros Ventre</i> landed at Flinders Bay.
1791	Vancouver named King George Sound.
1792	D'Entrecasteaux on the <i>Recherche</i> and Huon de Kermadec on the <i>Espérance</i> sighted Cape Leeuwin and explored the land near Esperance.
1801-1803	Baudin in the <i>Geographe</i> and Hamelin in the <i>Naturaliste</i> charted the South West and south coasts of Australia.
1802	Flinders charted the south coast of Australia sailing eastwards in the <i>Investigator</i> and met Baudin at Encounter Bay.
1818	Philip Parker King landed at King George Sound (present day Albany W.A.), with surveyor Roe and botanist Cunningham.
1826	D'Urville in the <i>Astrolabe</i> arrived in King George Sound in October.
1826	Lockyer in the <i>Amity</i> settled at King George Sound with convicts from Sydney.
1827	Stirling and botanist Fraser explored the Swan River upstream to Ellen Brook.
1829	The Swan River colony was proclaimed in June 1829 by Captain Stirling as Lieutenant Governor.

If comments about trees or forests had been a significant aspect of the observations of the European navigator-explorers, it is highly likely this would have been noted by Battye (1924) or Marchant (1982). It seems reasonable to conclude that the European navigator-explorers, with the exception of Milius, Fraser and Stirling, to whatever extent they encountered forests, were not overly impressed. In any case, the focus of the first navigator-explorers was on charting the coastline to make future voyages less dangerous, on collecting specimens of animals and plants, including trees, and on searching for fresh water as well as judging the areas for their potential as places for agricultural settlement, for this was the Age of Colonization as well as the Age of Enlightenment.

2.3 Early Settlement and the First Inventory

Captain Stirling as Lieutenant Governor proclaimed the Swan River settlement at Fremantle on 18 June 1829. The colony was established on the west coast of Australia, largely (as noted above) because of Britain's fear that the French may have had eyes on this part of the world⁷ as a base for trade with the Spice Islands and as a stepping stone for their interest in the Pacific. However, the decision to establish the British colony on the Swan River was largely due to the enthusiastic report sent to Britain by Stirling following his 1827 exploration of the Swan River with the botanist Charles Fraser. It seems most likely⁸ that the primary interest of the French was scientific. Although they

⁷ Battye (1924, p.71) quoted a letter from the Secretary to the Admiralty sent to the Colonial Office dated 2 August 1828, that supported the idea that transferring the establishment at King George Sound to the Swan River was to thwart any attempt by other nations, especially the French, to colonise the western part of New Holland. Furthermore without a British settlement on the western part of the continent, the small settlements on the east coast at Port Jackson, Hobart and Brisbane may not have been enough, under international law, to maintain a British claim.

⁸ Marchant (1982) considered that the presence of the French in southern waters was more likely due to their interest in scientific matters as a result of the influence of the Age of Enlightenment than any colonising intention. "*In the records of the accounts of the French (Baudin) mission, there is a further reference to political motives which adds weight to the point that the Baudin mission was sent for only scientific reasons*" (Marchant, 1982, pp. 104-105). Marchant (1982) also considered that by the time the British were concerned about the likelihood of the French attempting to establish a colony at the Swan River, the French had given up that idea and were concentrating on New Zealand as a possible settlement which they did briefly achieve in 1838 at Akaroa, just south of present day Christchurch.

collected many thousands of specimens on their voyages, they demonstrated little appreciation of the forests or of the land generally.

On the other hand, Kessell, the Conservator of Forests in Western Australia from 1921 to 1943, in the Annual Report of the Forests Department of 1927, offered another reason for the establishment of the Swan River colony. He implied that at least qualitative inventories would have been taken, and wrote (Forests Department Western Australia, 1927, p. 3):

...the foundation, in 1829 by the British colonial authorities, of a settlement at the entrance to the Swan River was largely due to the reports received in England as to the existence of immense forests of valuable hardwoods in the South-Western portion of what was then generally known as New Holland.

However, little weight can be placed on this statement, which also was inconsistent with the more authoritative observation by Lane-Poole (1922). Kessell provided no direct evidence that the forest wealth of the South West was the main reason for settlement or even that it was considered as a valuable asset (Forests Department Western Australia, 1927; Kessell, 1927). Perhaps Kessell was merely highlighting the value of the forests of the South West under his responsibility.

After settlement at the mouth of the Swan River at Fremantle and further upstream at Perth, the main task was to establish farms with the forest being considered as a plentiful source of fuel and an excellent construction timber for the immediate requirements of the settlement, but otherwise not much more than a hindrance to growing food. Fraser also explored further inland and noted the open nature of the forest and commented that the trees did not average “*more than ten trees to the acre*” (Battye, 1924, p. 66). This is almost certainly the first forest inventory in Western Australia with an attempt at quantification, rather than just a descriptive phrase, and characterised the limited extent and quality of inventories that were undertaken at least through to the 1850s.

2.3.1 Early Settlers

Joseph Hardey was one of the early settlers in the Swan River Colony and arrived in the brig *Tranby* on 3rd February 1830. He and his family settled alongside the Swan River at Maylands, only a few kilometres upstream from Perth, and his diary records that on Monday 21st June 1830 he “*Felled a gum tree with 150 feet⁹ in the bole*”, providing definite (measured) evidence of a very tall eucalypt, probably a jarrah or a tuart, on the Swan coastal plain (Hardey, 1839). The author lived in Hardey’s former home *Tranby House* for five years (1969-1974) and can confirm that tall trees do grow in the area (Williamson, personal observation).

Amongst those early settlers who journeyed in the South West of Western Australia and noted the country around them, the following examples from Hallam (1975) give an idea of a rudimentary forest inventory, and of how the forest appeared to them. Lieutenant Preston in September 1829 explored the Canning River above the scarp and noted “*the trees, generally of immense size, the largest hollowed out at the root by fire*” (Hallam, 1975, p. 24). Ensign Dale at the top of Mt Toolbrunnup in the Stirling Range (north of Albany, Figure 2.2) in 1833 noted that “*the country is not thickly inhabited and the forests are extensive*” (Hallam, 1975, p. 28). Bunbury in 1836 journeying from the Murray to the Vasse (both rivers are south of Perth) observed that because of the fires lit by the aboriginal people “*the country is kept comparatively free from underwood and other obstructions, having the character of an open forest throughout most parts of which one can ride freely*” (Hallam, 1975, p. 47). Sir George Grey in 1839, searching for a lost settler in the vicinity of the headwaters of the Harvey River (east of the present day town of Harvey, Figure 2.1), noted that (Hallam, 1975, p. 26):

...the whole country was thickly clothed with mahogany (jarrah) trees, so that in many parts it might be called a dense forest. These mahogany trees ascended, without a bend or throwing off a branch... forty to fifty feet¹⁰ ... and the ground was so encumbered by the fallen trunks of these forest trees that it was sometimes difficult to pick a passage between them.

⁹ 45 metres

¹⁰ 12 to 15 metres

The settlers clearly came across some big trees in the early years of the colony as well as other areas with very little tall vegetation. The overall impression on such a small population was one of vast areas of trees, which had to be cleared to allow settlement to proceed and farms to be established.

Thus, for the period 1829-1850, following European settlement, forest inventory was limited and rudimentary at best, and almost exclusively centred on the area of forest that was present around the settlements, while public administration was concerned only with revenues from licences and policies that promoted clearance. The colony was establishing itself and the population was more preoccupied with the basics of survival, developing farms, growing of food, and settlements than managing the forests on a sustained basis.

2.3.2 Pre-Industrialisation

It is likely that the early inventory observations noted above were directed towards the ease with which forests could be cleared for farms rather than as stocktaking for a timber industry, especially since the transport technologies at the time meant that any timber industry needed to be near the coast or a waterway. Indeed, until at least the 1850s, an inventory for the purposes of establishing a timber industry was scarcely required, if only because the predominant milling technology was of such low productivity that the stock required to feed such an operation would have been minor. The more important considerations for a timber-milling operation at that time, rather than tree size and density, would have been a coastal or riverside location surrounded by rising land gradients to facilitate transport to and from the operation.

From the first settlement, sawn timber was produced manually over sawpits. Sawing timber was such a labour-intensive process that splitting and hewing would have been the primary method used for producing construction materials. Timber sawing continued essentially on a subsistence basis for decades (Evans, 2005). Those early sawmills in 1833 at Mt Eliza (now Kings Park) and further inland at Mount Helena (35 kilometres east of Perth) (Robertson, 1956) would have therefore required only a scant estimate of timber volumes available as these mills could have supplied timber only for limited demand.

Nevertheless, the first export of timber to England was of 200 loads ¹¹ of jarrah in 1836 (Battye, 1924), only 7 years after the start of the colony, but the small-scale milling was more an exercise in clearing for farming than the start of an export trade in timber. This initial export of jarrah to England was for the British Admiralty who, however, did not consider Swan river mahogany (jarrah) suitable “...for the construction of war vessels” (Robertson, 1956, p. 3). Transport of timber was manual, and by bullock and horse. Timber milling needed to be undertaken at a low point so that timber transport to the mill could be gravity-assisted. European and American sawmilling was water powered, but water was in short supply in Western Australia. Timber as an industry was of low value and only as an opportunistic supplement to land clearing.

Small sawmills first appeared in Western Australia in 1833 (Evans, 2005) and would have required some consideration of the available feed-stock, but even then, productivity continued to be limited by the realities of land transport via horse and bullock. Steam powered rail in the timber industry in Western Australia did not appear until 1871, which marked the take-off of the industry (Evans, 2005).

In the early years of settlement, there was little if any regulation other than site and jinker licences. Great quantities of timber were simply wasted. “*Only the best trees were taken, and there was no follow-up silvicultural treatment to ensure regeneration*” (Evans, 2005, p. 2). Land management policies throughout much of the nineteenth century discouraged the retention of timber and millions of hectares were simply ring-barked and burnt by settlers Australia-wide. The timber was unproven and despite Stirling’s reports of 1827 and 1838, not recognised as suitable for shipbuilding by the standards authority (Lloyd’s of London).

The settlement of Augusta in 1830 was illustrative of the challenges.¹² This settlement, initially lasted just 19 years, partly due to the difficulties of working the hardwood timbers, and the poor soils. In the early 1850s, another attempt to cut jarrah for export from Augusta also ended in failure due to the difficulties of working the timber with technologies of the time that meant that it was not commercially viable.

¹¹ about 280 tonnes

¹² Oral History Museum of Augusta. Retrieved from <http://www.amrshire.wa.gov.au/recreation-and-tourism/local-history/> (20.3.2011)

Also illustrative, was the early history of what is now Kings Park. Setting aside land, such as Kings Park, for recreation was not considered a priority given the unlimited land and forest availability for the small population. As early as the 1830s, the Colony's first Surveyor, General John Septimus Roe, recognised the qualities of the Kings Park area and tried, unsuccessfully, to protect it for public purposes (Jackson, 1982). Bennett (1988) noted that by 1835, Roe's protection was overturned and the first shipment of jarrah was cut at Mt Eliza, becoming the colony's first export. Logging in the area continued until eventually in 1871 Roe's successor, Malcolm Fraser, persuaded the then Governor Weld to set aside 1.75 km² as public reserve (Kings Park Authority, 2014).

2.4 Forests of Negative Value

For the first decades following settlement, notwithstanding the exception of Kings Park, it seemed that the value attached to the forests was low or even negative - representing a cost or impediment to realising agricultural opportunity. Under these circumstances, the notion of an inventory of forests would have seemed superfluous, as would have been the concepts of value, resource management, and regulation. An overall lack of community appreciation, interest or awareness of forests was to be acknowledged even thirty years later, as further outlined in Chapter 3.

Chapter 3 Forests as a Valued Resource (1850-1919)

From the 1870s, forty years after settlement, the value assigned to the forests shifted from near zero or negative, to being a significant economic resource, while also widely perceived as essentially inexhaustible.

The Kalgoorlie gold rush of the 1890s dramatically increased the population and the demand for water and timber. The demand for timber was also driven by interstate and international trading opportunities. These demand factors were such that by the 1890s serious concerns were aroused that the forests of the South West were not unlimited or as Ednie Brown (1899, p. 61) put it: “*The fallacious arguments include that the forests are of vast extent and need no special care or attention for a long time to come.*”

3.1 Logging Unlimited

As noted previously, the first sawmills were established with timber production being unregulated and unlimited within their leases, while timber mills needed to be located near waterways and the bullock teams used initially in transporting the timbers were inadequate for the unfolding major extraction. Timber extraction, initially for the small domestic market, was transformed in the second half of the nineteenth century by forces both of supply and demand.

In terms of supply, in addition to the investment in powered sawmills, the introduction of steam locomotives and rail from 1871 (Robertson, 1956) meant that the timber industry was no longer limited to coastal regions and waterways, but could access timber much further afield. On the demand side, in addition to significant trade opportunities, Australia was experiencing its first gold rushes, and the requirement for timber increased dramatically, as a material for mining and more broadly for the diverse requirements of a dramatically expanding population. There was also major demand for railway sleepers, especially from South Australia and Victoria. This resulted in ~~that~~ the timber industry ~~was~~ being increasingly perceived as having significant commercial value.

The inclusion by Lloyd's of London of jarrah and karri in 1871 and 1873 respectively among the A class shipbuilding materials boosted their economic value for shipbuilding (Battye, 1924). Their reputation as a quality, long-lasting timber for poles and jetty timber, and later on as paving blocks was also soon established and investment in the industry followed. By the end of the century there was a glowing account of the Western Australian hardwood industry in the *Illustrated London News* of May 1897, which in part reported (Illustrated London News, 1897, p. 598):

They (jarrah and karri) are practically imperishable and will neither rot in the ground nor yield to the ravages of the white ant and other destructive insects. It is not necessary to creosote karri or jarrah sleepers. ... For bridge planking, shafts, spikes, elbows and large planking of any sort, general wagon work, and boards, there are few timbers which equal the Westralian karri and jarrah.

The sawmilling industry expanded dramatically from the 1870s as the opportunities in interstate and international markets grew, and technology evolved. Investment was increasingly forthcoming and large sawmills were established to take advantage of markets in the eastern states, India, South Africa and England, and timber harvesting and processing rapidly became an important industry for the State of Western Australia (Robertson, 1956).

In 1871, with a population of about 25 000 people just over 40 years after the colony was founded, Jarrahdale was established as the first major sawmill (Figure 2.1). Haulage by bullock and horse gave way to mechanisation and the first steam locomotive appeared in that year (Evans, 2005). The mill produced timber mainly for export with only a small amount needed to meet the local demand. To start a major sawmill, an inventory would certainly have been carried out to ensure that there was sufficient timber available and accessible to supply the mill to at least cover the initial investment, and hopefully well into the future to make the export business profitable. The inventory may only have been an estimate based on the view from a horse while riding through the forest, but it would have been amongst the earliest attempts to establish a forest inventory of sufficient reliability and authority to attract investment capital required for a major sawmill in Western Australia.

In 1874, for the first time timber exports were greater than timber used locally (Robertson, 1956), but the industry was still regarded as being in its infancy. However, by the 1880's the timber industry was booming with mills, jetties, ports, towns, infrastructure such as railways and tramways were being built to cope with the demand for Western Australian hardwoods and link mills to railheads (The West Australian, 1907; Robertson, 1956).

The long-term timber leases offered by the Western Australian government in contrast to the short-term licences generally available in most other parts of Australia were designed to encourage investment in infrastructure (Robertson, 1956; Evans, 2005). That policy objective was successful and major infrastructure followed. Tramways for timber extraction were of the same gauge as the Western Australian government railways and used similar locomotives, and the Western Australian tramway system more than any other State reached an industrial scale (Evans, 2005).

More timber left the colony in the 8 years from 1884 to 1892 than in the entire period of 50 years pre-1884 (Robertson, 1956) and by 1900, Western Australia was exporting 114 000 loads¹³ of timber annually (Battye, 1924, Appendix IV). The demand was so great that timber became Western Australia's second largest export, after wool. Timber companies became major enterprises. Around 1878, Maurice Coleman Davies became the major timber producer in the colony with an international standing, producing over 30% of all Australian timber exports, and created a worldwide market for Western Australian hardwoods (Robertson, 1956; The West Australian, 1947). Again, at least rudimentary estimates of the timber available in the forest must have been made to raise the investment capital from London, UK. In 1902, Davies merged with seven other companies to form the Millars Timber & Trading Co Ltd (Millars Combine), which approached the American industrial scale in terms of locomotive numbers, track length and standard of construction (Evans, 2005).

What today would be classified as first class timber was used to make paving blocks and railway sleepers. From 1900 to 1914, approximately 17 million railway sleepers

¹³ 161 000 m³

were cut from the Augusta-Margaret River region alone.¹⁴ The London, UK, streets of Pall Mall, Piccadilly and Regent were all paved with karri blocks.

Logging at that time was rampant without any concern for sustainability. The exploitation around Denmark provides a case study. At the same time that the Swan River colony was being founded, Thomas Braidwood Wilson explored the Denmark area (1829). Settlement didn't establish there until a timber industry began in 1894 and in August 1895, Millar purchased 20,000 acres of freehold timber country at Denmark River, known as the Denmark Estate. In October 1895, after a stock exchange listing in London to raise the capital, Millars' Karri and Jarrah Forests Limited commenced a railway extension from Torbay to Denmark River. The formation was completed and the first timber mill constructed at Denmark timber station in December 1895 (Millar, 1896). Millars built its third mill in 1898 (The West Australian, 1929), yet resource depletion on these land holdings soon followed and resulted in a collapse of the local industry. By May 1903, with the closure of the No 1 Mill, the Denmark milling industry was in decline. On 30 September 1904, Millars' Denmark operation permanently closed down (Hamling, 1979).

The timber industry had thus become one of the pillars of economic development, which led the rollout of extensive infrastructure that had various economic and social benefits. With this timber-supported prosperity for a small population, it is perhaps not surprising that the need for regulation and controls were not perceived as a priority and were slow to follow (as noted in the following section). This was a successful industry and its commercial and social values, measured by railways, ports, employment and exports, self-evident.

The State itself had a vested interest in these developments, which was conflicting with the idea of regulation of the industry. Administration was by a lease associated with a sawmill, which for an annual fee allowed the leaseholders to cut as much timber as they wanted with no requirement to ensure regeneration. After the Government State Trading Concerns Act 1912 was passed in December of that year, several State-operated businesses were established including the State Saw Mills, which commenced with

¹⁴ Oral History Museum Augusta

purchasing the South-West Timber Hewers' Co-operative for £80,000 (Mills, 1988) and followed up with construction of several large mills.

The initial Western Australian timber boom proved to be short-lived. The rate of harvesting decimated the forested leases, leaving forest areas that were not economically viable and depleted leases. By the 1900s, the demand for Western Australian karri and jarrah had declined due to South African competition, flooding of karri and jarrah of overseas markets and the effects of the Boer War. By 1902, the industry was in rapid decline and by 1913, all of Davies' saw mills had closed down (Hamling, 1979). Thus from an infancy in the 1870s to over-exploitation and the beginning of decline took just 25 years, although prosperity continued in some areas such as Busselton until the 1960's.

Although extractive efficiency increased enormously, inventory and forest management remained undeveloped, such that the productivity of the new technologies threatened the sustainability of the industry for the first time. A more recent concept of sustainability in forest management refers to the *“management of our private and public forests to ensure they continue to provide not only a sound supply of renewable timber for present and future generations, but also maintain their environmental values and social services”* (Forest and Wood Products Australia, 2011). This concept of sustainability has itself been overtaken by values that are not as human-centric, as will be discussed below.

3.2 Rising Concerns and Forest Management Inventories

Even during the boom times, there were those who were uneasy about forest destruction, as was articulated in official reports to Parliament and by a Royal Commission (1903; 1904). That disquiet was primarily focussed on the risks to the sustainability of the now highly valued timber industry, but also emerging at that time were explicit expressions for the preservation of natural heritage and conservation values.

Apart from general observations by the settlers themselves, the first authoritative forest inventory had been that of Ferdinand von Mueller, the Government Botanist of Victoria, who had produced a report on the forest resources of Western Australia in 1879

(Mueller, 1879). Von Mueller in developing his report, travelled from the Swan River south to Geographe Bay, then from Geographe Bay eastwards to the Shannon and Gordon Rivers (Figure 2.1). His report did not say how the inventory was carried out, but he would have had to make use of horseback and horse drawn carriages, and both would have provided an adequate platform from which to observe the forest. The more scientific methods, such as strip line surveys, would not be applied in Western Australia for another 36 years. The report itself consisted of 29 pages, and a further 20 pages containing high quality life-size drawings of the buds, flowers and fruit of the 18 eucalypts that he saw on his visit (Mueller, 1879). For each of the species he gave an idea of the likely height and girth and a general idea of their extent (Mueller, 1879). However, there were no figures or maps giving estimates of the extent of the forest areas. He was strong in his praise for the quality of jarrah timber (which he spelt “yarrah” - one of the many spellings in use at the time) (Mueller, 1879).

Von Mueller wisely stated that timber from natural forests was not inexhaustible and that it was important to reserve forested areas from alienation to private property (Mueller, 1879). Von Mueller recommended planting exotics and listed possible species from other countries that could be tried (Mueller, 1879), and in doing so, revealed himself as being far ahead of his time. The Surveyor General Malcolm Fraser reporting to Governor Robinson in 1882 on Von Mueller’s 1879 report, and while acknowledging Von Mueller’s cautionary statements about the finite extent of the forest, commented that this would not need to be taken into account for many years (Fraser, 1882, p. 19):

There can be no doubt that the preservation of the forests is a matter of considerable importance to the future of the Colony; nor is there much doubt that very great waste is taking place every day; but at present the untouched area of the Colony is so great that no anxiety need be felt as to the supply falling short for very many years to come.

The context and focus of this statement indicated that the considerations of forest management centred on commercial extraction: the concerns of both Fraser and Von Mueller were to do with supply and sustainability of the timber industry, rather than conservation.

At the time of Fraser's report (Fraser, 1882), the timber industry in Western Australia was in its expansion phase and Fraser's comments would have given them great confidence. Fraser's comments were made when the population of Western Australia was about 31 000, well before the major population increase to 168 000 in 1898 following the discovery of gold in 1892. While Fraser's comments were not incorrect, the future sustainability of the forests would have benefited from a more cautionary tone that emphasised the finite extent of the forest area. It was not until almost half a century later, in 1918, that the Forests Act was passed (Government of Western Australia, 1918) and the need to ensure satisfactory regeneration after logging began to be seriously dealt with.

Fraser's report included a statement by Manning, the Clerk of Works, reporting to the Legislative Council in 1871 about the value of jarrah timber, "*the timber is perfectly sound*" after 35 years as piles in a jetty (Fraser, 1882, p. 7). Another component of Fraser's report contained supplementary statements by J.S. Harris, the late resident magistrate at Vasse (Figure 2.1), about the extent of the main tree species used by the existing sawmills and the other products obtained from the forest besides timber, including wattle bark, manna gum, blackboy gum, gum from red gum, and charcoal (Fraser, 1882). It is true that the forest was capable of producing other valuable products, however the overwhelming use and perceived value of the forest at that time and for decades to come was for commercial timber.

Ednie Brown became Inspector General of the Woods and Forests Department in 1894. His 1899 report, "*The forests of Western Australia and their development, with plans and illustrations*" (Brown, 1899), was the next significant forest inventory statement after those of Mueller (1879) and Fraser (1882), and was produced after his own survey throughout the forests of the South West with surveyor Newton Moore (estimates shown in Table 3.1) and presented to the Hon George Throssell, MLA, Minister of Lands.

Table 3.1: Inventory estimates from Ednie Brown's 1899 report

	jarrah	karri	Tuart
Extent	8 000 000 acres	1 200 000 acres	200 000 acres
Volume on virgin forest	40 000 000 loads	15 000 000 loads	300 000 loads

Source: Brown (1899, pp. 29-30) *The Forests of Western Australia and their Development*. 1 acre = .405 hectares; 1 load = 1.4 cubic metres.

The report included the areas of each of the main forest tree species and the volume and values of those species (Brown, 1899, p. 29), which he mapped throughout the South West as shown in Figure 3.1. Ednie Brown emphasised the need to manage the forests “...by systematic conservation in order to ensure their permanency” (Brown, 1899, p. vii). Section XI of the report dealt with setting apart portions of the timber areas as “*State forests and timber reserves*” and was thereby consistent and in line with the recommendations twenty years earlier by Von Mueller concerning the planting of exotics. Ednie Brown provided an eloquent argument for reservation, including that it is easier to alienate reserved forest than to repurchase cleared land for forest, and dismissed as fallacious the arguments that the forests were of vast extent and needed no special care or attention for a long time to come (Brown, 1899).

Concern about the longevity of the timber industry as a result of the virtually uncontrolled logging was also voiced in the Western Australian parliament by several members including Charles Harper, the member for Beverley, who moved on 8 October 1902 (Government of Western Australia, 1902, p. 1453):

That in view of the rapid depletion of our hardwood forests, it is desirable that a searching inquiry should be made into the condition of the trade in this class of timber with a view to ascertaining: 1) The world's supplies of timber which come into competition with those of this State. 2) The supplies viable in this State of each variety. 3) The area of jarrah and karri forests, respectively, already cut over. 4) The rate at which the forests are being depleted. 5) Whether the frequent reports of enormous waste are correct, and if so, what steps are necessary to prevent same. 6) That until Parliament is in possession of this information, and can provide for the better conservation of supplies, no further leases of jarrah and karri forests shall be granted.

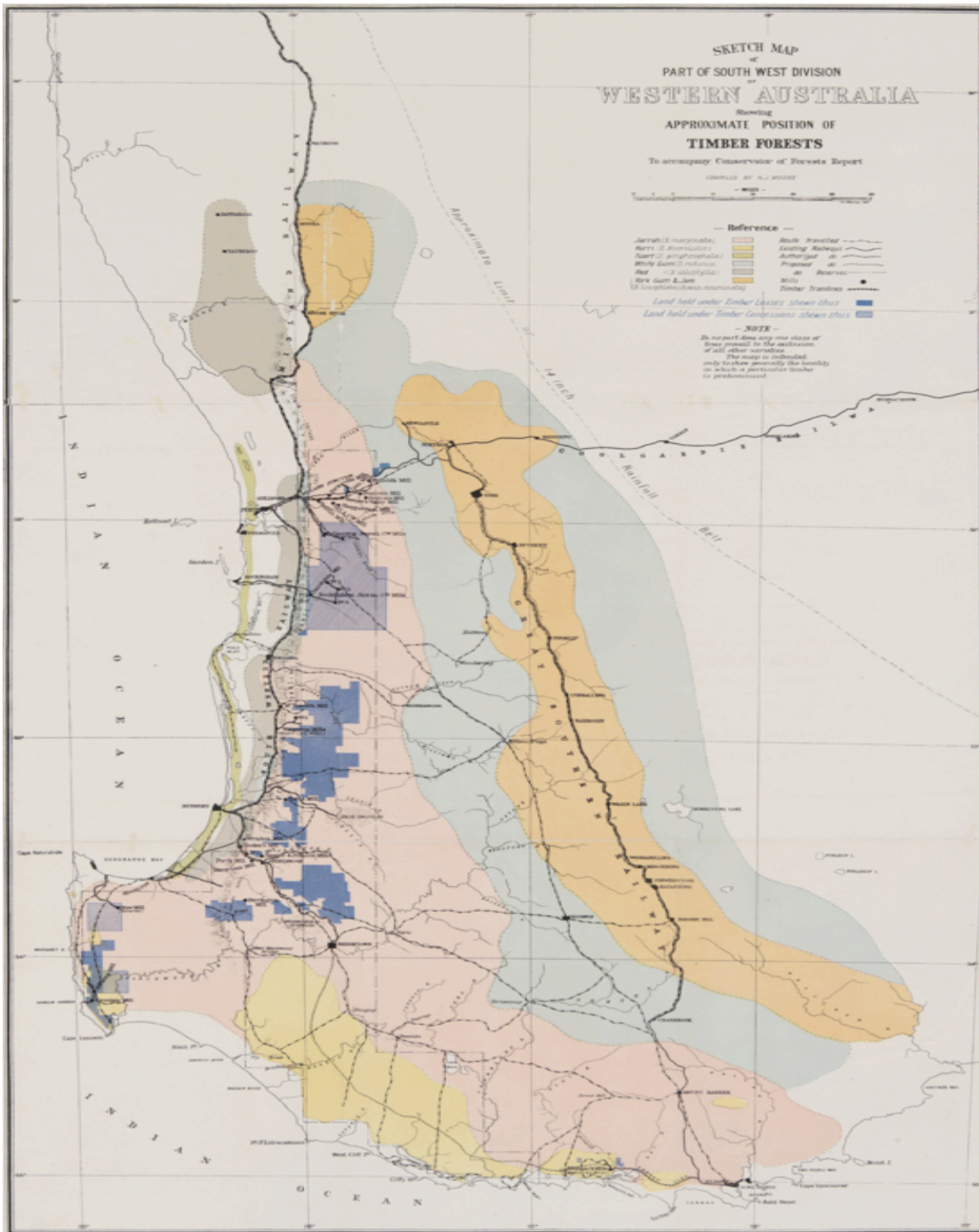


Figure 3.1: Approximate position of timber forests. Forest resources of Western Australia as recorded and mapped by Brown (1899). Index (roughly from west to east): light green (strip along west coast) indicates tuart (*Eucalyptus gomphocephala*) occurrence; dark grey indicates marri (*Corymbia calophylla*); pink area indicates jarrah (*E. marginata*); light grey indicates white gum, the common name for many *Eucalyptus* species, characterised by a relatively smooth (white) light coloured bark (e.g., *E. wandoo* and *E. lanepolei*); dark yellow indicates York gum (*E. loxophelba*) and jam (*Acacia acuminata*) associations; and light yellow (predominantly in the south) indicates karri (*E. diversicolor*) occurrence. Blue and purple blocks indicate areas leased for logging.

Two issues are important here. Firstly, much of the information required to respond to these points could only be supplied by forest inventory, which in turn required professional input into the forest policy, regulatory and management framework. Secondly, the motion was carried except for Point 6, which meant that the only control over further logging - the issue of granting further leases for logging - was denied. It seemed that the Parliament was prepared to tolerate the longer-term risks in order to continue to achieve the short-term financial reward from its commercial yield. Furthermore, the motion, while concerned about the conservation of the forest, was clearly focused on the preservation of sustainable yield and of commercial value rather than conservation *per se*.

3.2.1 Royal Commission of 1903

In April 1903, a Royal Commission was appointed¹⁵ by Walter Kingsmill, the Acting Premier, with almost identical terms of reference to Harper's 1902 motion (Government of Western Australia, 1902, p. 1453, see above) for the first five points but with the addition of a replacement point 6): “ *Whether any, if so what, steps should be taken, and in what locality, to plant softwoods in Western Australia*” (Royal Commission, 1904, p. 3/357). In June 1903, Gregory, the Acting Colonial Secretary, added five further terms of reference to the Commission (Royal Commission, 1904, p. 4/358):

1) To make inquiry and take evidence as to the methods of cutting, carrying and distributing timber by all persons engaged in the timber trade of this State, and to make recommendations thereon;

2) To make inquiry and to take evidence as to the efficacy of the existing regulations for the protection of the forests in all senses, and to make recommendations thereon;

3) To take evidence and to make recommendations for the future development of State Forestry, inclusive of the training of officers, the raising and planting of desirable exotic timber trees, as well as the indigenous species, and the suitable localities for such operations;

¹⁵ The royal commission was appointed on 22.4.1903 and its final report was presented on 19.5.1904.

4) To make recommendations as to the advisability or otherwise of establishing State Forests under Statute;

5) And to inquire into any other subjects in connection with the forests and the timber trade, which may, in the opinion of the Commission, be desirable in the public interest.

The influence of Ednie Brown and his 1899 report was evident in the term of reference Number 4 (Brown, 1899). In fact, in their progress report in August 1903, one of the recommendations of the Commissioners (Royal Commission, 1903, p. iii) was “*that the forests of karri, jarrah, and tuart of good quality should be preserved from alienation by statute.*” Thus one of the attitudes of the ‘official’ community was to protect forests from alienation and therefore from being cleared for farms.

It was evident that the major, if not the only, thrust of the Commission was to deal with matters relating to the timber industry and the management of asset value from a commercial perspective. The many witnesses who appeared before the Commission were all associated with the timber industry such as sawmill managers, timber inspectors, railway sleeper inspectors, forest rangers, as well as the manager of the Timber Hewers Association. The Secretary of the Forests Department Western Australia, Charles Richardson, appeared as a witness but was questioned only about timber matters. When he was asked by Harper, the Chairman of the Commission, “*What are the principal duties of the (forest) rangers?*” Richardson’s reply indicated that the rangers were dealing with matters requiring forest inventory in relation to potentially marketable timber (Royal Commission 1903, Question 20, pp. 1-2):

In the forest country they have to prepare all applications for conditional purchases, homestead farms, and grazing leases, which are tantamount to conditional purchases. Permissions to ring-bark are referred to them before approval, so that they may examine the land and report as to whether there is valuable timber on it. If they report that it contains valuable timber, the application is refused.

The fifth of the June 1903 terms of reference was “*to inquire into any other subjects in connection with the forests and the timber trade which may, in the opinion of the Commission, be desirable in the public interest*” (Royal Commission, 1904, p. 4/358).

This could have provided an opportunity for the Commission to inquire into other forest values besides commercial timber or for the witnesses to make such a comment. The point could have been made that logging to remove timber may have prevented some aspects of forest conservation and recreation or regeneration from being achieved. That kind of question or comment was not made, and concern for forest values other than timber was not apparent even after the passing of the Forests Act in 1918. Although there were environmental concerns at the time (discussed below), the community did not voice strong concern for values other than timber until the 1970s as discussed in Chapter 5. Forest policy and management were clearly focussed on sustainability of the forestry industry.

The Commission asked witnesses about areas cut over, areas remaining to be cut, volumes of timber removed and growth rates of the main timber species - all important aspects of forest inventory and sustainable forest management. The responses indicated that the areas cut over and the volumes removed were known with reasonable confidence, the volumes of timber to the acre and the area still to be cut were known with less confidence, and the regeneration or growth rates of the trees were largely unknown (Royal Commission, 1903; 1904).

Inventory figures presented to the Commission included volumes of 25 to 30 loads to the acre¹⁶ for the karri forest near Denmark (see Figure 2.1) (Table 3.1), and growth of about half an inch¹⁷ per year of diameter for the first 30 or 40 years for jarrah (Royal Commission, 1904). The karri volume figures would be regarded today as in the medium to high productivity class for karri, while the jarrah diameter growth rate would today be regarded as in the exceptionally high productivity class for jarrah. The life of the jarrah timber supplies north of the Blackwood River was estimated at about 32 years at the then rate of cutting (Royal Commission, 1904).

Henry Yelverton MLA, manager of the Wellington Sawmill, but before that running the Quindalup and Donnybrook sawmills for about 18 years, was asked by the Chairman of the Commission Charles Harper MLA (Royal Commission, 1903, p. 93): "*Have you observed in those portions (of the forest) you cut out many years ago at Quindalup, whether the forest has to any extent recovered itself?*" Yelverton replied: "*It is*

¹⁶ 87 to 105 m³/ha

¹⁷ 1.2 cm

recovering, but very slowly. The country cut out by my father, 40 to 45 years ago, is certainly not fit to put a mill in to cut timber now. There are not enough logs of a size suitable for milling purposes.” This observation by Yelverton was an accurate observation of the slow growth rate of jarrah and this kind of question was put to several witnesses to try to determine the likely life of the timber industry.

Table 3.2: Inventory estimates from the 1903 Royal Commission reports (1903; 1904)

	Jarrah	Karri	Tuart
Extent	2 600 000 acres	1 200 000 acres	100 000 acres
Area cut over	530 000 acres	150 000 acres	
Area of virgin forest	2 000 000 acres	1 000 000 acres	
Volume on virgin forest	6 000 000 loads	12 000 000 loads	150 000 loads
1903 cutting rate	60 000 acres/yr		
Life at 1903 cutting rate	32 years		
Growth rate	0.5 inches diameter/yr		

Was this interest in the life of timber supplies the timber industry’s concern for their future profits or was it a conservationists’ concern about the ‘life’ of the forest? The final report has the following sentence: “*state acquiescence in the destruction of good timber only because the export trade demands it, is a crime against the coming generations*” (Royal Commission, 1904, p. 10/364). This statement could denote concern for the commercial opportunities of future generations and/or it could reflect a genuine conservation concern. Regardless, it was not evident in any obvious way in the community at the time although there was probably a nascent environmental awareness by then. In 1904, in the context of a small population concerned about building a thriving community surrounded by undeveloped forest areas, the statement is more likely to have been motivated by concerns regarding intergenerational commercial equity, intending to ensure that the next generation would still be able to enjoy the commercial rewards of the timber industry. Nonetheless, it indicates considerable foresight and the concerns could be loosely defined as the need for ‘sustainable forest management’.

The majority of the recommendations from the Commission (Royal Commission, 1904) dealt with the timber industry, but others dealt with the need to have a scientifically

trained forester to run a Forests Department that was separate from the Mines Department and that would be responsible for the training of field foresters (rangers) to assist in running it. Also, of great importance was the recommendation that the good quality forests of karri, jarrah, and tuart should be preserved from alienation by statute. Except for the production of clean water, there were no other recommendations that indicated an interest in forest values other than those connected with the timber trade and the supply of timber. Values not connected with the timber industry were not inquired into, nor were they offered by the witnesses (Royal Commission, 1904), which leads to the conclusion that the Commission and the community in the 1900s valued forests mainly, if not exclusively, for the commercial timber they contained.

Regardless, the government largely ignored the Royal Commission outcomes (Royal Commission, 1904) - evidently its concerns carried little political weight - and little action followed for the next 15 years, except that a Forests Advisory Board was appointed only to be dissolved in 1908 (Carron, 1985). Nevertheless, twenty years after Fraser's dismissive report (1882), the Royal Commission report (1904) clearly indicated that the early perceptions of an inexhaustible forest resource had changed. The Royal Commission in 1903 reflected a growing concern about the life of the timber industry, because the forests were now being heavily logged, while the land classification project (discussed below) that followed in 1916 demarcated forestland from agricultural land. These and other changes tracked the evolution in perceptions in the early history of forest inventory in Western Australia as listed in Table 3.3.

Table 3.3: A chronology of the relationships of the community with the forests and the development of forestry in Western Australia: 1829 to 1919. For locations, see Figure 2.1

Year	Event
1829	The Swan River colony was proclaimed in June 1829 by Captain Stirling as Lieutenant Governor.
1833	Early (small) sawmills established at Mt Eliza (now Kings Park) and Guildford (a suburb east of Perth).
1829-1836	Some settlers' (Hardey, Preston, Dale, Bunbury, Grey) comments about the forest.
1836	Export of 200 loads (approx. 280 tonnes) of timber from the Swan River Colony.
1871	A major sawmill began at Jarrahdale, south east of Perth (Figure 2.1).
1872	Part of Mt Eliza gazetted as a public park; later (1895) with additions, renamed Perth Park; later still (1901) renamed Kings Park.
1878	Maurice Coleman Davies started his sawmill at karridale, south of Margaret River.
1879	Mueller reported on the forest resources of Western Australia (Mueller, 1879).
1882	Comments on the state of the forests by the Surveyor General Malcolm Fraser.
1892	Gold discovered in Kalgoorlie followed by a rapid population increase.
1899	Ednie Brown's report on forest resources (Brown, 1899).
1898	John Forrest National Park reserved, 25 kilometres east of Perth.
1903	Royal Commission into the timber industry (Royal Commission, 1903; 1904).
1903	Ringbarking of nearly 9 000 hectares of the Helena River catchment in an effort to increase run off for public water supplies.
1914	Formation of the Australian Forest League.
1914	Hutchins visits Australia with the British Royal Society.
1916	Hutchins' report about Australian forestry, with a special section on Western Australia.
1916	C. Lane-Poole appointed Conservator of Forests.
1916	A major land classification survey began in South West Western Australia.
1918	Passing of the Forests Act 20.12.1918.
1919	Governor McCartney signed the Forests Act into law 14 days later on 3.1.1919.

Sources: see text.

The appointment of the forestry graduate Charles Lane-Poole as the first Conservator of Forests in 1916 and the passing of the Forests Act in 1918 marked the end of unregulated logging and provided effective authority to limit the amount of timber taken, as well as for the introduction of scientific forestry that included, in principle (i.e., dependent on budget resources), forest inventory based on systematic data rather than *ad hoc* observations.

3.2.2 The Hutchins Review

Recently retired, Sir David Hutchins was invited to visit Australia with the British Association in 1914 and to comment on Australia's forestry situation. Hutchins was the pre-eminent forester of the British Empire at the time and a graduate of L'Ecole National des Eaux et Forêts, Nancy, France. Commencing in 1824, the forestry school at Nancy was one of the earliest European forestry schools, and one that many British and some Australian foresters attended. Hutchins had experience in India, had been one of the Cape Colony's Conservators of Forests, had worked in Sierra Leone, and had reported on the forest situation in a number of non-tropical countries (Dargavel, 2008).

Collier, a member of Scaddan's Ministry, asked Hutchins to include a report on forestry in Western Australia in the report Hutchins was writing on Australian Forestry (Robertson, 1956). Following his visit, he made a great many recommendations in his comprehensive 434 page report, published in 1916, which covered all the aspects of forestry connected with maintaining a healthy forest for timber production (Hutchins, 1916). His vast experience and high standing ensured that his views, often trenchantly expressed, had a major influence on how forestry was conducted in the next half century in Western Australia. He stated "*Western Australia has the best chance of all the Australian states for successful forestry because it has gone the shortest distance down the wrong road*" (Hutchins, 1916, p. 364), where the "wrong road" is clearing forests for agriculture.

Hutchins' comments made it clear that from his point of view the main use of forests was for timber production, although he does note that forests have other uses besides timber. There was no indication of public participation in establishing forest values or policy in his report, nor is there evidence of any groundswell of interest from the public.

Nonetheless, this time also saw the creation of the Australian Forest League in 1914, which had the explicit objective of forest conservation. Hutchins was speaking as an expert and a man of vast international experience. In fact, he bemoaned the fact that the community knew little about forestry. Hence he emphasised the need for forestry education at all levels (Hutchins, 1916), as did Lane-Poole (1922).

3.2.3 Industry Regulation: C. Lane-Poole and the Forests Act 1918

In addition to his own ability, a major reason that C. Lane-Poole became Conservator of Forests in Western Australia in 1916 was that Hutchins recommended him for the position (Dargavel, 2008). As in his work in Africa, Lane-Poole set about assessing the extent and nature of the forest resources he was responsible for and he implemented a land classification survey to assess the nature and quality of the South West forests. Inspired by Hutchins' report "*West Australia requires a working Forest Act, not a rider to a Land Act*" (Hutchins, 1916, p. 220), C. Lane-Poole worked hard to prepare this important legislation. By June 1917, he had completed the draft (Dargavel, 2008). The Forests Act was introduced as "*An Act to provide for the better Management and Protection of Forests*" (Government of Western Australia, 1918) and was signed into law on Friday 3 January 1919. This Act greatly elevated the value of forests and introduced strong conservation and management provisions for them. Under the Act, once an area had been declared State forest it could not be used for purposes other than forestry or alienated for other uses such as agriculture or settlement without the consent of both Houses of Parliament (Government of Western Australia, 1918). This proved to be a very sound and foresighted protection.

The 1918 Forests Act included provision for the establishment of a separate Forests Department (the existing agency was part of the Lands Department), and the preparation of working plans for forest management (Government of Western Australia, 1918). For the first time since settlement the Forests Act regulated a requirement for a forest inventory, described in Clause 19 of the Act by way of a classification and preparation of 'plans' (i.e., maps) to determine land suitable to become State forest (Government of Western Australia, 1918):

19. (1.) The Conservator shall, with the approval of the Minister, cause a classification of the forest lands of the State to be made for the purpose of determining which of the lands are suitable to be:

(a) permanently dedicated as State forests; or

(b) reserved from sale as timber reserves.

(2.) The Conservator shall cause plans to be prepared of the lands so classified showing the quantity of timber growing thereon, and indicating those portions which, in his opinion, do not carry or are not likely to produce marketable timber.

A direct consequence of the Act was to require that the forests be managed, with management informed by comprehensive forest inventories and the development of management information (Government of Western Australia, 1918). The newly passed Forests Act gave great power to the Conservator of Forests in forestry matters. For instance, working plans shall not be altered except on the recommendation of the Conservator (Government of Western Australia, 1918). The Act focused on controlling logging and ensuring that logging was followed by regeneration, with forest inventory informing these regulatory and management activities (Government of Western Australia, 1918). Little consideration was given to other potential uses of forests.

The Act has been recognised as very good, needing only a few minor amendments over the decades that followed (Forests Department Western Australia, 1969). Consequently, much of its content was incorporated into the Conservation and Land Management Act (1984), which replaced the Forests Act (Government of Western Australia, 1918) when the Forests Department was combined with the National Parks Authority and the Wildlife Research section of the Department of Fisheries and Wildlife to form the Department of Conservation and Land Management (CALM).

3.2.4 Royal Commission of 1922

The 1922 Royal Commission was appointed by Governor Newdegate¹⁸ and the terms of reference were (Royal Commission, 1922, p. 2):

to inquire into and report upon:

- (1) *The financial provisions of the “Forests Act 1918”, and the operation thereof, and*
- (2) *The administration of the said Act generally*

William Pickering was appointed chairman, and the other two members were Henry Mann and Peter O’Loughlen. All were members of parliament. Pickering was the member for Sussex, a forested area in the South West of the state, O’Loughlen was the member for Forrest, a forested area in the far South West of the State, and Mann was the member for Perth.

Pickering had shown a keen interest in and support for forestry and had moved in 1921 that a select committee be appointed to inquire into the above matters as well as the extensions of Millars’ Timber and Trading company’s leases and concessions. While the population of Western Australia in 1921 was about 350 000, Pickering considered that the forests should be managed for the timber needs of a future population of “*three to four million people*” (Government of Western Australia, 1921, p. 1010).

The select committee was changed to a Royal Commission on the motion of Premier Mitchell (Government of Western Australia, 1921) who, however, excluded the part of Pickering’s motion dealing with Millars’ leases. The Commission in 1922 interviewed 113 witnesses (Royal Commission, 1922), including the recently resigned former Conservator C. Lane-Poole¹⁹ whom Pickering held in high regard.

Many of the recommendations of the Commission dealt with the timber industry and it is clear that, while there was pressure from some witnesses for making good quality forest available for group settlement, the major interest in those forests that were to be set aside as State forests was that they should be well managed for their timber products

¹⁸ The Royal Commission was appointed on 18.1.1922 and the report was presented on 8.11.1922.

¹⁹ Lane-Poole ceased duties as Conservator on 22.10.1921.

for present and future populations. Several of the 29 recommendations concerned matters not directly to do with timber production *per se*, such as one dealing with the reservation of catchment areas, one dealing with education about forestry for primary and secondary schools, as well as three dealing with fire protection (Royal Commission, 1922). These cannot be considered to represent a divergence from the ethos that forests were for timber. This is also probably a reasonable indication of the level of community interest in forests in the 1920s. Responding to the need and recommendation dealing with education about forestry, the Forests Department had started producing ‘bulletins’. They proved popular especially with schools. A total of 94 bulletins were produced (Forests Department Western Australia, 1919-1985). Of these 94 bulletins, 17 were of direct relevance to forest inventory and contained notes about the forest resources of the state.²⁰

3.2.5 Forests and Water

Clean water was one of the many important values associated with forested catchments and valued by the community. By 1903, a dam had been built in the forests of the Helena River catchment near Perth and a pipeline from it laid 530 kilometres to Kalgoorlie to supply water to the dramatically increased population resulting from the discovery of gold in that semi-arid region. To improve the supply of water to the dam, a decision was made to ringbark the trees on about 9000 hectares of the catchment (Stoate, 1926). This was not considered controversial at the time. The idea was that removing the trees would make available the water that the trees would otherwise use in growth and transpiration. While this was so, it was not realised that this would also cause the water to become saline. Subsequent runoff was more saline and became increasingly unsuitable for human consumption.

The scientific community became aware of the cause from a paper by Wood (1924), a railway engineer, who correctly diagnosed the relationship between clearing native vegetation and the subsequent increase in the salinity of runoff water. ‘Clean’ non-saline water from the Helena catchment was regained after a few years by allowing the trees to regenerate themselves. The young trees, in the course of their natural growth, used water during transpiration thus lowering the water table below that part of the soil

²⁰ Especially bulletin numbers 2, 4, 5, 10, 12, 13, 15, 21, 22, 42, 47, 55, 60, 61, 62, 63, 69.

profile that contained salt, so that future run off was non-saline. It became the responsibility of the water authority (in 2010 this was the Department of Water) to measure (i.e., inventory) the amount and quality of the runoff water in catchments supplying water to metropolitan Perth. For the first time, forest conservation and management was recognised as having value beyond the immediate commerciality of wood products.

3.3 The Need for Management and Regulation

From the early 1870s and for the next 50 years, the forests shifted from representing an impediment to settlement and agriculture, to becoming first an important export industry that attracted investment, industrialisation and infrastructure, and then a valued commercial and conservation resource, followed by an emergent concern by a relatively few forestry specialists about how long the forests would remain commercially viable. The strong regulatory protection that ensued also resulted in the appointment of a scientifically trained forester as Conservator of Forests in 1916 and laid the groundwork for the commencement of scientific forestry in Western Australia including much more work on forest inventory.

From settlement through to the passing of the Forests Act 1918, Western Australia over the course of ninety years had faithfully followed the first three steps along the path laid out by Botkin (1995) for the New World, namely (i) discovery, (ii) intense exploitation, and (iii) wakening conservation - associated with the first attempts at rational, scientific-based management of wild resources - often with single or limited utilitarian purposes. The rational scientific-based management that followed is set out in Chapter 4.

During the transition from being a cost to a valued resource industry worthy of protection, there is no evidence of significant community reaction against commercial exploitation, and very likely community perceptions would have been aligned with the commercial values and employment benefits. Similarly, there was no recognition of the importance that the commercial regulation and management of these forests had for conservation and recreation values. Perhaps ironically, the subsequent ability to appreciate and protect the ecological values of forests in the latter part of the 20th century may have been very different had the commercially oriented sustainability

objectives of forestry in those years not been pursued. The pursuit and protection of these values led to a period during which the principles of scientific forestry were implemented, and large areas of public forest were protected by statute as State forest, which are both discussed in detail in the next chapter. These management initiatives ensured large areas of forest were under protection through to the 1970s and beyond when environmentalism appeared and seriously started engaging with protecting the ecological and other social values of forests.

Chapter 4 Forest Inventory and Scientific Management (1919-2010)

During much of the period of 1919 to 1985, the focus of the Forests Department was on managing the forest to continue to supply timber to meet the demand from local and overseas markets. Except for managing forested catchments for urban water supply, there appeared to be little concern for other forest values early in this period, despite or as witnessed by the meagre membership of the Forest League at that time.

4.1 Forest Managerialism

The Forests Act of 1918 represented a political intervention between the commercial interests of agriculture and unsustainable logging versus the commercial interests of a sustainable timber industry (Government of Western Australia, 1918). The overwhelming forestry needs at this time were to secure the best forested areas from being cleared for agriculture by dedicating them as State forest, and to sort out the chaos of the previous 90 years of exploitation when there had been virtually no control over how much timber was removed from leases and concessions, and no requirement to ensure that regeneration followed logging.

The aim from a scientifically trained forester's point of view was to meet the demand for timber on a sustained basis. However, individuals who became foresters generally pursued this vocation at least partly because they had an interest in forests, often but not always beyond narrow commercial objectives. An interest in forests beyond the commercial might then be reflected in the policy development and advice they provided as part of their roles and responsibilities. For many foresters, managing timber for the sustainability of the timber industry also then meant that other forest values would also be sustained (Williamson, personal observation).

To achieve commercial sustainability (a value-loaded concept for conservationists, as discussed later) and management, there were several essential requirements, most involving forest inventory. These considerations of forest management formed the

agenda of the Forests Department following the passing of the Forests Act of 1918, bearing in mind the three closely interrelated aspects of forestry professionalisation; namely forest inventory, forest management, and forest policy. These essential requirements are further explored and discussed in this chapter and take into account:

- Legislation to provide a legal underpinning for forestry.
- Good quality forest would need to be surveyed, mapped and dedicated as State forest to secure it from settlement, agriculture or other uses.
- Regeneration to be protected from bushfires to allow it to grow to maturity and produce the full volume of its potential of marketable timber that bushfires would otherwise reduce or destroy.
- The extent, number, quality and growth rate of the trees in the forest had to be determined. That is, a forest inventory must be carried out to supply the facts on which a sustained yield of marketable timber could be calculated.
- The extent of any damaging fungal disease (such as jarrah dieback) or insect attack (such as jarrah leaf miner) had to be assessed to allow for its effect on sustained yield.
- A working plan had to be prepared to inform how forest managers, based on the data provided by forest inventory, would implement the goal of sustained yield.

4.1.1 Dedication of State Forests 1919-1935

The period between 1919-1935 were of pivotal importance for the forests and their management in South West Western Australia (Williamson et al., 2005). The 1920s were very much part of the era of the ‘expert knows best’ and the expert foresters at the third Empire Forestry Conference in Australia in 1928 endorsed “*the need to reserve forests and plan their management on a sustained yield basis*” (Dargavel, 2008, p. 135). However, before the 1918 Forests Act, there was no forested land reserved to remain as forested Crown land.²¹ Therefore, the forests and its marketable timber could all be harvested and, if suitable, the land could be cleared for settlement and farms. A need to reserve forested land as State forest had been advocated firstly by Harper (the member for Beverley), and then the 1903 Royal Commission, and again by Hutchins in his 1916

²¹ Land owned by the government.

report and then C. Lane-Poole when he was appointed Conservator in 1916. The 1918 Forest Act finally forced the issue of allocating forests as State forest.

However, the prominent politician James (“Jimmy”) Mitchell, then Premier, and later Lieutenant Governor then Governor of Western Australia, could be considered an enemy of forested land. He was not necessarily against forests for their own sake - they just got in the way of his vision for Western Australia as the food bowl of the world, described by Bolton (2008, p. 110) as Mitchell’s well-known “*tunnel vision about agriculture*”. To achieve Mitchell’s vision, forests had to be cleared of trees so that crops and pasture could be grown.

Even after the land classification project that recommended which areas should remain as forest and become State forest, and which areas were available for agriculture, the newly established Forests Department had difficulty in having the relevant areas dedicated as State forest when Mitchell was Premier. This position of the Premier was also an indicator of public indifference to forest values - advocating large-scale forest clearance was not considered as incompatible with being Premier at that time. Consequently, the largest addition to State forest was 820 000 hectares during the 24 months ending March 1929 - a time when Mitchell was not Premier.²²

Despite the slow start under Mitchell, the bulk of the dedication of State forest occurred during the decade 1920-1930 as shown in Figure 4.1. According to Kessell²³, by 1935 the whole of the good quality jarrah and karri forest remaining in the possession of the Crown had been permanently dedicated as State forest (Forests Department Western Australia, 1935; Kessell, 1935).

²² Phillip Collier not James Mitchell was Premier in 1929. Mitchell was Premier from 1919 – 1924 and again from 1930 – 1933.

Mitchell was Lieutenant Governor of WA from 1933 – 1948 then Governor from 1948 – 1951.

²³ Stephen Kessell was Acting Conservator from 1921-1923, then Conservator of Forests from 1923-1945.

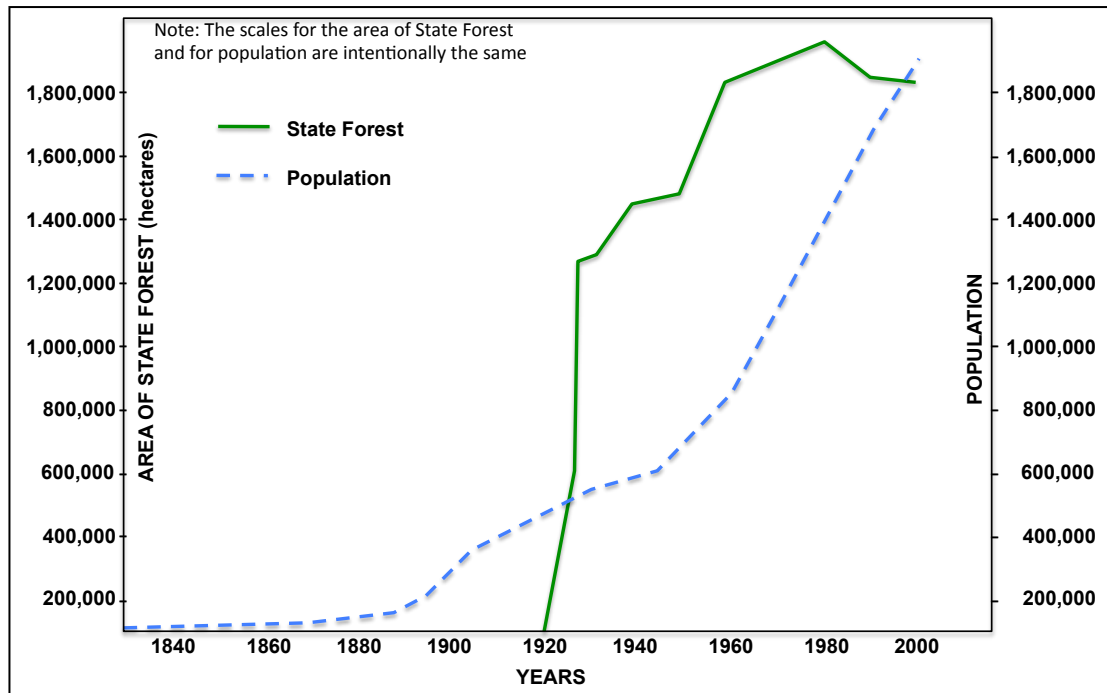


Figure 4.1: Area of State forest in Western Australia and Western Australian population since 1830 (Forests Department Western Australia, CALM and DEC Annual Reports 1920 to 2010).

After the 1918-1935 period, allocation of State forest was slow due to other political priorities during the war years (Figure 4.1). Allocation of State forest was further put under pressure and slowed due to the increases in the population. For instance, farmers were looking to increase the size of their farms to cater for their sons and there were many requests, especially during the 1960s, to extend their farms into adjacent State forest. From the farmer's point of view, a small amount of forest added to their farm could make their farm viable and would make little difference to the total area of the forest. However, from the State's and the forester's point of view this would set a precedent for other requests that in total would significantly reduce the area of State forest and so reduce the opportunity to conserve forest values and the volume of timber available for future populations. In addition, the need to get support from both houses of Parliament would have represented positive discouragement. Therefore, only a small number of these requests were agreed to. All in all, the State forest allocation process eventually resulted in 1.9 million hectares of State forest around the year 1980 (Figure 4.1).

4.1.2 Regeneration

With hindsight, the uncontrolled logging of the forests of the South West of Western Australia from the beginning of European settlement in 1829 until 1920 simply constituted a mining of the resource. In addition, only rudimentary forest inventories of the likely timber present, consisting of no more than ocular estimates from a walk and a horseback or buggy ride were carried out. Similarly, during that 90-year period no formal effort was put into ensuring that regeneration of the forest occurred (Forests Department Western Australia, 1929a). When regeneration did occur, it was by chance not by design. For example, the stand of karri at Boranup south of Margaret River, shown in Figure 4.2, is the result of ‘regeneration by chance’ after heavy cutting at Davies’ mills at Karridale and Boranup in the 1890s. The jarrah forest survived its early cut through lignotuberous regrowth. To the professional practice of forestry, it is a basic requirement to ensure that there is sufficient regeneration to replace any trees that are removed. It is one of the simple foundations of perpetuation of the forest and of sustainable use.

In the jarrah forest, a sustained yield cut will extract approximately half to one per cent of the forest each year (personal view, author). In any sustainable timber industry, it is important that the annual cut should not exceed the growth rate of the forest to ensure indefinitely long life for the forest and its inhabitants. The net growth on a virgin (uncut) forest will be close to zero - the growth on younger trees being offset by the death of the old trees (personal view, author). Whereas the growth on a previously cut over forest will vary according to the scale and the intensity of the cut. In addition to the changing growth rate of the forest, there may be a change in the products and volumes that harvested trees can contribute, and to the tree species that are marketable.



Figure 4.2: Boranup karri forest (WA) - Regrowth karri in the 1990s following logging in the 1890s.

Nonetheless, the aim for areas of forest set aside for logging should be to reach the optimum level of cut in the smallest number of operations possible. This requires regular monitoring to allow for different levels of original cut due to changes in growth rate with age, changes in products harvested, changes in species harvested, changes in annual rainfall, and changes in areas available for cutting due to conservation, disease, fire and recreational use, as well as a margin for error in the inventory. Thus to avoid mining the resource and to achieve a sustained yield of timber, one essential step was therefore to systematically ensure that regeneration followed logging and the re-growth forest was protected. This was of such concern to C. Lane-Poole that ensuring adequate regeneration became a major goal of the new Forests Department and of C. Lane-Poole's successors as Conservators of Forests.

The third Empire Forestry Conference met in Perth, WA, and then the Australian eastern states in 1928 and its report included the comment about Western Australia that

a reduction in the cut will in itself (Forests Department Western Australia, 1929a, p. 49):

...not achieve the object of a sustained yield unless it is accompanied by an active development of regeneration work over the very large area of the forest cut over in the past. The regeneration methods adopted during the last few years, have given satisfactory results...

When the community valued the forest mainly for the timber it could produce, the treatment of the forest would be aimed at producing regeneration that would result in trees with good quality logs suitable for timber production (Kessell, 1928a, b). As a fortunate by-product of this commercial focus on regeneration, supported by good forest management, especially the fire control component, the forest could also be suitable for a great many other values that future generations would want, such as catchment protection, nature conservation and recreation (Williamson, 1981).

When the new Forests Department was formed in 1919, it began actively carrying out silvicultural operations to produce regeneration in the areas that had been cut over in previous years. It was realised that “*the axe of industry could become the silvicultural tool of the forester*” (Forests Department Western Australia, 1969, p. 47). By 1929, 18,000 hectares of jarrah and 1,900 hectares of karri had been treated for regeneration (Forests Department Western Australia, 1929a).

Because of the depression during the 1930s, up to 1,500 sustenance workers on unemployment relief were able to be employed mainly on regeneration treatment work during that decade. During the 5 years to 1934, 188 200 acres (76 200 hectares) were treated compared to the area cut over during the same period of 108 500 acres (43 900 hectares). The area treated for regeneration was catching up with the area cut over. By the end of the 1930s, a total of 426 000 acres (172 500 hectares) had been treated for regeneration (Forests Department Western Australia, 1940, p. 10). No regeneration work was carried out for the duration of World War II, or for the remainder of the 1940s. However, since the 1950s, it has been standard practice to ensure that adequate regeneration is achieved following logging.

4.2 Measurement of Commercial Value - Scientific Management

While forest inventory was not specifically mentioned in the Forests Act (Government of Western Australia, 1918) it was clear that forest inventory was one of the most important sources of information that enabled informed forest policy to be developed and forest management to have the necessary information to implement that policy. Clause 19 (2) of the Forests Act required plans to be prepared of the lands classified as State forest showing the quantity of timber growing on them (Government of Western Australia, 1918). This requirement could only be fulfilled from data supplied by forest inventory. A similar need for information from forest inventory was necessary to fulfil the requirement of clause 31 dealing with the preparation of working plans. And yet again the need for forest inventory was evident from clause 19 (43) which dealt with the authority to make regulations covering the kinds, sizes, and quantities of any forest product which may be removed (Government of Western Australia, 1918).

Resolution number 2 of the Empire Forestry Conference in London in 1920 gave further emphasis to the importance of forest inventory (Forests Department Western Australia, 1921, p. 23):

The foundation of a stable forest policy for the Empire and for its component parts must be the collection, co-ordination, and dissemination of facts as to the existing state of the forests and the current and prospective demands on them.

By the time the Forests Act had been proclaimed, an inventory and land classification project was already underway commencing in 1916 as a collaborative effort between Lands Department officers representing agricultural interests and Forests Department officers representing forestry interests. This project was aimed to determine which areas of the prime jarrah forest should be retained for forestry and which lesser quality forest could be cleared for agriculture. C. Lane-Poole, the newly appointed Conservator of Forests, advised District Ranger Schock that (WASRO, 1916a):

...the work of classification will begin shortly and you will take charge of the inspection work ... there will be two camps and two assistant rangers for each camp ... the work is to start from the Blackwood River and work north right through the Jarrah country.

Ranger Schock also received a copy of a letter to be sent to forest rangers about how the professional inventory of the jarrah forest was to be carried out. Each centre line of the survey was to be marked out 800 metres apart by the Lands Department surveyors so that they could be accurately located on a map. For each 10 chains (200 metres) along the centre line and for 5 chains on each side of it (10 chains x 10 chains = 100 square chains),²⁴ the forest was to be classified as they went along into one of the following five classes (WASRO, 1916b):

- (i) Virgin forest.
- (ii) Cut over but a few mill logs left.
- (iii) Cut over but only hewing timber, poles and piles left.
- (iv) Entirely cut over, no hewing timber, few poles or piles.
- (v) No timber now and has not contained jarrah in the past

For each 10x10-chain section of these strip line surveys, the forest rangers were also to estimate and record the number of jarrah trees with marketable timber. Once a week they were required to select an acre and measure the trees for girth and length of bole to the first branch. In this way, this forest inventory and land use survey produced a thorough picture of the extent of the jarrah forest and ensured that the entire forested area was covered by teams who had experience in both farming and forestry. The aim was to permanently dedicate the area of prime timber country to forestry purposes under the title of 'State forest'; to dedicate the area of second class timber country as a timber reserve until all its marketable timber had been removed; to throw open agricultural land for selection; and to afforest waste barren land where suitable (Kessell, 1928a, b).

Lane-Poole was intent on ensuring that the best forest areas were not lost to agriculture. At the end of World War I, Lane-Poole was allowed to employ some returned soldiers and augment the existing two survey teams by another two. The project was the first forest land-use mapping exercise in Western Australia and the fieldwork for this

²⁴ 100 square chains \approx 10 acres \approx 4 hectares

exercise was completed in September 1919 for the country north of the Blackwood River. The good news for Lane-Poole and the security of the best forest areas, was that the classification showed that the bulk of the prime timber country (the best forest areas) was not on land with great agricultural potential (Lane-Poole, 1922).

Classification work continued beyond 1919 for areas south of the Blackwood River and in 1923 the forester in charge of classification camps in 1923, H. Smith, included the following in his article (Smith, 1923, pp. 50-51):

Classification work was first started in the Western Australian forests by the late conservator of forests, Mr C.E. Lane-Poole, with the idea of ascertaining the available supplies of marketable timber in the forests of the country.

A camp consists of one surveyor and assistant, three classifiers, three compass hands, and one cook, one horse-driver, and usually one or two forest apprentices are in camp for practical experience.

The information gained by the classification of the forests will be of great value to the Forests Department, as a great deal of country supposed to be carrying timber of a high loadage (volume) has been found to be carrying little or no timber of a remarkable value.

The importance of accurate, measured inventory information was well understood in this classification work, which remained focussed on the commercial value of forests and its sustainability.

By 1920, the area that had been evaluated and inventoried was 981 000 hectares and the growth rate of marketable timber was given as 5 cubic feet per acre per year (3.5 cubic metres per hectare per year), but no basis was given for this figure (Forests Department Western Australia, 1920, p. 3). The volume removed in the 12 months period to 30.6.1920 was given as 806 000 loads (1 128 000 cubic metres) compared to the estimated sustained annual yield of 270 000 loads (378 000 cubic metres) although again no basis for the sustained yield figure was given (Forests Department Western Australia, 1920, p. 3) (sustained yield being the rate of cut that does not diminish the

capital base itself). Nonetheless, this indicated the magnitude of the problem the Department faced in reducing the annual cut to the level of the sustained yield.

The main part of the land classification project in the jarrah forest was completed by 1921 (Forests Department Western Australia, 1921, p. 5). By 1923, the classification project, including the karri forest, was complete except for about 100 acres (40 hectares) between the Weld and Frankland rivers, although the plotting work was not yet complete. The approximate area figures determined by that “virtually completed” land classification project were (Forests Department Western Australia, 1923, p. 6):

<i>Prime jarrah</i>	<i>943 000 hectares</i>
<i>Prime karri</i>	<i>30 000 hectares</i>
<i>Prime red tingle</i>	<i>2 700 hectares</i>
<i>Prime tuart</i>	<i>2 400 hectares</i>

Other inventory work in that decade included assessment of close on 40 000 acres of cut over jarrah country to determine the number of healthy marketable saplings less than 10 inches (i.e., 3.9 centimetres) in diameter. This inventory found that there were only 2.45 marketable saplings per acre (i.e., 6 per hectare) compared to 21.2 unmarketable saplings per acre (i.e., 52 per hectare) (Forests Department Western Australia, 1921, p. 13). This was further followed by assessment surveys in 1926, covering 249 000 acres (100 800 hectares) to determine marketable volumes available for sawmills (Forests Department Western Australia, 1926, p. 16). These surveys resulted in that for the first time the commercial valuation of the forests could be known with reasonable certainty.

Additionally to assist the inventory efforts, in 1925, a one square mile grid system of map reference was adopted to make location in the forest simple and to allow inventory assessment lines to be relocated for re-measurement. It consisted of marking the position of 2 or 3 reference trees per square mile on a map. These trees were near existing tracks and the unique identity of each tree was marked on it by a shield cut into the wood and facing the track. A shield tree, as they were known, with the marking BV 73 3 would indicate the shield tree number 3 marked on the map near the track in map square BV73 (Figure 4.3). This tree is near the parking area for Sullivan Rock. This system has been replaced by global positioning systems but many of the trees are still present in the forest today, including BV 73 3.



Figure 4.3: Shield Tree BV 73 3 near Sullivan Rock, WA.

4.2.1 Forest Inventory 1930-1940

In order to manage the forest to sustainably provide timber, more information was needed about where the best quality forest occurred, how much of it there was and how fast it was growing. The land classification project and inventory of the 1920s had indicated that harvesting was being undertaken well beyond sustainability. From 1932 to 1938, a major inventory²⁵ of the jarrah forest was undertaken in 21 centres from Beraking and Jarrahdale in the north to Pemberton, Nannup and East Witchcliffe in the south (Stoate and Helms, 1938). Each plot measured was part of a strip line survey,²⁶ with strips a half chain (i.e., 10 metres) wide within a given soil type, and mostly 20 chains (i.e., 400 metres) apart providing a 2.5% sample of the area covered. All trees in

²⁵ Inventory was sometimes interchangeably called stocktaking, assessment, or survey.

²⁶ Strip lines were the standard approach to forest assessment surveys until replaced by plots in the late 1950s.

each plot over 2 feet girth (i.e., 61 centimetres) were measured and the standing volume of saw-logs was calculated. Each tree measured was also given a numbered tag to allow it to be identified and re-measured in the future to determine its growth. Disappointingly, no maps accompany the report (Stoate and Helms, 1938), even though the report would not have been considered complete without them.

In conjunction with tree measurements, a soil survey was also carried out. This was the first occasion on which such surveys were carried out on an organised basis in the indigenous forests (Stoate and Helms, 1938). Each soil pit dug had the dimensions of 4 feet long by 2 feet 6 inches wide (i.e., 120cm x 76cm) and down to the C soil horizon of decomposing rock. The aim was to see if forest quality was related to soil type. Much of the jarrah forest occurs on laterite soil, a soil type formed under moist tropical conditions (Stoate and Helms, 1938). Knowing the soil type and its extent would also be essential in deciding whether exotic species such as pines could be planted.

Other attributes of the forest besides tree volume and soil type included observations of the number and quality of any regeneration, the effect of fire “*older stems of jarrah are protected sufficiently by the fibrous bark to withstand comparatively light ground fires without serious damage*” (Stoate and Helms, 1938 p. 137), and the main understorey plants occurring in each of the seven forest types encountered. An important finding was that there was a good correlation of height growth with volume so that tree height was a useful index of site quality. This was a finding consistent with the species-specific tree volume tables that were appearing for forests in other countries (Carron, 1968).

4.2.2 Forest Inventory 1940-1950

“*Timber assessments were carried out in various Divisions to tree marking standards and to obtain information required for any future revision of the jarrah Working Plan*” (Forests Department Western Australia, 1941, p. 10). In 1947 temporary (80 hectares) and permanent (150 hectares) assessment was carried out (Forests Department Western Australia, 1947, p. 11). A major initiative in 1949 was the preparation of forest type maps covering 80 000 hectares from aerial photos. This was the beginning of the widespread and productive use of aerial photos in forest inventory that prevails in a refined and developed form to this day. In 1950, a further 58 hectares of permanent assessment lines were measured and marked, although as would be noted in the Royal

Commission of 1951, there was still a long way to go to gain a comprehensive data set for these forests (Royal Commission, 1951).

These inventories evolved in the 1950s to measurement of plots within forest types interpreted from aerial photos. In addition to these “routine” timber assessments, forest inventory was also carried out for special projects including the detection and mapping of jarrah dieback disease, the extent and damage of the Dwellingup bushfire, and the extent of marri. Forest inventory had begun as part of general forest administration and finished as a branch in its own right with its own specialist staff, work programs and budget. The overall thrust was to evaluate land for marketable timber and its growth. This was also the main thrust of the training of professional foresters.

4.2.3 Forest Inventory 1950-1960

The need for more inventory data was clear from the Royal Commission report on 1951 (Royal Commission, 1951, p. 52):

The volume of resources of these forests is inadequately known. ... There is insufficient information available of different types of forest, their stocking in trees of different sizes and their rates of growth to enable any useful figures of increment to be advanced, much less for any useful forecast to be made of their potential future growth. It is known that the state of growth of the jarrah forest, which comprises the bulk of the forest resources of the State, is at present generally very slow.

Current marketable volume and other components of the forest useful for providing sawlogs were assessed on long ‘strip lines’ as in the 1930s. The dimensions of the strip lines changed from the 1930s to two chains (40 metres) wide (rather than the half chain width in the 1930s) and generally a mile apart (1.6 kilometres) (rather than 20 chains apart as in the 1930s). The aim remained however, to achieve a 2.5% sample of the forest. The basis for these lines was ‘May’s Line’ which went north to south starting just south of the Albany Highway north east of Jarrahdale and going due south virtually through Collie, Bridgetown and Manjimup to the south coast east of Point D’Entrecasteaux (Fig. 4.4). The full assessment of May’s line was not completed before being replaced by plots located in forest types marked out on aerial photos.



Figure 4.4: May's Assessment Line. The green patch indicates forested area with marketable timber resources.

While tree quality was noted, as was the future growing stock of marketable trees (Shedley, 1950), no account was taken of recreation, conservation, or aesthetic values,²⁷ although those doing the assessment were aware of these values as observed at that time by the author (Williamson, personal observation).

Throughout those decades, temporary and permanent assessment lines were measured with increasing sophistication based on forest type maps produced from aerial photo interpretation. *"The use of aerial photo interpretation has been developed by officers of this Department on a practical basis to a stage where it forms one of the most important aids to the forester in designing and organising the economic development and management of State forests"* (Forests Department Western Australia, 1954, p. 12).

Two forestry conferences held in Australia in the 1950s were the 7th British Commonwealth Forestry Conference in 1957 held in Australia and New Zealand (Nunn, 1957) and the 10th Australian Forestry conference in 1959 at Tumut in NSW (Nunn, 1959). If community values about forests included values other than commercial timber,

²⁷ With a population of 573,000 in Western Australia in 1950 there was little demand for specific areas to be set aside for forest recreation.

it was evidently not influencing those responsible for managing public forests (i.e., the foresters at these conferences) and therefore not influencing forest inventory. Both these conferences dealt almost entirely with marketable timber and its management, although the need to protect the water quality in urban catchments through proper forest management was also acknowledged (Nunn, 1957; 1959).

4.2.4 Forest Inventory 1960-1970

During the 1960s, aerial photos were used to locate sample plots within interpreted forest types. That work built on what had begun from the use of aerial photos for military purposes during World War II, although aerial surveys were conducted in Canada as early as 1911 (Honer and Hegyi, 1990). Their use for forest inventory in Western Australia began in the early 1950s in which aerial photos were used to interpret the forest into crown density classes²⁸ and later into stand height²⁹ and stand structure³⁰ as well as stand density classes (Bradshaw et al., 1997). All work was field verified to ensure its accuracy. This kind of aerial photo interpretation (API) enabled efficient allocation of plots within the forest types of interest. It was considered that measuring marketable timber from strip lines through the forest was inefficient because of difficulties knowing whether the forest ahead would be dense or open, mainly mature trees or mainly regeneration. It was necessary to measure a lot of trees to get an accurate estimate of the total marketable timber in an area.

With API of forest types, a picture was produced of the kind of forest in an area before measurement (stratified sampling). Plots could then be allocated to achieve an estimate of marketable timber in each forest type. It was much more efficient to measure plots within forest types interpreted from aerial photos than to measure along strip lines with a great variation in the marketable timber encountered, although for some purposes field work remained indispensable.

As standard practice, all interpreters were tested to see that they had three dimensional vision. This would help them detect the different height of mature trees, poles and saplings on the stereoscopic pairs of aerial photos when viewed through a stereoscope.

²⁸ Crown density is the percentage cover occupied by the crowns of a similar patch of forest

²⁹ Stand height is the average height of the mature trees

³⁰ Stand structure records the occurrence of sapling, pole or mature trees

One outstanding interpreter (Max Rutherford), however, did not have stereoscopic vision. His father was a field forester and from a young age, Max had visited the bush and could picture it in his mind. He knew that mature trees had large crowns, poles had lesser crowns and saplings had the smallest crowns of all. He could see the crown size of the trees on aerial photos without stereoscope vision. Others with initially less bush knowledge needed stereoscopic vision to determine the height of the trees and be convinced of their sapling, pole or mature status.

In 1960, Western Australia became the first state in Australia to produce a forest inventory to national standards (Williamson, 1964). The emphasis was entirely on evaluation of marketable timber. In 1962, the progress report for the period 1955-1960 presented to the 8th British Commonwealth Forestry Conference in Kenya concentrated on production and protection matters. In 1966, statistical methods were introduced for selecting inventory plots within forest types interpreted from aerial photos in Western Australia (Williamson, 1965). The number of plots chosen depended on the desired sampling error and this approach reduced the number of plots that needed to be assessed.

API was also applied in a comprehensive interpretation of the extent and severity of the catastrophic Dwellingup fires that occurred in 1961 using photos taken a few weeks after the event. A Royal Commission was established in the same year to consider the management and response to bush fires (Royal Commission, 1961). The Royal Commission was followed several years later by an assessment of the extent and value of timber loss from the fire using plots within the damage classes from the earlier aerial photo interpretation work (Peet and Williamson, 1968). A thorough research program into fire behaviour in the jarrah forest was commenced following the Dwellingup fire and the 1961 Royal Commission (Peet, 1965). This work by George Peet and his team formed the basis of the prescribed burning program for minimising damage from severe bushfires under the conditions of the Western Australian environment. In the climate of South West Western Australia, a sustained yield of marketable timber required that the damage from bushfires be minimized. Such an approach can also minimise damage to nature conservation and recreation objectives.

Aerial photography was also deployed during this period to identify and map the extent of dieback disease. In 1965, *Phytophthora cinnamomi* (PC) was determined to be the

cause of jarrah dieback disease (Podger et al., 1965). PC is a soil borne pathogen and is spread mainly by soil movement. It was therefore important to determine its occurrence in the forest landscape so that infected areas could be quarantined to keep logging and other activities that disturb soil out of infected areas and so limit the spread of the disease. The quicker this could be done the better. In 1968, three years after PC had been scientifically determined as the cause of dieback (Podger et al., 1965) aerial photos covering 56 000 hectares were scanned for evidence of the disease.

Aerial photos covering a further 364 000 hectares were interpreted in 1969 for the disease. The solution involved the use of 70mm colour transparencies flown under shadowless conditions of high cloud to obscure the sun so that the understorey of banksia, a species that shows a browning of its crown within three years of infection by PC, could be detected (Bradshaw, 1974). Transponders on towers 60 kilometres apart accurately guided the aircraft taking the photos on parallel flight lines. The photos in each flight line were stereo pairs to aid in the interpretation of the affected banksias. Field checking of the dying banksias with soil samples taken from their roots were analysed in the Dwellingup research laboratory for the disease. This clarified whether the dying banksias were affected by PC or only by drought. The project was a success (Bradshaw and Chandler, 1978) and a modified version of this application of aerial photos is still used to this day to map the occurrence of dieback disease.

Inventory was also conducted over this period for species of less commercial value than jarrah. Marri (*Corymbia calophylla*) is a major component of the jarrah forest but its timber is not as commercially valuable as jarrah. However, it is suitable for the manufacture of paper pulp from which high quality paper is made, so it was important to know how much of it there was and where it was situated. In fact, marri was interspersed widely throughout the forest but it was not initially possible to separate the similar appearance of marri from jarrah, until interpreters realised they had different flowering times: for jarrah September-December and for marri February-March. The prolific creamy white flowers of marri make their crowns stand out against the green jarrah crowns if the aerial photos are taken when marri are in flower and jarrah is not. Initially, aerial photos were taken in March 1962. This was a disappointment as 1962 turned out to be a very poor year for marri flowering. A repeat exercise in March 1963 had glorious success as this was a bumper year for marri flowering and current

knowledge of the accurate distribution of marri on forest type maps comes from interpretation of these 1963 aerial photos.

The interest in marri was driven by its commercial value for woodchips. Through the Commonwealth Government's role in approving export licences, the WA government, as proponent for the wood chipping industry in this State, was required to prepare an environmental impact statement. The forest inventory described was used to inform this statement.

Interpretation of aerial photos enabled the discovery of previously unknown stands of valued timber species. For example, during the interpretation of forest types from photos in the southern forest in 1963, it was noticed what looked like karri (*E. diversicolor*) near Black Point, a columnar basalt promontory on the south coast west of the Donnelly River east of Augusta. The crowns were large, like karri, but the existence of such an isolated patch seemed unlikely. The nearest karri was 20 kilometres to the north in the Donnelly River Valley and to the west karri was 40 kilometres away near Karridale. However, to the interpreters the large crowns in the patch near Black Point still appeared as "karri".

As there was no mention of karri at this location on any existing forest type maps it was necessary to check this in the field. The track stopped just west of Lake Jasper and from there it was an hour's walk, guided by aerial photos. It was indeed a magnificent stand of karri. The photos had not been deceptive. It was exciting to put this isolated patch of karri on the forest type maps. The Donnelly River sawmill became interested in logging the area but was persuaded that the cost of putting in a road would not warrant the relatively small volume of logs that could be harvested. Today the area is safely inside the Shannon D'Entrecasteaux National Park, a conservation by-product resulting from scientific forest inventory and conservationist values held by foresters.

4.2.5 Forest Inventory 1970-1985

In the early 1970s, it became apparent to foresters that the State forests were being increasingly used for recreation, especially near the capital city Perth. A survey confirmed this observation (Spriggins, 1975). Other foresters became involved in land use planning at this time (Havel and Batini, 1973; Havel, 1975). From this came, for the

first time in an official report, the notions of multiple-use planning and a diversification of the concept of value in the jarrah forest (Forests Department Western Australia, 1977b). In further response to the realisation that public forests should be seen to provide for all legitimate uses, some of which were compatible with each other and some not, the Forests Department developed the approach of allocating Management Priority Areas (MPA). The concept of MPAs was encapsulated in multiple-use planning in the northern jarrah forest in 1977 and published by the Forests Department in 1980 (Forests Department Western Australia, 1977b; 1980). By 1982, the concept of multiple-use and MPAs was well established by the Department. Use of forests for recreation had been widely embraced in the United States by this time, with this change permeating into forest management practices in Australia.

Multiple-use planning engaged *de facto* trading between forest values held by foresters and the inclusion of forest policies. Multiple-use worked as follows, using catchment protection as an example. Where catchment protection was the priority use, other uses such as recreation, timber production, conservation and mining became the compatible secondary uses and could only be permitted where the risk of spread of jarrah dieback disease was low. A similar approach was taken in other areas where land uses such as recreation, water production, timber production, conservation, and mining may be the 'priority use' with other 'compatible land uses' being the secondary uses. Even in areas where timber production was permitted, recreation was generally possible for over half the time between logging operations. To respond to changing conditions, the multiple-use approach was reviewed on a five to ten year basis.

Softwood inventory was carried out throughout the decade, and hardwood inventory based on sample plots within forest types interpreted on aerial photos continued. Dieback interpretation and mapping continued using 70 mm shadowless colour transparencies. An inventory of cypress pine was also undertaken in the Kimberley in 1970 and is included here to demonstrate that the methodology was quite robust under very different conditions. That survey confirmed the findings of McVicar's 1921 inventory in the Kimberley that the commercial possibilities of exploiting cypress pine were very doubtful. When a proposal was received to cut cypress pine (*Callitris intratropica*) in the Kimberley a reconnaissance inventory was carried out to determine the nature, extent and quantity of cypress pine in the north Kimberley (Williamson,

1974). The occurrence of cypress pine was field checked from aerial photos in the event there was not enough volume of cypress to warrant any cutting, also bearing in mind the more than 200 kilometres distance from the proposed processing sawmill at Derby. In addition, several plots were measured to provide information on stem numbers, size and volume. This study found that there was little cypress regeneration (Williamson, 1974), and any logging would have reduced the chance of survival of cypress in the face of annual bushfires in the Kimberley .

Forest inventory to assess volumes available under the marri woodchip project continued. The Forests Department made a submission to System 6, the component of the Conservation Through Reserves Committee (CTRC) that dealt with the most populated areas of the South West of Western Australia. The CTRC was established in 1972 to ensure that areas in Western Australia with conservation value should be recommended as conservation reserves (Rundle, 1996). The timing of the submission to the CTRC fitted closely with the Forests Department's development of MPAs and multiple-use management strategies (Forests Department Western Australia, 1977b).

In the latter part of this period and consistent with the Forests Department's policy towards water production and catchment protection management in metropolitan catchments, thinning trials were carried out in the Wungong catchment to determine the relationship between a thinned (low basal area) stand of trees and the rate of replenishment of the shallow groundwater table. Depending on the results, regeneration and thinning techniques were to be modified to favour water refill of shallow aquifers.

4.2.6 Transformation of Land Use and Planning 1985-2010

During the period 1985 to 2010, a great deal of State forest was converted to national parks, where commercial logging and mining are not permitted. National parks increased to almost one million hectares, by reducing and reclassifying the area of State forest, where logging and mining are permitted. The reduction in area of State forest from about 1.9 million hectares in 1980 to about 1.2 million hectares in 2011 indicated the result of the very large increase in interest in public forests over this period. This rebalance reduced the amount that could be harvested from the forest on a sustained yield basis.

Not all changes were driven by conservationist movements, but were generally consistent with the changes in community values. Major projects involving forest inventory and forest planning occurred in Western Australia during the period 1985-2010. Some of those projects which began before 1985, such as the 1975 recreation survey, were instigated by the Forests Department in response to the need to manage the forest for other uses besides marketable timber. Other projects, such as the 1984 recreation framework plan (further discussed below), were due to the combined interest of the community and foresters, and social inventories, were in response to community interest especially in relation to the late 1990s Regional Forest Agreement process (RFA, 1999). Additionally, attention in the 1980s, in other states such as Victoria, to recreation planning and visual resource management influenced forest management in the southwest of Western Australia.

The conservationist influence also forced a new method of inventory for the jarrah forest. From the 1980s, more and more areas were being removed from availability to sawmills and were reclassified as national parks, where logging was disallowed. Every time an area available for logging was changed, volume calculations had to be made to find the new volume in the remaining area of State forest that was sustainably available for a timber mill. The established method was not designed for this level of flexibility. A change in measuring plots for timber volumes was therefore made in the period 1988 to 1990 from total ground measurements of randomly selected plots to predominantly aerial photo measurement of plots selected systematically. Ten per cent of these plots were also measured on the ground to provide verification and corrections where necessary. While remote sensing has greatly improved inventory there are always factors that cannot be accounted for in this way and fieldwork remained as part of data collection as highlighted by Kleinn (2002, p. 10):

...fieldwork is particularly indispensable for a large range of variables that cannot be observed through remote-sensing technology within an acceptable range of accuracy, or at all. Remote sensing, combined with ground control, is the choice for mapping and landscape-level analysis.

A more detailed explanation of the new inventory method follows in the next sections. From inventory plots in API types to systematically selected photo plots was a three-year project (1988-1990). The previous method until 1990 involved interpreting forest

types from aerial photos, field-checked to ensure the accuracy of the API types, then measuring all the plots on the ground within the API types to a sampling error of +/- 15%. The new method involved selecting plot positions systematically on a 'grid' of the jarrah forest. The grid consisted of parallel lines 1 000 metres apart. Plot positions were selected at 500-metre intervals along the grid lines (Spencer, 1992). There were 29 000 plot positions selected in this way. Each of the 29 000 plot positions had stereo aerial photos of them taken at a scale of about 1: 1 200. A plot on each of these stereo photos was then measured for species and tree height from the photos themselves.

Previously determined relationships allowed tree volume to be calculated. Ten per cent (2 900) of these photo plots were also measured on the ground to allow any necessary adjustments to be made to the photo plots. This entire program of 29 000 photo plots in the jarrah forest and 2 900 ground plots was measured in the three years 1988 to 1990. Because the plot positions were identified by a global positioning system and stored in a computer-based geographic information system, any defined boundaries could have the volume within it readily calculated by using the relevant plots (Spencer, 1992).

This improvement in efficiency in forest inventory technique had two major benefits. It enabled timber volumes for the jarrah forest to be obtained much less expensively than by the previous method of measuring ground plots only within API types. And its flexibility also enabled any area of the jarrah forest to have its marketable volume calculated. Furthermore, when utilisation standards for the logs in the trees changed, it was a simple matter to recalculate the gross bole volume available to these changed standards without having to do a reassessment. It became a simple matter to recalculate the volume available to the sawmill from the plots remaining within the new boundary.

It was one thing to collect important information on which to base management of the forest. A separate challenge was to store it in a usefully retrievable way. The WA Forest Management Information System, initiated in 1980, addressed this challenge. The entire forest area of more than two million hectares was divided into 2 ha units (more recently refined to 0.5-hectare units) and each unit was assigned up to 32 items of forest information. More recently this was expanded to over 130 items per 2 ha unit all stored in a readily retrievable manner (M. Rayner, pers. comm., 2010).

These developments in inventory techniques were consistent with those developed nationally, where information has been collected or collated since 1988 under the National Forest Inventory (NFI) programme. Nevertheless, the task remains complex, especially with monitoring of change and there have been proposals towards a continental forest-monitoring framework (CFMF) as outlined by Brack (2007, p. 104):

CFMF is proposed to consist of three Tiers: (1) satellite imagery of the continent to identify forest and change in forest cover; (2) systematic high-resolution remotely sensed data and (3) permanent ground points at 20×20 km grid interception points. The CFMF approach is in line with the international trend of national forest inventories in developed countries although the Tier 2 approach offers a useful extension.

4.3 Working and Management Plans

Working plans were required to be developed by the Forests Act (Government of Western Australia, 1918). These set out the policies and objectives for a forest, the ways in which these were to be fulfilled, and described how the forest would be managed. Working plans were initially prepared for areas of forest managed from one field station. It became more efficient to prepare them for species (karri in 1927, jarrah in 1929) and then, beginning in 1945, to prepare general working plans for the whole forest. In 1985, when CALM was formed, the term ‘management plan’ replaced ‘working plan’ and had virtually the same meaning. To be realistic a working plan (or a management plan) for forest areas had to be based on accurate information from a forest inventory.

4.3.1 Forest Working Plans

The first working plan prepared covered the ‘Mundaring Working Circle’ and took effect from 26 September 1921 (Stoate, 1926). The three main aims of that plan were: to maintain pure water in the Mundaring catchment; to produce jarrah timber, including firewood for the number 1 and 2 pumping stations of the Goldfields water supply scheme; and to plant pines where possible on forest not suitable for jarrah. By the 26 July 1926, 24 other working plans had been prepared (Stoate, 1926). These were all for

individual areas, but in 1927 a general working plan for the karri forest as a whole was approved. This plan dealt with the assessment of the whole of the karri growing stock and control of the sawmilling industry operating in the karri forest (Forests Department Western Australia, 1927).

The Forests Department Annual Report in 1929 indicated the development of the concept of sustained timber yield “*cutting only the increment*” (Forests Department Western Australia, 1929a, p. 3). As a first step to bringing the timber industry as a whole onto a permanent basis, a General Working Plan for jarrah was approved by the governor-in-council in March 1929 (Forests Department Western Australia, 1929a, p. 17). The volume of mature standing jarrah timber suitable for sawmilling was estimated to be 1 033 000 000 cubic feet (36 000 000 cubic metres) (Forests Department Western Australia, 1929b). At the then rate of exploitation, with all mills working at full capacity, this represented only 28 years of cutting.³¹ Data concerning the growing stock represented by younger age classes are limited, and no satisfactory increment figures or yield tables for jarrah existed. It was evident, therefore, that any calculation of permissible annual cut must be approximate and to some extent arbitrary. Ninety years was accepted as the rotation, and it was considered that, if the cutting of the present mature crop could be extended over the first half of the rotation, with an active policy of silvicultural treatment and protection, the immature growing stock should develop sufficiently to maintain this rate during the second half of the rotation. This gave a permissible annual cut of 23 300 000 cubic feet (652 000 cubic metres) of log timber measured in the round. The General Working Plan for jarrah aimed to reduce the cut to 25 000 000 cubic feet (708 000 cubic metres) during the next five years and to 23 300 000 cubic feet within 10 years, or approximately half the actual 1928 sawmill production (Forests Department Western Australia, 1929b). Such a dramatic reduction in the permissible cut³² would have been a formidable task but the onset of the Great Depression in the 1930s reduced the demand for timber and the saw millers themselves reduced their cut accordingly (Robertson, 1956). It could be said that the Depression saved the forest from continuing to be so heavily overcut and helped bring the forest closer to sustainable management for marketable timber.

³¹ From these figures the rate of cutting must have been approximately 1.3 million cubic metres per year in 1928.

³² From approximately 1.3 million cubic metres to 650 000 cubic metres.

The General Working Plan for jarrah was revised in 1939 in accordance with its intended 10-year life (Forests Department Western Australia, 1940). By the 1940s, it was considered that a working plan for the major species used in timber production - jarrah, karri and wandoo - could be prepared and a combined working plan for the three species was produced in 1945 (Forests Department Western Australia, 1945). A Photo Working Plan was prepared to cover future requirements for native forest use and submitted to the State Mapping Committee in 1950 (Forests Department Western Australia, 1950). The General Working Plan for jarrah, karri and wandoo was revised and approved in 1956 (Forests Department Western Australia, 1956a), and a Pine Plantation Working Plan was also approved in the same year (Forests Department Western Australia, 1956b). It was clear to C. Lane-Poole and his successors Kessell and Stoate that the native hardwood forest was not sufficient in volume or growth by itself to supply the timber needs of a future, larger population in Western Australia. In fact, from the days of Ednie Brown's 1899 report (Brown, 1899) there was an interest in planting faster growing imported pines (e.g., Douglas fir) and to augment the volume of marketable timber available from the native hardwood forests for a future larger population.

The 1960 General Working Plan envisaged a permissible cut of not less than 643 000 cubic metres per year (23 000 000 cubic feet) (Forests Department Western Australia, 1960). General Working Plan number 85 was completed in 1971 and mentioned major multiple uses including timber, apiary, tourism, bushwalking, biodiversity, and habitat preservation (Forests Department Western Australia, 1971). The General Working Plan number 86 that replaced it five years later in 1977 listed the same uses (Forests Department Western Australia, 1977a). General Working Plan number 87 was produced in 1982 and was the last General Working Plan produced by the Forests Department before it became the Department of Conservation and Land Management. It listed the following forest values as part of the concept of multiple-use forestry: water, wood, recreation, scientific study, education, flora, fauna, landscape and minor forest products such as sandalwood, honey and wildflowers (Forests Department Western Australia, 1982b, p. 15). All of those forest values required an inventory to supply information to enable them to be satisfactorily managed.

The last of the single use plans for the South West forests - a draft framework plan for recreation in the northern forest region - was prepared and circulated by the Forests Department to other organisations for comment during 1982 (Forests Department Western Australia, 1982a). This focus on non-timber values was novel and indicated that the ‘winds of change were blowing’ in the Forests Department and for forest management in general. The Conservation and Land Management (CALM) Act 1984 includes a statutory requirement to circulate such a draft plan for public comment (Conservation and Land Management Act, 1984). As at 1982, the dying stages of the era of the ‘expert knows best’, a draft document was only trusted to other ‘experts’ for comment.

From ‘inside’ the Forests Department the attention to recreation in the 1970s and 1980s (Forests Department Western Australia, 1984) was driven in part by what foresters knew the forest could provide and any community interest gave them the opportunity that lack of government direction denied them (personal observation, author). Additional inventory data beyond that provided in ‘classical’ forest inventory was provided by separate surveys such as that reported in Spriggins (1975). Other significant drivers in the 1970s and 1980s were the surge in recreational use of forests (and wilderness more generally) in the United States and Canada, and efforts in other Australian states (particularly Victoria) to plan and manage for recreation alongside other more conventional uses of the forest such as timber and water production.

4.3.2 Multiple-Use Management Planning

From 1928 to 1985 the working (management) plans had been prepared for the whole of State forest areas with a focus on timber values. In contrast, over the period 1985-2010 separate management plans were prepared for each of the three CALM forest regions in 1987, and in 1994, after public consultation, CALM published a single 10-year management plan for the whole area of State forest and associated tenures under its jurisdiction in South West Western Australia. Multiple values were included; adding water, biodiversity, and recreation values to the ongoing interest in timber production (CALM, 1994). In 2004, the Conservation Commission of Western Australia produced another 10-year forest management plan for the whole area of State forest and other tenures under its jurisdiction and a draft plan in 2011 covering the same area.

(Conservation and Land Management Act, 1984; Conservation Commission of Western Australia, 2004; 2013).

Planning also became more inclusive and consultative, symptomatic of the end of the ‘expert knows best’ era. Before 1985, the nearest thing to involving others outside the Forests Department in forest land use matters was during the preparation of the 1982 Forest Management Plan “General Working Plan (GWP) 87” (Forests Department Western Australia, 1982b). During the preparation of GWP 87, the views of several other agencies (i.e., other professionals or ‘experts’) were sought, such as those in the Public Works Department, the Department of Conservation and Environment, Department of Resources Development, Mines Department, National Parks Authority, State Energy Commission, and experts from association such as the Campaign to Save Native Forests, Sawmilling companies, Vasse Conservation Committee, the Royal Society of Western Australia and 47 other stakeholder groups (Forests Department Western Australia, 1982b, pp. 10-11). However, the views of individual members of the general public were not taken into account. Since 1985, however, it has become standard procedure, required by the CALM Act 1984, to involve the community in the preparation of management plans for all land managed by CALM³³ (Conservation and Land Management Act, 1984, sections 57, 58, 59).

4.4 Regional Forest Agreements

The National Forest Policy Statement (NFPS) (Commonwealth of Australia, 1992), along with other intergovernmental agreements, were responses from existing institutions to the heightened values of ecologically sustainable development. The NFPS pursued region-specific agreements (the Regional Forest Agreements) between the Commonwealth and State governments in an effort to reconcile conflicting values while continuing to provide for sustainable forestry in Australia.

In the early 1990s, the Federal Government initiated development of the Regional Forest Agreement (RFA) process “*in an attempt to defuse the political sensitivity of forest management decisions*” (McDonald, 1999, Abstract), and also to seek stability for the timber industry. It is important to appreciate that the RFA process was not directed

³³ “CALM” land consists of State forest, National Parks, and Nature Reserves and some other tenures.

towards resolving conflicting interests or values within the community; rather, as noted by Brown (2002), the RFA was intended to end disputes between the Commonwealth and the States. It was an intergovernmental agreement, and did not prescribe solutions for these conflicts, and it “*never received significant support from environmental non-government organisations (NGOs) nor the commercial timber industry*” (Brown, 2002, p. 20).

The RFA would draw on major inventories of environmental aspects, heritage, the economy, and social aspects (RFA, 1999). A comprehensive regional assessment (CRA) was commenced that would provide information on which to decide soundly based land use decisions. The CRA presented a comprehensive, representative and adequate reserve system to cater for conservation aspects. The CRA also provided information on heritage, recreation, timber industry, and social aspects, all of which would help to inform soundly based land use decisions (DAFF, 1998). It was clear that community activism was the major influence in having these inventories carried out.

In 1999, the Regional Forest Agreement for Western Australia was published (RFA, 1999) (after the collapse of a first attempt a few weeks earlier (Brueckner et al., 2006)). It was a 20-year agreement between the State and Commonwealth governments on the use and management of the forests of Western Australia’s South West region. Point 45 on page 13 of the Western Australian RFA (1999) stated that “*Western Australia confirms that the sustained yield for native forest on Public Land will continue to be based on areas available for timber harvesting outside the CAR reserve system and that the average annual cut will be within Sustained Yield in the 10 year period of each Forest Management Plan.*” The volume and growth figures (inventory figures) that are used to determine the sustained yield were those produced by the relevant section of the Department of Conservation and Land Management.³⁴

The obligations and commitments that the RFA (1999) contained were delivered to (try and) ensure effective nature conservation, forest management and forest-based industry outcomes. From an early stage potential problems were identified with the RFA process (Slee, 2001), including the difficulty of identifying legitimate stakeholders and the implied equality of stakeholders’ views. Further, a number of barriers were identified to

³⁴ CALM became DEC (Department of Environment and Conservation) in 2006. Since June 2013 DEC became the Department of Parks and Wildlife.

the embedding of social assessment into the RFA (Coakes, 1998) and the ongoing maintenance of social values in the RFA. There was also the perceived scientific bias in the process, meaning that values that could not be scientifically inventoried tended to carry less weight - the problem of legitimizing social information in an industry traditionally technically managed (Brown, 2002).

Quantitatively based analyses can be appropriate for understanding the consequences of decisions, but tend to be poorly equipped to evaluate, prioritise or incorporate a wide range of social values (Lane, 1999; O'Brien, 2003). Issues were also interpreted in terms of economic rationalism rather than forestry science, while the consultative process underscored conflicting stakeholders and implied compromise, rather than promoting collaboration such as occurred in the South Queensland Agreement (Ford, 2013; Brown, 2002). In those various experiences, the symptoms were often the same - a lack of ownership of the process, political expediency, widespread but poor quality public inclusion, and a bias towards commercial use (Musselwhite and Herath, 2005; Brueckner, 2007). Overall, the forestry management bodies did not have the tools to engage with the RFA (1999) agenda leading to ongoing conflicts.

The 2004 and 2009 five yearly reviews of the RFA also revealed serious problems in implementing the system. The RFAs are considered by the environmentalists to be ineffective and the timber industry also has concerns. Overall, the evidence was that the RFA improved the situation somewhat, but that opposing sides, the environmentalists and the saw-millers, were not happy with the outcomes, albeit for opposite reasons (Ford, 2013). Environmentalists claimed that there was not enough land set aside where logging is prevented and the saw millers claimed that there was not enough land set aside for sawmilling.

4.5 Scientific Rationalism and Beyond

The boom in the timber industry from 1870 to the early twentieth century supported a time of significant development and prosperity in the Western Australian community. Concerns about over-exploitation were largely in terms of the sustainability of timber as an industry, rather than conservation as such. Somewhat belatedly, after parts of the industry had gone through a boom and bust cycle by 1900, long after the 1903 Royal

Commission, and years after the launch of a land classification scheme that sought to bring some semblance of order, the government legislated for forest management and control (Government of Western Australia, 1918). Even then, the resources provided for management were spartan, as would be noted in the Royal Commission of 1951 (Royal Commission, 1951), which resulted in difficulties in assessing the capacity of the forests to sustain the timber industry at that time.

The driver for the Forest Act 1918 was, at that time, and for years to come, sustainability of the timber industry, although sustainability at what level was not considered. The value of the forests continued to be aligned with the commercial value of timber, not only in the minds of the industry itself but also in the community. The value of the forests in commercial terms was readily accounted for through inventories of log sizes, forest density, and regeneration rates. Notwithstanding threats or risks such as fire and disease, inventories could be converted into monetary terms simply by compounding them with market prices.

At this late stage of development of the industry, the government, in legislating in 1918, introduced truly exceptional legislation, which afforded forests the protections of both houses of the Parliament. This ushered in an era of increasingly sophisticated data-based management and planning of the forests that prevailed for the remainder of the century by which time forest management and planning had been placed on a strong scientific footing.

Although the intent at the time was the protection and sustainability of the timber industry, the professionalization of forest management also would eventually align, at least partially, with the interests of new forest values that were yet to surface in the community, such that the Forests Department was able, in due course, to migrate with ease from timber industry management to multi-use planning. Multi-use was the foresters' model for incorporating social values into forest management, alongside the timber industry.

The question that was to arise was whether multi-use planning was able to deliver the forest values that the community would come to expect. The next chapter tracks the emergence of broad community awareness and activism, which challenged the whole notion of forest value, its assessment and its management. This would in turn challenge

the roles of professional foresters themselves and transform the task of forest assessment and valuation from an accounting exercise to a multi-disciplinary negotiation of great complexity.

Chapter 5 Emergence of Community Values and Activism

Over the short history of the State of Western Australia, community values have changed from being content with ‘unmanaged’ forests, to forests managed by the State government on their behalf for timber, plus water catchment (and in some cases grazing), and now in the 21st century, with the community having a much greater awareness of the environment including the many values that a forest can provide. These changes are summarised in Table 5.1 and explored in this chapter.

There was general societal agreement until the late 1950s and early 1960s that commercial timber production was the prime value for the forests of South West Western Australia. Commerciality was readily measured from forest inventories and market prices. However, there were other voices that sought forest management and protection for uncommercial motives, and purported that valuing forest in terms of commerciality was a moral issue. It would be incorrect to claim that these voices were somehow representative of the community generally, but nevertheless, they did demonstrate that a conservationist ethos existed decades before it became political mainstream.

5.1 Early community values regarding the South West forests

From early times, there was expert and scientific awareness of the need for conservation from Lane-Poole (1922) and even earlier, which was far ahead of broad community concern. Hutton and Connors (1999) claim that the conservation movement in Australia has its roots in the eighteenth century. In *Spoils and Spoilers*, Bolton (1992) traced how a conservation movement emerged between 1880 and the 1930s initially in New South Wales, Victoria and Tasmania. However, in the case of Western Australia it is difficult to identify any such movement before the 1890s (Chapman, 2008). Early awareness of the environment and natural history saw the formation of the West Australian Natural History Society in 1904, the Western Australian branch of the Australian Forest League in 1913, and the Western Australian Naturalists’ Club in 1924.

Table 5.1: Milestone events indicating community interest in the environment including forests in Western Australia in the period 1890-2010.

	Significant Events	Influence on inventory and policy
1891	Western Australian Natural History Society formed	-
1894	Pinjarra Reserve created	-
1903	Royal Commission recommends effective protection for State forests and Pinjarra reserve	Calls for forest inventory and scientific management.
1911	Pinjarra reserve opened up to logging	-
1913	Formation of Australian Forest League of Western Australia	-
1918-1919	Forest Act and formation of the Forests Department	Inventory put on scientific footing
1920-1930	1922 Royal Commission 1924 WA Naturalists Club formed	Royal Commission concerned to ensure the industry was on a sound footing. Data requirements consolidated.
1930-1940	Forest League of Western Australia declared 'extinct' ³⁵ in 1935 and again in 1951 Western Walking Club formed 1937	
1940-1950	Tree Planters Association disbanded 1951	
1950-1960	1951 Royal Commission 1954-1959 Proposal to build a swimming pool in Kings Park declined	Royal Commission focussed only on industry issues and calls for better inventory data.
1960-1970	1961 Royal Commission into bushfires 1961 ALCOA bauxite lease signed 1963 ALCOA begins bauxite mining 1966 ACF formed 1967 WA Nature Conservation Council formed 1969 Woodchip agreement signed 1969 Perth Bushwalkers Club formed	Dieback survey commenced Karri inventory at Black Point, WA.

³⁵ Chapman (2008, p. 49)

<p>1970-1980</p>	<p>1970 George Seddon publishes “Swan River Landscapes”</p> <p>1971 WA EPA passed</p> <p>1972 Foresters propose south coast national park</p> <p>1972 CTRC³⁶ began</p> <p>1973 EIS for woodchip operations prepared</p> <p>1973 Routley and Routley publish “Fight for the Forests”</p> <p>1973 Conservation Council of WA formed</p> <p>1974 Woodchip operations begin in Western Australia</p> <p>1975 Start of CSNF and SWFDF³⁷</p>	<p>Inventory attributes widened partly as a consequence of the Routley debates.</p> <p>Dieback mapped from 70 mm aerial photos.</p> <p>Recreation Survey in native forest near Perth.</p> <p>Woodchip environmental impact statement.</p> <p>Forests Department develops multiple use planning in the northern jarrah forest.</p>
<p>1980-1990</p>	<p>1980 IFA Western Australia publishes report on bauxite mining</p> <p>1985 CALM formed combining Forests Department Western Australia, National Parks and Wildlife Research</p>	<p>FMIS created for State forests</p> <p>Forests Department develops the MPA (Management Priority Area) concept.</p> <p>Forests Department develops a Forest Recreation Framework Plan.</p> <p>Whole tree assessment for wood quality developed.</p> <p>Inventory involving systematically selected 29 000 photo plots and 2 900 ground plots.</p>

³⁶ CTRC = Conservation Through Reserves Committee

³⁷ CSNF = Campaign to Save Native Forests; SWFDF = South-west Forests Defence Foundation

1990-2010	<p>National Forest Policy Statement</p> <p>The Regional Forest Agreement (RFA) Process</p> <p>CALM publishes the Forest Management Plan 1994-2003</p> <p>Regional Forest Agreement between Western Australia and the Commonwealth signed May 1999, but rescinded a few weeks later.</p> <p>The Labor government wins power in Western Australia and classifies more State forests to National Parks.</p> <p>DEC formed combining CALM and Environmental Protection.</p>	<p>New survey method developed as a consequence of shift of large areas from State Forests to National Parks.</p>
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For abbreviations: see List of Acronyms and Abbreviations (pp. 7-8). Sources: see text.

In that period, inventory and the discipline of forest management generally lay outside of the environmental and natural history consciousness. For any of these signs, it is nevertheless difficult to make a case that they represented a broadly held ethos within the community. In reality, there is considerable evidence to the contrary. Mills (1989) considered the lack of conservation ethos in the early years of settlement to be an aspect of the old class war-conflicting interests between the rich and the poor, with wealthy landowners acquiring large tracts of land including the timber rights, while the poor classes were engaged in logging to earn a living.

Similarly, just as the timber boom was gathering pace the Fremantle Herald (November 1874) published criticism of (as cited in Chapman, 2008, p. 37):

...alien capitalists...having no interest in the colony, conduct all their money transactions on the principle of getting as much out of the bargain as they can, and will when all is exhausted, leave behind them a treeless, heat producing desert, and seaboard.

However, a more mundane interpretation was provided by Lane-Poole (1922, pp. 35-36):

The object of the settlers in every case was to get rid of the timber in the quickest possible way, so that the land on which fine timber had grown might be available for crops. It can readily be understood therefore how it arose in the popular mind a belief that timber was of no value and was indeed an excrescence on the face of nature and a hindrance to farming.

Also from Lane-Poole (1922, p. 36) was evidence at the time that overall there was apathy and little broad public interest in the forests:

The Australian Forest League and kindred Associations have done a good deal in the way of correcting popular misapprehension on the subject of forestry; but the in-grained prejudice of generations is hard to eradicate, and in many quarters still - and in quarters too where one might reasonably look for enlightenment - there is a good deal of apathy on the subject, and efforts to improve forestry conditions are often looked upon with little favour.

The first annual conference of the Australian Forest League took place in Melbourne on 29 October 1914 with the Governor General Sir B.C. Munro Ferguson as President, and included Sir John Forrest who was the Western Australian representative on the committee. Mr R. de Malraison, the Hon Secretary of the West Australian Forest League was reported as observing that (The West Australian, 1914, p. 6):

...it is satisfactory to note that the question of forest conservation and the formation of societies to deal with the matter has received much attention lately in Australia.

Nearly three years later in *The West Australian* it was reported that (The West Australian, 1917, p. 8):

The revival of public interest in the important subject of forest conservation was exhibited by the decision of a well attended meeting in the lesser St George's Hall last evening to re-establish the Western Australian branch of the Australian Forest League. This body, formerly in existence in this State, lapsed for want of public support, but as the result of the efforts of a provisional committee of enthusiasts, last evening's meeting was called with the object of imparting new life to it. His Excellency the Governor Sir William Ellison-Macartney presided.

These two newspaper articles suggest that in 1914, there was enough interest in forest conservation, at least by important public figures in Western Australia, to support the formation of the West Australian section of the Australian Forest League, but it lapsed soon after through lack of support. The level of community interest in forest values could not be considered as highly developed.

Several individuals at this time also noted that the commercial value of forests was not at all a sufficient measure of their value. For example, in 1909 Berthoud (as cited in Chapman, 2008, p. 46) wrote to the West Australian Natural History Society deploring the destruction of forests:

So far, what is being done to assist nature, to recuperate and replenish with young trees, the areas now being denuded of their natural timber? ... Upon the S. W. Hills much valuable timber is unnecessarily ring barked and destroyed...is it not now wiser for us to cultivate the higher ideals, and relegate mere money making to a secondary place in our thoughts?

This together with the following statement from Ednie Brown were amongst the first to explicitly challenge the presumption that forests could be valued purely in terms of their potential for commercial yield. Brown (1899) argued that forests should be valued and managed primarily for their continued existence and conservation. Although not trained as a forester, Ednie Brown was an experienced arborist and these sentiments of efficient

conservation and permanency are core concepts of sustainability shared by subsequent scientifically trained foresters. It was a great loss to forestry in Western Australia when he died in 1899 aged only 50 years old.

The concerns and protests during these times were rather individualistic, however, albeit often from prominent individuals. Some national parks and nature reserves were set aside from early times, such as the John Forrest National Park in 1898 and the Perth Park in 1875, but it was not until the 1970s that public interest in the recreation and conservation aspects of the South West forests became prominent. However, during the period between the two world wars (1920-1940) there were the beginnings of a broader-based interest in the Australian community in 'nature study' and 'bushwalking' that started a trickle of concern about the need to protect native forests for recreation and conservation. The formation of the WA Naturalists' Club in 1924 and the purchase of the lease of Blue Gum Forest in the Blue Mountains of New South Wales in 1932 by bushwalkers are clear examples of this new movement of conservation concern.

Around the formation of the WA Naturalists Club in 1924, there was an initial concern for other biodiversity values of forests as well as the trees. In NSW in 1932, the lease for Blue Gum Forest in the Blue Mountains west of Sydney was bought by a group of Sydney bushwalkers to prevent it being cleared to plant walnuts (NSW National Parks and Wildlife Service, 2014), and Blue Gum Forest is now part of the wider Blue Mountains National Park. Paddy Pallin and Myles Dunphy (Williams, 2006) were the 'gurus' of bushwalking in New South Wales at that time. Day outings and camping in forest areas were also popular in NSW in the 1940s. The experiences of NSW were well in advance of Western Australia where the population was still small and the distance to interesting locations like the Stirling Ranges required a major expedition, as private cars were not widely available. Apart from the Western Walking Club formed in 1937, there was no great interest in bushwalking in Western Australia until the late 1960s,³⁸ which likely influenced the development of the environmental awareness at the time.

One of the earliest examples of emerging environmentalism from Western Australia was the broad community support for protecting Kings Park, a forested park, now located in the centre of Perth. Kings Park at about 400 hectares is larger than Central

³⁸ Perth Bushwalkers Club was formed in 1969. Retrieved from <http://www.perthbushwalkers.asn.au/PBCweb/history.php> (12.05.2012)

Park in New York (about 340 hectares) and although Kings Park has some development - a restaurant, a botanic garden, tennis courts, a water reservoir, some car parks and a children's playground - it gives an overall impression of nature and naturalness. This park is highly appreciated by the public as indicated by Bryson (2000, p. 384): "*What especially sets Perth apart is the possession of one of the world's largest and finest parks*".

When in the 1950s there was a proposal to build an Olympic swimming pool in Kings Park as part of Perth's preparation for holding the Commonwealth and Empire Games in 1962, there was strong opposition. The opposition was so strong and so persistent - it went on for 5 years - that the pool was not built in Kings Park but in north Perth at Beatty Park. This was a clear indication of the Perth community highly valuing a 'natural' area and that they were willing to publicly demonstrate and protest against the development of special natural areas. This was the first indicator that broad community concern for forest values had changed and that the notion of value itself had shifted and was no longer synonymous with commerciality (e.g., *The West Australian*, 1954).

Nevertheless, until the 1960s the dominant community interest in public forests was for their marketable timber. This ensured that from 1919, when university trained foresters were first employed by the Forests Department, forest inventory measurements were carried out as efficiently as possible to obtain the information necessary to manage the forests sustainably for marketable timber. The improvements in efficiency, from measuring along strip-lines through the forest to measuring plots within forest types interpreted from aerial photos to measuring plots on the aerial photos themselves, were all independent of direct community influence. These were improvements in how the information was obtained, but this did not reflect any changes in the applications to which this information was put, namely timber production.

A similar picture is evident from the Royal Commission into the timber industry in Western Australia in 1951. Mainstream awareness at this time was still firmly focussed on forests as commercial resources. The Commission was established by Governor Mitchell (who was the Premier 29 years earlier when the 1922 Royal Commission was appointed) to inquire into 10 aspects of the forestry and timber industry in Western Australia. The findings are summarised in a total of 67 recommendations on pages 52-61 of the report (Royal Commission, 1951), which deal almost exclusively with the

resource use aspects of State forests. The emphasis on the supply of timber and its administration was probably the result of 1951 being only 6 years after the end of World War II and the substantial requirement for timber for housing following repatriation of ex-servicemen and the influx of European migrants causing the post war economic boom.

If anything this 1951 Royal Commission was more directly focused on the timber industry than the 1922 Royal Commission and provided no hint of the political tempest that would soon follow. Nonetheless, on page 34 of the report many other values of forests are listed such as soil conservation, preservation of flora and fauna, protection of water catchments, recreation and aesthetic values (Royal Commission, 1951). While the focus of the Commission, and presumably of community interest generally, was on the commercial use of the forest, the Commission chaired by G.J. Rodger, a noted forester, was clearly aware of the other, i.e., the non-commercial values of forests (Royal Commission, 1951).

5.2 International Influences

In the 1960s, concern for the environment began to gain international momentum with several influential publications and advocates who seemed to resonate with a formerly acquiescent or latent community awareness of environmental issues.

5.2.1 *Silent Spring*

Rachel Carson published *Silent Spring* in 1962 in the USA and described the harmful effect of pesticides on the environment (Carson, 1962). It became apparent from Carson's book that while the experts knew how to kill insects attacking crops, the experts did not necessarily know what adverse side effects their actions would cause the environment. This was probably the earliest significant statement about damage to the environment in the twentieth century and drew worldwide attention to the adverse effect that industrial agriculture was causing. It also highlighted that a narrow specialisation approach was inadequate to deal with the many interactions between complex ecosystems and human health. Its message was noted in many countries including

Australia and can be considered as a major factor initiating the start of the modern environment movement.

5.2.2 The United Nations interest in the environment

Three international environmental events stand out as indicating global concern for the environment, each one acted to raise and progress awareness worldwide.

The United Nations Conference on the Human Environment 1972

Point 6 of the proclamations at this Conference opened with (UNEP, 1972): “*A point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences*”. The slightly tentative language indicates an early stage in the growing world acceptance of the importance of considering the effect of development on the environment.

The Brundtland Report 1987 (WCED, 1987)

This report was the result of the formation in 1983 of the World Commission on Environment and Development by resolution 38/161 of the United Nations. Gro Harlem Brundtland, a former Prime Minister of Norway, chaired the Commission and its report was known as “Our Common Future” and sometimes referred to as the Brundtland Report. A major thrust of the Commission was to have development and the environment considered as one single issue (WCED, 1987). Its concern was mainly for sustainable development and ways in which the international community could deal with environmental issues. The Commission’s definition of sustainable development was one that is often quoted (WCED, 1987, p. 41):

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

It contained within it two key concepts; the concept of ‘needs’, in particular the essential needs of the world’s poor; and secondly the idea of limitations imposed by the

state of technology and social organization on the ability of the environment to meet present and future needs.

The Rio Conference of 1992

The third major environmentally focused global event was the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. Principle 7 (of the 27 principles affirmed at the Conference) continued the reference to sustainable development (United Nations Conference on Environment and Development, 1992):

States shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command.

One of the five main documents produced from the Conference concerned forest principles. These were clearly prepared with specialist forester input, as they contained several points such as sustainable development and multiple use as sections (b) and (f) of the preamble demonstrate (United Nations Conference on Environment and Development, 1992):

(b) The guiding objective of these principles is to contribute to the management, conservation and sustainable development of forests and to provide for their multiple and complementary functions and uses.

(f) All types of forests embody complex and unique ecological processes, which are the basis for their present and potential capacity to provide resources to satisfy human needs as well as environmental values....

Principle 2 (b) referred to a wide range of forest values (United Nations Conference on Environment and Development, 1992):

Forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations. These needs are for forest products and services, such as wood and wood products, water, food, fodder, medicine, fuel, shelter, employment, recreation, habitats for wildlife, landscape diversity, carbon sinks and reservoirs, and for other forest products. Appropriate measures should be taken to protect forests against harmful effects of pollution, including air-borne pollution, fires, pests and diseases, in order to maintain their full multiple value.

Principle 6 (c) concerned the requirement for decisions about management of forests to be based on comprehensive assessment (forest inventory) of all economic and non-economic aspects, including environmental aspects, of the forest. In 2000, the United Nations Millennium Declaration included the following sentences in the section on “Protecting our common environment” (United Nations Millennium Declaration, 2000):

22. We reaffirm our support for the principles of sustainable development, including those set out in Agenda 21,³⁹ agreed upon at the United Nations Conference on Environment and Development.

23. We resolve to intensify our collective efforts for the management, conservation and sustainable development of all types of forests.

The output from these United Nations’ conferences showed that from around 1970, there was an increasing emphasis worldwide for the need to protect the environment and forests explicitly, while sustainably developing resources.

The Montreal Process formed in June 1994

The Montreal process resulted from forest principles developed at the Rio Conference in 1992. It is also known as the *Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests*. It aims to

³⁹ Agenda 21 was one of the five main documents produced from the 1992 Rio de Janeiro conference.

facilitate sustainable forest management. The seven Montreal Process criteria together encapsulate the essential components of sustainable forest management. Each criterion has qualitative and quantitative indicators. Collectively they cover environmental, social, economic and policy conditions (Anon., 2015).

5.3 Australian Influences

5.3.1 Lake Pedder

In 1972, Lake Pedder in southern Tasmania was flooded to make a reservoir for hydroelectricity purposes. The proposal was strongly opposed by environmentalists because of its pristine 'wilderness' condition; but the lake was flooded in spite of the protests. At that stage, the Tasmanian Hydroelectric Commission, which organised the flooding, was a very powerful organization. As mentioned below, the outrage at the flooding of Lake Pedder contributed to enormous and ultimately successful opposition a few years later when a further dam was proposed on the Franklin River in western Tasmania (Australian Conservation Foundation, 1972).

5.3.2 The Franklin Dam protest

In 1978, the Franklin River in western Tasmania was proposed to be dammed for hydroelectricity purposes. The protests against this proposal were very large indeed and came to a head in 1982/1983 when many people were arrested on site during the protest, including Bob Brown who later became the leader of the Greens in Federal parliament. It was said that the success of the Franklin campaign was helped enormously by the outrage at the flooding of Lake Pedder. Without Lake Pedder, the protest against the Franklin Dam proposal may not have succeeded. In any event, the success of the Franklin Dam protest in which the Federal government intervened in favour of conservationist values, produced enormous publicity and encouraged opposition to projects of environmental concern throughout Australia.

5.3.3 The Sydney Green Bans 1970s

Around the same time, the union movement in Australia, in this case the Builders Labourers Federation (BLF), undertook action in Sydney against proposed developments that they and others considered would be detrimental to the urban environment (Roddeweig, 1978). The BLF implemented green bans in Sydney in protest against the development of natural areas in favour of housing and industry during 1971-1974 (Mundey, 1976). Catherine Williams asserted that “*it was the union’s obligation to be concerned about social issues*” (Williams, 2006, p. 107). These protest actions by a group outside the mainstream environmentalists drew great publicity (e.g., The Canberra Times, 1974a).

5.3.4 The Fight for the Forests

The Fight for the Forests by Routley and Routley (1973) was a 290 page well documented and emotionally argued case against exploitation of Australian forests by the forestry industry. The Routley and Routley (1973) book was reviewed by the eminent British forester S.D. Richardson (1974). Richardson was not impressed by most of their arguments or their language. Richardson (1974) even claimed that the attitudes displayed by the Routley’s would have a negative impact on the conservation of forests in Australia. Nonetheless, the Routley and Routley (1973) publication aroused much interest and discussion in the press (e.g., The Canberra Times, 1974b) and its extreme language and claims were generally welcomed by environmental activists.

While the language was strong and the authors’ examples of extravagant claims by others were matched by their own, they highlighted important questions that should be answered in any resource use proposal connected with public forests. Those included (Routley and Routley, 1973):

- That there is evidence for a demand for the end product in both quantity and quality,
- That the project will not destroy unique plant and animal populations,
- That other relevant environmental issues such as water quality and quantity, pollution, erosion and scenery will be dealt with satisfactorily.

A major theme of the book was encapsulated in the following sentence (Routley and Routley, 1973, p. 168).

The most basic change required is a change in forest orientation and ideology - in particular that forest services give up using the State forests in the interests of the forest industries, as a source of cheap raw material, and that they cease to regard the provision of this raw material as the most important role of the forests they control and one that overrides all other roles.

The book contributed motivation and support for those against logging in native hardwood public forests, and this in turn led to a need for a broader set of values to be inventoried in the Comprehensive Regional Assessments of the Regional Forest Agreement process later in the 1990s.

5.4 Local Awakening

After World War II, once post war reconstruction was taken care of, the somewhat rarefied trickle of specialist interest in the environment in Western Australia became a torrent of general community concern. Over 23 000 people were estimated to have visited State forest within 40 kilometres of Perth in 1969. The interest in forest recreation continued with a survey in Mundaring and Kelmscott forest divisions in 1970 (Spriggins, 1975) and a survey in Dwellingup division in 1973. Picnic spots were developed and people on unemployment relief carried out tourism work during that decade. The Bibbulmun walk track was officially opened in October 1979. The interest in forest recreation was intensified, and with this interest came a new sense of the meaning of forest values.

It is evident that the 1970s were a watershed separating relatively complacent community attitudes towards the environment from the more contemporary intense awareness of the environment in Western Australia and other parts of Australia and the world. Highlighted by *Silent Spring* (Carson, 1962), concern for the environment increased across the developed world, including Australia (and Western Australia).

5.4.1 Bauxite mining

In 1961, legislation allowing bauxite mining to commence in State forest was introduced and had a trouble-free passage through the Western Australian Parliament. The few who did question the wisdom of permitting bauxite mining in these forests were assured during the second reading speech that the area to be mined would not exceed 12 hectares (30 acres) per annum (Government of Western Australia, 1961, p. 747):

It is anticipated that the total clearing for the first year would be in the order of 30 acres; and for subsequent years, and so long as the company was on an output of 550 000 tons per annum, 25 acres. I stress these acreages because I think it has been conveyed in the public mind that huge areas will be involved all the time, and we will have ugly scars all over the place from one end of the State to the other.

The 1.2 million hectare bauxite lease was granted over State forest in Western Australia to Western Aluminium N.L. Limited, which later became ALCOA (the Aluminium Company of America). This was possible because of Section 30 of the Forests Act that allowed mining to prevail over forests (Government of Western Australia, 1918). In 1963, ALCOA began production at their bauxite mine near the historic sawmilling township of Jarrahdale. Community resistance has existed since that time with some success by groups including the Jarrahdale Forest Protectors (2010). Initially only about 12 hectares was cleared for mining each year. However, in the space of 16 years mining increased so that 250 hectares was being cleared each year. By 2010, annual clearing for bauxite mining was 900 hectares per year (Osborne, 2005; 2009).

In response to a proposal to expand ALCOA's operations at Wagerup, less than 100 kilometres south of Perth, the Institute of Foresters submitted an official objection. The objection was well described in a publication produced by the WA division of the Institute of Foresters (Institute of Foresters, 1980). It was an erudite and objective discussion of the risks associated with the proposed expansion especially the danger to Perth's water supply from an increase in salinity. Further clearing for bauxite mining was likely to spread dieback disease and this would kill jarrah trees and other susceptible vegetation and so cause the water table to rise, dissolving the salt in the soil

profile. The resulting saline water would be a serious problem for Perth's water supply. Although the proposed extension went ahead, as a result of this particular concern bauxite mining has been restricted to forest areas least susceptible to potential salinity problems.

The Institute of Foresters' publication (1980) expressed the concern for forest health in relation to bauxite mining of that part of the community represented by professional foresters. Their concern had already influenced forest inventory over a decade earlier when the forest was mapped to show the extent of dieback disease that was followed by a program of quarantining the healthy forest from further infection (Brandis 1983). The 1980 Institute of Foresters' publication also contained a concise rationale for one of the tasks of a professional body that illustrated their objective approach to land use matters in the transition from the era of the 'expert knows best' to the era of public involvement (Institute of Foresters, 1980 p. 5):

One of the tasks of a professional body is to provide the best possible advice to government and to interested members of the public on important matters in its area of expertise. That advice should be presented in an objective and rational manner. Decisions, whether favourable or unfavourable to differing points of view, will then have to be taken in the light of full knowledge of that advice.

It was clear that by 1980, a 'professional body' had become just one, albeit an important one, of the many components of public involvement in a particular environmental issue. Amongst the recommendations in the Institute of Foresters publication was a significant one that was adopted when the expansion was approved - that the eastern part of the bauxite lease would not be mined until it was proved that it would not cause the spread of jarrah dieback disease and therefore adversely affect Perth's water supply. This resulted in that up to 2013, there had been no bauxite mining in the eastern part of the lease. Community concern expressed publicly by forestry experts about the forests and water supply clearly influenced policy proposals by experts in other industry fields (i.e., mining).

5.4.2 Forest campaign organisations

The following organisations have been influential in promoting and in many cases protesting to support the non-commercial values of the forests in Western Australia: the Australian Conservation Foundation (a national body but also influential in WA), the Conservation Council of Western Australia, the Campaign to Save Native Forests, the South West Forest Defence Foundation, the Men of the Trees, and the Western Australian Forest Alliance.

Originally named the Nature Conservation Council in 1967, the 'Nature' was dropped several years later when the Conservation Council of Western Australia became involved in broader environmental issues (Conservation Council, 2014). It initially consisted of four community conservation groups - The Western Australian Naturalists Club, The Tree Society, The Wildflower Society (Western Australia) and the Kings Park and Swan River Society. These came together in response to rapid development of logging in old growth forests, woodchipping, mining, agricultural expansion, power lines and roads, which were leading to a noticeable loss of the natural environment. The Conservation Council launched an unsuccessful class action against ALCOA in Pennsylvania in 1981 (The Canberra Times, 1981). By 2010, the Conservation Council of Western Australia represented over 100 groups (Conservation Council, 2014).

The Campaign to Save Native Forests (CSNF)⁴⁰ was established in 1975 to oppose logging in State forests and was greatly encouraged by the Routley and Routley (1973) book. It was also an example of a technique adopted by environmental activists. Rather than stay with an existing protest group that was formed to protest against an earlier issue, whenever possible new environmental groups were formed to protest about a new issue and this allowed more people to enter the protest fold and gave strength and diversity to the overall environmental concern. This approach has worked very effectively in Western Australia (Chapman, 2008). In the same vein, the South West Forest Defence Foundation is another anti-logging group formed in 1975 whose approach has been through legal rather than protest activities. They also brought a class action against ALCOA in 1981, which they lost, but considered the publicity well worthwhile (Chapman, 2008).

⁴⁰ Retrieved from: http://en.wikipedia.org/wiki/Campaign_to_Save_Native_Forests (28.5.2012)

The Men of the Trees⁴¹ was founded in Kenya in 1922 by John St Barbe Baker and the Western Australian group was formed in 1979. It extolled the benefits of trees and its aim is to revegetate farmland with appropriate trees. It aligns itself under the banner of the Conservation Council of WA and is considered a supporter rather than an activist in environmental matters.

Formed in 1990, Western Australian Forest Alliance⁴² was an alliance of about 20 groups who wanted logging stopped completely in State forests. They had great success after the election of the Gallop Labor government in 2001 and by 2005 about half of the area of State forest in 1990 had been changed to National Park, Conservation Park or Regional Park. This did not completely achieved their goal of cessation of logging in existing State forest, whether for sawlogs, woodchips, pulpwood for paper production, or tree removal prior to bauxite mining. Their anti-logging stance was confirmed at a well-attended public meeting on 11 June 2011 at Notre Dame University in Fremantle (POST newspaper, 2011, p. 51). This is unlikely to have any effect on forest inventory as all the information necessary to consider their approach was already included in existing assessments. However, it remains to be seen if their continuing protests have an effect on forest policy.

5.4.3 Reserving the forest for non-commercial uses

In 1961, a proposal by the Public Works Department (1961) to dam Western Australia's Murray River, together with poor agricultural land management upstream, resulted in a bonus for forest recreation and conservation. The proposed dam would have approximately doubled the water storage for metropolitan Perth at the time. The Forests Department needed to carry out a forest inventory to plan how much marketable timber would be harvested before the dam was built and the forest landscape flooded. The inventory section of the Forests Department carried out the inventory and determined the volume of marketable timber that would have to be removed. This dam, however, was never built and the part of the river that would have been flooded is now a treasured part of the Lane-Poole Reserve.

⁴¹ Retrieved from: <http://www.menofthetrees.com.au/> (28.5.2012)

⁴² Retrieved from: <http://waforestalliance.org/> (28.5.2012)

The dam was not built because the cost of diverting the saline water in the tributaries of the Murray to the east of the forest area (the Hotham and the Williams rivers) with a dam below where they met the Murray and then piping the water west to the ocean south of Mandurah would have been too costly. The Hotham and the Williams Rivers were saline because they drained the wheat growing area that had been cleared for agriculture. The subsequent rising water table following clearing for agriculture dissolved the salt in the soil profile and caused the rivers to become saline. Ironically, as a result of poor land management in the wheat belt, the Murray River is now a highly valued conservation and recreation reserve.

Another example of how emerging, new values for the forest resulted in new reserves is from the south coast of Western Australia. In 1975, a group of West Australian foresters, members of the WA Division of the Institute of Foresters of Australia, prepared a detailed proposal for a national park on crown land along the coast south of Pemberton (Bradshaw et al., 1975). It formed the basis of the present day D'Entrecasteaux National Park. It underpinned the conservation and recreation component of the foresters' approach to land use, and provided further evidence of the growing community concern for the environment in the 1970s, beyond that of traditional environmentalists.

5.4.4 Woodchips

In 1969, the government signed a woodchip agreement - the Wood Chipping Industry Agreement Act 1969 - with WACAP (West Australian Chip and Pulp) and Bunnings. The proposed and then actual woodchip industry triggered strong reaction from environmentalists in Western Australia just as similar woodchip projects had caused strong reactions in NSW and Tasmania. In 1976, an event took place that marked the level of emotions that has arisen in parts of the community against this industry. John Chester and an accomplice exploded a bomb at the woodchip wharf at Bunbury, WA, that caused severe damage to the loading gear. No one was hurt and the culprits were eventually captured, charged and found guilty. It had been a major terrorist type of action associated with environmental activism. The mainstream anti-woodchip activists dissociated themselves from it. Nonetheless, it indicated that there were strong public feelings against the project (The Canberra Times, 1976).

5.5 Part of a Worldwide Rush of Concern for the Environment

The trend worldwide in developed countries was clear: before World War II there was some slight interest in the natural environment; after World War II especially into the 1960s and 1970s there was a sea-change in concern for the environment, broadly based in the community. *“The late 1960s and early 1970s witnessed the birth of modern environmentalism in Australia related to a wider tide of social change in the Western world”* (Frawley, 2005, p. 60).

Contributors to this increasing awareness and concern are posited as: an increasing population, finite resources, the health of the planet relying on a healthy natural environment; and the need to retain habitat for wildlife to survive. However, a major factor is also likely to have been growing affluence, which afforded a diversification of community values and expectations. Furthermore, it has been observed that social values appear to have changed over time, particularly since the 1970s, with eco-centric and intrinsic values for nature having become more prevalent (Routley and Routley, 1973; Dargavel, 1995; Xu and Bengston, 1997).

In Western Australia’s situation, the relatively small population in relation to forest areas before World War II gave the impression that the forests were not under great threat. After World War II an increasing population and concern for the environment in Tasmania and NSW as well as overseas together with major projects (bauxite mining and woodchips) that threatened (bauxite mining) and appeared to threaten (woodchips) the survival of Western Australian forests brought about a major increase in concern for the environment.

A selective list of influential environmental events globally, nationally, and closer to home in Western Australia follows. The purpose of its inclusion is to demonstrate the escalating interest in the environment as a basis for better understanding the changes in forestry in Western Australia in the last two decades.

- In the USA, Gaylord Nelson was a major instigator of Earth Day that was first celebrated on 20 April 1970.

- Woodchip operations began in Eden in NSW in 1971 and at Longreach on the Tamar River in 1972.⁴³
- The first ‘green’ political party in the world, the United Tasmania Group, was formed in 1972.⁴⁴
- The successful Franklin River campaign was conducted from 1973 to 1983. Associated with the campaign the Tasmanian Wilderness Society was formed in 1976 and became known by its present name of The Wilderness Society,⁴⁵ an Australia wide organisation.
- The first stage of the Tasmanian Wilderness World Heritage Areas was proclaimed in 1982. In 2012, it included seven national parks and covered about 20 per cent of the land area of Tasmania.
- In Western Australia George Seddon published *Swan River Landscapes* in 1970, and drew the community’s attention to the aesthetic setting of the city of Perth describing the magic of the place as a limestone landscape. As the Governor General Paul Hasluck⁴⁶ said in the foreword that Seddon had done a great service in revealing the beauty of the Swan River landscapes through his words and photographs (Seddon, 1970).
- The first Environmental Protection Act was passed in Western Australia in 1971, and demonstrated that the level of community concern had now made its way into the political mainstream (Commonwealth Government Acts, 1971). The Conservation Through Reserves Committee began its work in 1972. This was aimed at studying all areas of Western Australia and recommending which were suitable for reservation as national parks or reserves (Rundle, 1996). The state was divided into 7 systems and the most contentious and most populated area was their ‘System 6’ in the South West including Perth. Again, this was clearly a response to the community concern for the environment.

⁴³ Retrieved from: <http://www.gabr.net.au/biogs/ABE0008b.htm> (30.5.2012)

⁴⁴ Retrieved from: http://en.wikipedia.org/wiki/United_Tasmania_Group (30.5.2012)

⁴⁵ Retrieved from: http://en.wikipedia.org/wiki/Tasmanian_Wilderness_Society (30.5.2012)

⁴⁶ Paul Hasluck was born and brought up in Perth. He was governor general from 1969 – 1974.

- The Conservation Council of Western Australia (CCWA), an independent umbrella body for many groups concerned about the environment, was formed in 1973. An environmental impact statement for the proposed woodchip operations near Manjimup was prepared in 1973 and operations began in the same year. Both the Campaign to Save Native Forests and the South West Forest Defence Foundation were formed in 1975 in response to the woodchip operation. Both were associated with the CCWA.

- A foresters' proposal for a south coast national park for the coastal strip from Black Point east towards Walpole in 1975 (Bradshaw et al., 1975) was accepted. This included the isolated patch of karri near Black Point. There was apparently both professional and public convergence of opinion on the need for expanded protection.

- In 1984, the recently elected Labor government announced the proposed formation of the Department of Conservation and Land Management (CALM). This new department would be an amalgamation of the Forests Department Western Australia, the National Parks Authority and the Wildlife Research section of the Department of Fisheries and Wildlife. This reorganisation was in part a response to the anti-logging campaigns of the environmental groups.

5.5.1 Sustainability Re-visited

Forest inventory still measured what was needed to manage a sustainable timber industry - the volume of marketable timber and its growth rate - however, this no longer equated to the notion of value, which now went well beyond the conventional commerciality and even the anticipated recreation benefits. In addition, at a more fundamental level the integrity of the notion of sustainability itself had been challenged. The Brundtland Report set a very broad definition that was human-centric (WCED, 1987). Contrary, foresters often talked of sustainable yield, referring to a traditional focus centred on timber production.

Ecologists on the other hand were concerned about sustainability of the whole forest ecosystem including flora and fauna, much of which is sensitive to forestry practices; which the forest inventories, being focussed largely on the timber industry notion of

sustainability, did not monitor. The ecological notion of sustainability was more consistent with emergent community values, and the Brundtland definition was replaced by one developed by the Ministerial Conference on the Protection of Forests in Europe (MCPFE), and adopted by the Food and Agriculture Organisation (FAO) for sustainable forest management (SFM) as follows (MCPFE, 2001, p. 94):

...the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems.

Data and knowledge deficits in the South West forest inventory have been claimed when the concern is for the ecology itself, as discussed by Calver et al. (1998). Evidently, the idea of sustainability is not value-free, which raises questions about the inventories themselves. As Calver et al. (1998, p. 261) note regarding forest science: “*it is a social process subject to contextual values and that objective knowledge is always interpreted from the perspective of values*”. Similarly, Levins and Lewontin (1985) describe denying the interpretation of the scientific and the social as a political act which hides social values behind scientific objectivity. Furthermore, Ford (2013) considered that forestry practice was not value-free and included specific value models held by foresters such as ‘multiple-use’. Ford states (2013, p. 47): “*Forest management will largely be based on the knowledge of professionals who understand the dynamics of forest ecosystems and the consequences of management actions. But it should also be recognised that professionalism involves specific value and belief systems that may or may not be shared by the community.*” Likewise, O’Neill and Spash (2000, p. 15) state: “*policy-making institutions are not themselves just neutral conduits through which the values of others, ‘the public’, pass for consideration by neutral policy-makers. Environmental agencies are made up of individuals and groups who will approach environmental problems through their own professional and personal values and are moved by their own institutional priorities*”. On the other hand, Abbott and Christensen (1994; 1996) argued that forest management in the South West has been scientific, principles-based and value free, and that there has been a sufficiency of data to ensure ecological sustainability. This controversy resonated with the rising scepticism in the

broader community about the role and capacity of the expert, and with the forestry profession's own questioning of its interpretation of social forestry values (Brack, 1997).

5.6 Community Values Demand New Management Models

The 1918 Forests Act enabled the Forests Department to be established and to bring logging under control (Government of Western Australia, 1918). To implement this new forest policy, information about the extent, nature and growth rate of the forest began to be obtained from forest inventory. Nonetheless, from 1920 to the 1960s, the WA community interest in public forests was almost entirely in their timber values. From the late 1960s and beyond the community in Western Australia showed a greatly increased interest in the environment including forests, provoked by two major projects, bauxite mining and woodchips, which was further encouraged by the public protests in response to environmental events interstate and overseas (Table 5.1). The rapidity with which these new expressions of values emerged was instrumental in a change of forest management in Western Australia. Foresters had anticipated an increasing public interest in forest recreation and had carried out non-timber surveys of forest recreation in the 1960s and 1970s. The professionals were supplied information regarding conservation issues by way of the research sections of the Forests Department and the Wildlife Research section of the Department of Fisheries and Wildlife. This continued beyond their amalgamation into the Department of Conservation and Land Management in 1985. However, the community values that inspired these developments could not be addressed by setting aside picnic and camping areas. Rather new levels of understanding by politicians and professional foresters were required. These developments challenged traditional practices in forestry, including forest inventory and management as well as the concept of sustainability as applied by forest industries, and new paradigms for assessing social values and forest planning, regulation and management would be required.

5.7 Old Institutions-New Realities

Political players from successive governments and across the country were shocked by the theological intensity around forest issues in the 1960s and 1970s (see for example Crichton-Browne, 1999). The established institutions struggled with the new reality, including the demand for informed inclusivity, and responded with institutionalized consultations such as the Regional Forest Agreements (RFA), to formally and publicly address policy-making and the management of strategic resource issues (Mercer, 1995; Dargavel, 1998). The period was one of traditional political responses to significant new agendas, namely to restructure and to regulate. Indeed, this period saw a “*spectacular process*” (Harding, 1998, p. 234) of institutionalization of environmental issues, leading to the establishment of new environmental bureaucracies and local, state and national regulation and legislation. In Western Australia, a new Department of Conservation and Land Management (CALM) was formed in 1985 with the amalgamation of the Forests Department Western Australia, the National Parks Authority and the wildlife research component of the Department of Fisheries and Wildlife. This new department replaced the Forests Department that had been responsible for forest areas from 1919 to 1985.

The political mainstream sought to facilitate agreements between stakeholders but found themselves confronting major and influential organisations for whom negotiation was apparently not an option. Federal and State governments themselves came into conflict (which continues through to 2014) over terms of natural resource management (e.g., Conacher, 1988; Eder, 1996), while public awareness of, and demands for involvement in environmental concerns led to a legitimacy crisis in some hierarchies and institutions of government (Brown, 2002) including a splintering of the Western Australian State Liberal Party in 1999.⁴⁷

5.7.1 Perception of Experts

Part of the challenge to government policy was attributable to changes in the public’s perception of experts. Before the late 1960s and early 1970s the era of the ‘expert knows best’ had been in ascendance. The community was content that the relatively few

⁴⁷ ABC PM Archive July 2 1999. Retrieved from <http://www.abc.net.au/pm/stories/s33187.htm> (3.6.2013)

trained professionals, who were those with university education and experience in their field (the ‘experts’), would make the decisions and these decisions were rarely questioned. This was the situation in forestry in Western Australia where, since the passing of the Forests Act in 1918, trained foresters set out to manage State forests according to the government policy that they were employed to implement. This was also the situation in most professions such as wildlife management, law, medicine, teaching, and engineering.

By the 1980s, however, more universities were established and a much greater proportion of the community was becoming educated at university level. A university education in whatever field gave graduates confidence to question graduates in other fields. This may have been a major factor in ending the era of the ‘expert knows best’ (the professional specialist) in Australia. Not that the expert was no longer important, but their opinions had to survive the scrutiny of others, often university educated and with other opinions. The end of this era overlapped with the political environmental events that spurred sections of the community to outrage in Australia, and reinforced the community’s confidence to question and protest against developments and management activities (such as forest logging) perceived as damaging to the environment.

The 1970s in Australia saw a transitional period for the environment movement from one of concern to one of activism and protest against what they considered harmful to the environment and especially to forests. Vigorous, confrontational and successful political protests from knowledgeable, well-informed antagonists were features leading to major changes in land use policy and management in Western Australian public forests. Foresters were considered not be value-free, and to have been close to the timber industry interests (Dargavel, 2005, p. 40):

The forest services were seen as having been captured by industry in a wood-production ideology, and the foresters were depicted by their most vituperative critics as being devious, hypocritical, secretive, misrepresenting the facts, poor at making decisions, neglectful of economics, propagandists and so forth. Not surprisingly the forestry organisations became bitterly opposed to the environmental movement, but at its root was a clash of values.

Also symptomatic of the end of the era of the ‘expert knows best’ was the formation of the Bush Fire Front in 2003 (Bush Fire Front, 2014). The Bushfire Front is an independent think tank formed to draw to the attention of the government and the public the need for an overhaul of bushfire management in the forested areas of the South West of Western Australia. Its small membership of experienced and knowledgeable people had over 400 years of collective experience in bushfire management between them. Their approach covers the whole spectrum of bushfire management including resources, training, prevention, detection, suppression and monitoring. They are particularly concerned that an adequate program of fuel reduction burning under mild conditions must be maintained so that the damage from bushfires under severe summer conditions is minimised. The inventory data needed to achieve this is collected by the fire management section of the Department of Environment and Conservation (now known as the Department of Parks and Wildlife (DPaW)) and includes fuel age, fuel moisture, topography, and weather conditions. Although sections of the environment movement are opposed to extensive prescribed burning, the results from the questionnaire reported in chapter 6 indicate that those people interviewed favoured, or strongly favoured, prescribed burning (Williamson et al., 2012).

By the late 20th century, a different relationship was evolving between community expectations in Australia about public forest management and inventory compared to earlier times. Here, the use of the term forest inventory continued to embrace survey, assessment, stocktaking, and monitoring, but also sought to incorporate some aspects of social and non-commercial values and culminated in the Comprehensive Regional Assessments (CRAs) of the RFA process (DAFF, 1998).

5.7.2 Values, Institutions, and the Regional Forest Agreement Process

The Regional Forest Agreement process was a new forestry institution requiring inclusion of new forms of knowledge beyond the physical and biological features of trees. Also given primacy were heritage, the economy, and social aspects. Initially the scientific forestry community considered that the RFA process had addressed the controversies and established management stability (Davey et al., 2003, p. 3):

Australia has effectively incorporated the principles and operational guidelines of the ecosystem approach into its National Forest Policy Statement, regional forest agreements, certification standards and other institutional arrangements for sustainable forest management.

Similarly, while Spencer et al. (2003) recognised some of the shortcomings of the RFA process and considered these to be substantial problems with incomplete inventory, data collection, and the software of the scientific models. The intrinsically more important value conflicts went, however, largely unrecognised.

The RFA program was based on the principles of public participation without prescribing how this would be designed, which distanced the Commonwealth from such processes. At the outset, there was disagreement over how community values on forest attributes should be assessed and incorporated into the policy-making process, and indeed what forms that process itself should take.

Some developments that emerged from the RFA framework were broadly successful, while others such as in relation to Western Australian forests were very much less so. What emerged from analysis of the RFA experience in Western Australia was that “*top-down processes are inadequate, especially when they depend on a discursive framing of the problem developed by a close-knit policy community and are not shared by the wider lay public*” (Hillier, 2003, p. 266). A need was perceived for “*the intertwining of scientific analysis with a fundamentally different, more deliberative, form of communication*” (Owens, 2000, p. 1144) to take account of the expectations, social capital and knowledge in the broad community, and the exclusivity of the scientific community (Smith, 2000). This resonates with the arguments from Trainor (2006, p. 21) that “*discursive, collaborative processes are well suited to potentially resolve value conflicts that include consideration of multiple realms of value in policy and decision making without requiring a common metric, yet they are not without theoretical and practical challenges*”. These outcomes were consistent with the critique by Brown (2002, p. 26) who described the RFA as having been built around a conventional ‘half and half’ approach, that was designed and expected to come to a mid-point between the two extreme groups without an intention to reconcile: “*Its ‘half and half’ outcomes did not occur by accident or through scientific method, but through policy design. In fact, the federal officials at the centre of the process demonstrated that far from attempting*

to integrate the conflicting values, their task relied on maintaining competition between them". These issues remain largely unresolved, and continue to challenge the collaboration between the forestry stakeholders and the public conservation movement.

Chapter 6 Community Expectations of Public Forests-A Survey Tool

“Forests are big, green and should be there for all eternity” (Alexander Canavan, aged 11).

The following discussion presents original research by the author exploring an approach to investigating changing contemporary expectations regarding public forests in Western Australia. The material presented here has largely been published in the journal *Australian Forestry*, in an article titled ‘*An exploratory study of community expectations regarding public forests in Western Australia*’ (Williamson et al., 2012).

The previous chapters chronicled the history of forest use in Western Australia and the influence of community values on forest inventory from the 1830s to 2010. From the 1970s, beginning with the strong opposition to the proposed woodchip operations in the forest to the present time, the anti-logging debate (really the anti-timber industry debate) demonstrated changes in community values from a previous acceptance of the timber industry to a strong vocal opposition from some people to the timber industry in State forests. The opposition has been such that it has appeared as if there are only two positions to consider with regard to public forests-whether they should support a timber industry or not. The apparent community polarisation into pro- and anti-logging attitudes has been partly due to the media treatment of the subject, including the tendency to fuel controversy. However, there is much more to forest valuation than the question of logging (Lee et al., 1990; Palma, 2005; Williamson, 1981; Winter and Lockwood, 2005).

The research reported in this chapter explored present day community expectations regarding public forests by asking the research question “*What do people want and expect from our public native forests?*” The answers to this question, carefully checked for environmental, social and economic acceptability, should influence what will be assessed with respect to the forest to ensure that the forest can be managed for those values that the community wants from forests. Not unexpectedly, the results from the survey showed that there is a great deal more that the community wants and values

about forests than whether they are to be logged or not. As community values about forests change in the future, this kind of research might be used to revise and improve approaches to forest assessment. This in turn can form a sound basis for providing input to forest policy and forest management regarding public forests.

6.1 Research Design

In the social sciences, surveys and interviews are the most commonly used method of exploring research questions (Sarantakos, 1998). The survey strategy adopted in this research study had two components - a face-to-face interview and a written questionnaire.

The face-to-face approach ensured that:

- Once a person agreed to take part, both the interview and questionnaire components were always completed.
- Any questions or need for clarification could be answered by the interviewer (the author) there and then, thus ensuring a more uniform interpretation of the questions.
- A face-to-face, but neutral to soft interaction with the participants ensured that they understood that there were no right or wrong answers and that it was their personal thoughts and perceptions that were important.
- There was no opportunity for the participant to discuss the question with their partner or friends, thus ensuring that the views were those that the participant held at that time.

It was important for the interviewer to maintain a passive-stimulating, friendly and permissive role to ensure that he did not introduce his personal bias to the survey (Sarantakos, 1998).

6.1.1 *Selecting the Participants*

The aim was to choose a sample of people with a range of social and professional backgrounds that collectively would be likely to have a wide range of expectations, wants and values in relation to forests and broadly represent the 'forest community' (i.e.

people living near these forests, those with an interest in them and/or those subject to the same government). Rather than seek representation of the broader population, the intention was to form a comprehensive catalogue of the range of values and opinions of this community. This would ensure that as well as indicating the range of wants and values of the people surveyed, a more comprehensive list of activities and meanings associated with forests than previously addressed by inventories would be produced.

No such comprehensive list has been published about forests in Australia, although a discussion of a comprehensive set of values for forests has been published by Ford (2013) including use, non-use, intrinsic, recreation, aesthetic, spiritual and cultural values. She used these values to review the adequacy of inclusion of social values in Australia's Regional Forest Agreement process, finding that greater stakeholder engagement "*can lead to incorporation of a broader range of relevant social values into decision-making*" (Ford, 2013, p. 43).

The benefits of such a list are threefold. Firstly, by asking the public what they value and want from public forests (which are managed on their behalf), a greater sense of ownership can be generated. Secondly, such a list makes it clear where measurement should be focused on in providing information for a management plan, and where public education is needed to achieve its aims. Public involvement and a greater sense of ownership in turn provide the third benefit, which is the potential for a more deliberative and consensual approach to long-term forest use and protection.

Those interviewed were selected both purposively and opportunistically from conservation, timber industry, forestry, primary producer, academic, and other affiliations including groups not usually represented in such surveys, such as recreationists, young people and indigenous people (Bengston, 2004). (Refer to section 6.2.2 for details on participants' affiliation and other salient information.)

6.2 The Interview Component

It is generally accepted that qualitative interviews (Sarantakos, 1998):

- Require the development of trust, collegiality and friendship between interviewee and respondent;
- Require a high level of competence on the part of the interviewer;
- Require a high ability of the respondent to verbalise views, opinions and ideas;
- Are demanding and time consuming.

The interviews were conducted to meet these standards. The interviews themselves each took 15 to 20 minutes.

A face-to-face semi-structured interview enabled the establishment of rapport with the participant, to answer any queries they had, to reassure them that there were no right or wrong answers and that it was their thoughts, their opinions, and their values about public forests that were important. To fine tune the questions, the interview was piloted on colleagues before actual implementation.

In summary, the interview component had the following attributes (Sarantakos, 1998): they were conducted face-to-face and recorded, only carried out once per subject, and the interviewer took on a neutral and low-key role in the interview. Furthermore, the questions were: semi-structured (although the order of the questions was structured), mostly open-ended, and mostly qualitative.

6.2.1 *The Information Sought Through Interviews*

The questionnaire that was used is outlined in Appendix 1. The questions in the interview component moved subtly from a general question to more detailed ones so that, as the questions stimulated their memory, the participants warmed to the concept of forests and they could include their additional thoughts in their response to the later questions.

The first four questions were open ended and required the participant to think about forests, what their feelings were about forests, whether forests were important to them,

what they liked and disliked about forests, and their memory of any visits they had had to the native forests of the South West of Western Australia.

Next, they were asked to consider their reaction to a hypothetical situation in which their favourite spot in the forest had been cleared 5 years before but where there was now healthy natural regrowth. In the forests of the southwest, 5 years is the minimum time it takes for a forest to return to an apparently healthy looking system (personal view, author). Then they were asked to consider almost the same hypothetical situation except that the clearing was followed by the development of a farm. This was followed by a question about their perceived knowledge of the forest. This question requiring a standardised Likert type response (Likert, 1932), with a 5-point scale ranging from “nothing at all” to “a great deal” (see Appendix 1, Question 7). They were then asked whether they considered that the forest could be left alone or whether it had to be managed and why they thought what they did about this aspect (Appendix 1, Question 8). The next three questions gave them the opportunity to elaborate on the things they most wanted from and, on the other hand, most disliked about forests. The final “opinion” question asked them for their suggestions about ways of finding out from community members what they wanted from forests (Appendix 1, Question 12).

The interview component of the survey finished with three demographic questions seeking their age group, their postcode and their ‘affiliation category’. For the affiliation, they were offered a list of 12 categories and asked to tick those categories that they felt closely affiliated with and then rank them in order of importance to them. If the given categories did not appeal then they were encouraged to list categories of their own choosing.

6.2.2 Results and Discussion from the Interviews

Q13 & 14. What age group do you fit into? What is your postcode?

A total of 69 people were interviewed, with age profiles shown in Table 6.1. The age of those interviewed ranged from 14 to 92.

Table 6.1: Age of respondents in years separated in age classes.

N	< 18	18-25	26-30	31-50	51-60	61+
69 (100%)	2 (3%)	2 (3%)	3 (4%)	15 (22%)	19 (28%)	28 (40%)

Ten of the participants had country postcodes in the South West of Western Australia, while 59 resided in suburban Perth.

Q15. Which of the following groups do you feel fits your situation most closely?

Of the 69 participants who responded to this question and allocated themselves to one of the 12 groups (Appendix 1), ‘citizen’ (identified as the group that fits their situation most closely by 26 respondents) and ‘conservationist’ (identified as the group that fits their situation most closely by 25 respondents) were the most prevalent. Other groups with which affiliations were identified included ‘other professional’ (7), ‘tourist’ (4), ‘academic’ (9), ‘forester’ (11), ‘public servant’ (1), ‘timber industry’ (1), ‘primary producer’ (4), ‘indigenous person’ (4), ‘journalist’ (2) and ‘politician’ (1). These numbers do not sum to 69 as a number of respondents indicated a priority affiliation with more than one group.

Another 40 categories of affiliation were added by 18 of the 69 respondents (Table 6.2). Although some of the additional 40 categories could be sensibly amalgamated into a smaller number, and overlap with some of the standard categories provided to respondents, there is still a wide range of categories. This gave confidence that the views presented were comprehensive. A much larger survey would be needed to test this so that this survey should be regarded as an exploratory one.

Table 6.2: The additional 40 groups or affiliation categories submitted by 18 of the 69 participants.

Activist	Female	Millennium Kids	Sustainability
Agriculture	Forest historian	Mother	Systems thinker
Apprentice	Forest owner	Observer of nature	Tree farmer
Architect	Grandfather	Parent	Volunteer worker
Bushfire specialist	Grandparent	Part time musician	Wife
Carpenter	High school student	Public health worker	Woman
Concerned person	Historian	Primary school teacher	World citizen
Ecotourism	Human group	Property developer	Writer
Environmental educator	Interested person	Recreational forest user	Yorga (meaning aboriginal woman)
Environmentalist	Interpreter	Retired	Young person

Q1. What do you think about when you see or hear the word forest?

A selection of the responses to this question, with the relevant affiliation in brackets, is:

- “Memory as a child. Camping trips.” (architect)
- “Healing. De-stress. Peaceful environment.” (indigenous person)
- “Pristine. Natural. No people.” (woman)
- “Sanctuary. Peace. Refuge for animals.” (conservationist)
- ”Beautiful trees. Beautiful eucalypts.” (academic)
- “Lots of large trees.” (citizen)
- “Stand of trees. Tall, dense, long boles. Healthy. Vibrant.” (timber industry)
- “Largish area of trees. Minimally impacted.” (public servant)
- “Career. Living in them. Using them without destroying them.” (forester)
- “Trees everywhere. Parents. Picnics.” (teacher)

For a range of affiliations, the major emphasis was on the aesthetic aspects of forests.

Q2. Are forests important to you or not and why do you think the way you do about forests?

Here is a selection of the responses to this question, with the relevant affiliation in brackets:

- “Important that they are there whether I use them or not.” (academic)
- “Their spiritual dimension. The contrast to urban existence.” (architect)
- “Because of their beauty and their resources.” (forester)
- “Forests use CO₂ to produce O₂. Forests are emotionally important.” (journalist)
- “Help prevent the greenhouse effect, salinity and erosion.” (mother)
- “Wilderness. Recreation.” (tourist)
- “Important for the birds and animals.” (apprentice)
- “Ecologically important. I grew up in a forest area.” (social activist)
- “Integral part of the world web. Spiritual.” (retired)
- “A spiritual resource. Habitat.” (recreational user)
- “Vital part of the environment. Employment.” (timber industry)
- “Important part of the environment.” (historian)
- “Respect and love for things that grow.” (environmentalist)
- “Something inside of me.” (indigenous person)

While there were a few mentions of the commercial value of forests, the major source of their importance to participants was the aesthetic aspect of forests, their tranquillity, their contrast to urban life, and their inspiration. The strong link that indigenous people have with forests was also apparent.

Q3. Could you please tell me about any visits you have had to the forests in our south-west?

Most, but not all, respondents had either been to some forest areas in the South West of Western Australia at least on a few occasions. Foresters, timber industry people and primary producers (farmers) had been to forest areas a great deal. Those respondents who had only a few visits to forests or had only driven through forest areas cannot be expected to appreciate the changes in forests over time and their answers were probably

somewhat impressionistic. Nonetheless, both groups, the frequent and the infrequent visitors to the forest, considered that forests were important to them.

Q4. What do you like about forests?

This question attempted to uncover more of respondents' thoughts about forests than Questions 1 and 2. It also provided a chance to build a closer rapport with the participant. While many of the answers were the same as for Questions 1 and 2 above, some new terms and associations appeared. Answers ranged from the spiritual to the mundane as the following representative responses show:

“Away from traffic. The language of the forest.” (architect)

“Everything that they stand for.” (indigenous person)

“Positive feeling. Emotional feeling. Great compared to the city.” (indigenous person)

“All the different plants.” (a wife)

“The world in good order. A healthy forest. Appreciation of nature.” (forester)

“Beautiful places. Restful. Natural forest not developed.” (social activist)

“Life to communities. Camaraderie. Uniqueness.” (timber industry)

“Inspiring. Quietness. Beauty. Wildlife. Large karri trees.” (woman)

“Forests are beautiful and grand. Tranquillity. Climate protection.” (systems thinker)

“Healthy forest. The light. Smallness of leaf.” (recreational user)

“Immersed in nature. The musicality of the forest environment.” (professional)

“Freedom. Away from noise and pollution. Birds, animals, trees.” (timber industry)

“Natural beauty.” (bushwalker)

“Sounds. Animal and plant life.” (carpenter)

“Cooking sausages.” (tourist)

About half way through the interview, and following questions 1, 2 and 4 on a similar theme, the participants had had time to develop greater rapport with the interviewer and to develop more deeply their own thoughts about forests. It was therefore appropriate at this stage to tease out more of what the participants liked about forests and so they were asked Questions 9 and 10 followed by Question 5.

Q9 and Q10. What would you like the forest to provide for you and what values associated with forests are there that you cannot do without?

The following is a representative selection of the range of responses to this question, with the relevant affiliation in brackets:

- “Cultural values. Healthy forest. Food. Music.” (indigenous person)
- “The range of resources. Recreation. Picnic sites. Maintain its extent.” (public servant)
- “Natural bush. Wild camping.” (part time musician)
- “That they be there forever. Recreation. Walking. Camping.” (conservationist)
- “All the multiple uses including aesthetics.” (forester)
- “Access. Camping.” (lawyer)
- “Biodiversity. Recreation. Resources. Education about nature.” (conservationist)
- “Social and economic benefits. Environmental benefits.” (timber industry)
- “Quality and quantity of rangers. Primitive campsites.” (landscape architect)
- “Educational tool, especially for children. Variety of trees, wildflowers.” (primary producer)
- “Big tall old trees. Experiences for my children.” (mother)
- “Peaceful. No machinery.” (high school student)
- “Timber if managed. Recreation for children. Hiking. Camping.” (carpenter)

The responses were now starting to include other values associated with forests such as education, concern for the ecology and mention of sustainable use, suggesting more of an interest in the science behind forestry from the general public. Recreational values (25%) became more important than in responses to earlier questions. This showed the increasing depth in their consideration of forests that the participants had developed during the course of the interview.

Q5. What do you dislike about forests?

This was the first time in the interview that the participant was asked about their dislikes. Responses included the following:

- “Dumped rubbish. Burnt cars.” (citizen)
- “Introduced weeds,” (indigenous person)

“Fallen limbs. Wildfire.” (grandfather)
“Logging. 4WD. Weeds. Man made disturbance.” (tourist)
“A degraded forest.” (forester)
“Prickles. Too many roads.” (social activist)
“When they are used and abused for political gain.” (timber industry)
“Fear of fire.” (landscape architect)
“Ticks. Noisy motor bikes.” (academic)
“Degraded forest. When used as a timber resource. Clear felled forests.”
(recreational user)
“Seeing them abused.” (historian)

While the above examples are representative of many of the responses, the most common response (18 times) was “nothing.” The indication is therefore that most people have a fundamentally positive perception of those associations they have with forests. Almost all of the negative responses, as reflected by those cited above, concerned adverse human impacts on the forest.

Q11. What things or values associated with forests do you not want?

When this question, a further development of Question 5, was asked later in the interview the responses similarly referred predominately to human impacts:

“Bauxite mining. Dumping rubbish.” (public servant)
“Woodchips. Railway sleepers.” (journalist)
“Dieback. Salinity areas.” (world citizen)
“Feral animals. Anything introduced or managed.” (indigenous person)
“Snakes. Clear felling. Hordes of people.” (tourist)
“Trail bikes. Rally driving. Any mechanised stuff.” (grandfather)
“Prickles.” (apprentice)
“Exotic species. Weeds. Hoons.” (academic)
“Horse riding. Mountain bikes. Camping. Litter.” (conservationist)
“Bull ants. Snakes. Forest not to be locked up. ” (professional)
“Litter. Destruction of plants and animals. ‘Do not enter’ signs. (primary producer)
“Leave untouched. Don’t use if replacement products are possible.” (teacher)

No one answered “nothing” for this second question concerning their negative associations with forests. Apparently, at this stage, they had thought more deeply about their dislikes and these can be placed into four groups:

- The first group contained things that were due to human disturbance: *rubbish and litter; burnt cars; clear felling; logging; too many roads; noise; too much recreational development; lack of toilets; 4 wheel driving.*
- The second group contained environmental problems, many of which were also attributed to human impacts: *dieback; bushfires; erosion; decimation of animal life; weeds.*
- The third group contained natural elements of forests that can cause human discomfort: *bull ants; snakes; mosquitoes; ticks; flies; prickly plants.*
- A fourth group specifically objected to human exclusion: *'Do not enter' signs; Forests not to be locked up.*

A summary of responses to these open-ended questions is presented in Table 6.3. Four of the five categories in this table are based on Bengston et al. (1999): AEV (aesthetic values), NEV (natural environment values), RECV (recreational values), RUV (resource use values). The fifth one, managing the forest (MTF), was added to cater for the many values and activities associated with managing public forests in Western Australia (Table 6.3).

Analysing the comments of participants for Table 6.3 was straightforward for the positive or “what do you like” or “what is important” about forests questions. For instance if a participant *liked* forests for their recreational values this was noted in the tally of comments in the RECV box of the relevant question (Questions 1, 2, 4, 9, 10). However, if some aspect of recreation is what a participant *disliked* about forests this was also noted in the tally of comments in the RECV box of the (different) relevant question (Questions 5 or 11). The interpretation was that there is some aspect of recreation in forests that the participant disliked, such as “noisy motor bikes”, “lack of toilets”, “4WDs”.

Q6. Supposing you revisited one of your favourite spots in the forest after 5 years, how would you feel if: (A) it had been logged and there was now healthy natural regrowth 5 metres tall; or (B) it had been cleared and there was now a farm there?

For both hypothetical situations, the responses were strongly against logging followed by successful regrowth, and much more strongly against replacing forest areas with a farm. The responses to the example of logging followed by regrowth were nearly all ones of either sadness *per se* or sadness for the loss of mature forest but pleased about healthy regeneration (Table 6.4). Only four people were completely happy with logging followed by regrowth, indicating perhaps a long experience and understanding of the time scale of the life of a forest. The range of emotional responses was indicated with expressions such as: ‘shocked’, ‘furious’, ‘devastated’, ‘sickened’, but also ‘happy’.

Table 6.3: Summary of responses to open-ended interview questions. For categories, see text and Bengston et al. (1999).

Interview question	N	n	AEV Aesthetic values	NEV Natural values	MTF Managing the forest	RECV Recreational values	RUV Resource use
Q1 What do you think about forests?	43	63 (100%)	40 (64%)	12 (19%)	2 (3%)	5 (8%)	4 (6%)
Q2 Are forests important to you?	64	95 (100%)	34 (36%)	49 (52%)	2 (2%)	6 (6%)	4 (4%)
Q4 What do you like about forests?	58	88 (100%)	47 (53%)	31 (36%)	1 (1%)	8 (9%)	1 (1%)
Q5 What do you dislike about forests?	60	70 (100%)	33* (47%)	15 (21%)	11 (16%)	5 (7%)	6 (9%)
Q9, Q10 What would you like the forest to provide for you?	66	167 (100%)	42 (25%)	49 (29%)	9 (5%)	41 (25%)	26 (16%)
Q11 What things do you not want in the forest?	54	73 (100%)	3 (4%)	10 (14%)	11 (15%)	24 (33%)	25 (34%)

Notes: N is the number of people who responded to the question (out of the 69 participants); n is the total number of times the items were allocated to the categories for each question. The scores in each cell record the number of times the responses were allocated to the given category by those N participants who responded to that question; i.e., each person may have had several reasons why they liked or did not like forests or things associated with forests and these fell into different categories. * Of the 33 who responded to question 5 in category AEV, 18 of them said there is “*nothing*” they dislike about forests.

The responses to the loss of forest for the creation of a farm were very strongly against the loss of forest (Table 6.4), even by the primary producers interviewed. The strong

message was that there was enough farmland already. Some qualified their disappointment at the loss of forest by wanting to know the reason for the creation of a farm. Again, the responses were expressed strongly including expressions such as: ‘devastated’, ‘deeply distressed’, ‘angry’, ‘beyond furious’, and ‘heartbroken’. Premier Mitchell’s view of a hundred years ago that the South West of Western Australia should be the food bowl of the world clearly no longer applies. The earlier priority attached to clearing forest for agricultural land has given way to an unambiguously positive preference for protection of the remaining forests in Western Australia.

Table 6.4: Percentage responses to the two hypothetical questions.

Hypothetical Question Q6	N	Strongly Against	May be All right	In favour
(A) Logged then regrowth	65 (100%)	43 (66%)	2 (3%)	20 (31%)
(B) Logged then a farm	63 (100%)	55 (87%)	5 (8%)	3 (5%)

Q7. How much do you consider that you know about forests?

Table 6.5 overviews the knowledge respondents considered they had about forests. No one considered that they had no knowledge at all about forests, even the youngest group of participants ($n = 2$, see Table 6.1). Whether this was due to greater familiarity as a result of increased recreation, the extent of media coverage over the last twenty years, or to some other factors, is a matter for further study. As might be expected those registering ‘a great deal’ of knowledge about forests were foresters, primary producers and some conservationists. While the foresters all said that they knew a great deal about forests, they also said “*that the more you know the more there is to know*”. Those respondents with close knowledge and experience of the forests - the foresters, timber industry people, primary producers and those with nature study interests - could be expected to have based their answers on a realistic understanding of forests and of the changes that occur in forests over time.

Table 6.5: Respondents' own idea of their knowledge of forests.

N	Nothing at all	Very little	A little	Quite a bit	A great deal
69 (100%)	0 (0%)	11 (16%)	25 (36%)	14 (20%)	19 (28%)

Q8. Do you consider that forests can be left alone to look after themselves, or do they need to be managed? Why do you think that?

Overwhelmingly, 89% of the responses favoured forests being managed (Table 6.6). However, a quarter (22%) of these respondents would have preferred the forests to be left alone but realised that with people visiting and using the forest they had to be managed. A small number of respondents (11%) wanted the forests to be left alone, the typical reason given that forests had looked after themselves for thousands of years.

Table 6.6: Should forests be left alone or should they be managed?

N	Leave alone	Like to leave alone but realise must be managed	Must be managed
67 (100%)	7 (11%)	15 (22%)	45 (67%)

Q12. How do you suggest we could find out what the community wants from forests?

Three types of suggestion were put forward: talking to people, especially one-to-one (as in the interview); survey (as presented in the following sections); and observing what people do in the forest. Another approach, although not mentioned by those interviewed, is content analysis of news media stories relating to forests (Xu and Bengston 1997).

6.2.3 Conclusions from the Interview Component of the Survey

The interview revealed that while for most people forests did not appear to be a large part of their daily thoughts, nonetheless when encouraged by open-ended questions they revealed that forests were important to them. Not only that, but they also thought

favourably about forests. Their emphasis was on the value of forests for the health of planet earth and for personal peace of mind rather than on the commercial value of forests, although eco-tourism and employment were not ignored. Most people had positive and protective thoughts about forests. It is important for them that forests are there. The concept of forests is ‘comforting’ to most people and the ‘tranquillity’ and ‘naturalness’ of a forest can provide a balance to the perceived ‘chaos in everyday life’.

When they think about forests –‘the words and phrases that most respondents used included ‘space’, ‘freedom’, ‘sanctuary’, ‘picnics’, ‘peace’, ‘beauty’ and ‘wonder’, to expressions of anger at people who want to destroy forests. It became evident that the focus on commercial use of forests in Western Australia of the 19th century and the major part of the 20th century has now been largely replaced with an emphasis on reverence towards forests and gratitude that forests are there for their inspiration and peacefulness. The mood from the respondents was that forests are important for their feeling of freedom, their aesthetic qualities, their naturalness, not too much tourism, not too much commercial use, very little or no logging, and just for forests to be there. It seemed that if forests are there then “*all’s well with the world*”.

Because the response that forests are important was so overwhelming in this group with widely varying backgrounds, it seems highly likely that we could expect similar feelings about public forests from the community at large. Given the opportunity to put a priority on the 12 listed affiliations and to add any additional affiliations that they felt closely fitted their situation, 18 of the 69 participants listed a total of 40 additional affiliations. This suggested that using a purposive approach was successful in achieving the aim of selecting participants with a wide range of views.

The qualitative, interview-based component of this study was valuable for its reminder about how much the wording of questions influences responses. For example, when asked in the interviews about the importance of forests only 6% of responses related to recreation (RECV, Table 6.3), but when respondents were asked about what they would like from forests the percentage for recreation increased to 25% (Table 6.3). Therefore, the precursor or guiding questions for any survey seeking information on expectations and related values must be carefully worded. Asking about peoples’ aspirations (‘wants’ in this study) is likely to evoke the broadest possible range of expectations and this in turn is most helpful in the development of forest policy for public forests.

6.3 The Written Survey Questionnaire Component

This part of the research sought to go beyond the general findings from the interview component that forests are important to the community, and explored in comprehensive detail by means of a survey questionnaire what it is that the community wants and values from the public native forests of the South West of Western Australia. For this purpose a new style of questionnaire was created for forest surveys by asking participants to respond to a comprehensive list of 176 specific items, presented in everyday language that would be readily understood (Appendix 2).

The questionnaire was filled in by the participant immediately after the interview with the interviewer still present. This enabled any queries to be answered that might arise and ensured that the questionnaire was in fact completed. In addition, the preceding interview component served as a warm-up for the questionnaire component because after the interview the participant was fully focused on the concept of forests. The questionnaire component generally took half to one hour to complete.

6.3.1 The Information Sought in the Written Questionnaire

The questionnaire used a 5-point Likert scale (Likert 1932), ranging from 1 = strongly against, 2 = against 3 = neutral, 4 = in favour, and 5 = strongly in favour, to determine the degree to which each item was supported or opposed (Appendix 2). The list of 176 items was designed to represent all the things that are associated (and valued) with the public native forests of the South West of Western Australia. The list was prepared by the author on the basis of many years (40+) of experience as a professional forester, and it is therefore an 'expert' list. As a member of a profession the author was likely to have been strongly influenced by the culture of their profession, in this case the culture of forestry, and so to make the list as comprehensive as possible, the participants were asked to add any terms they could think of to the list. In this way, the research was intended as a step toward empowering the stakeholder to contribute to the planning process, and therefore to the management of public forests.

The items in the questionnaire were originally grouped into seven categories. The seven categories were: *Activities in forests; Products from forests; Things associated with*

forests; Values of forests; Access in or through forests; Products from trees; Ferals in forests (Appendix 2). Within each category set, there was similarities among the items; the purpose of the groupings was to help participants and address an extensive range of items (176) by splitting them into manageable categories. For instance, ‘walking’, ‘fishing’ and ‘photography’ were in the ‘Activities in forests’ group, while ‘aesthetics’, ‘inspiration’ and ‘tranquillity’ were in the ‘Values of forest’ group. The categories appeared to have been clear enough to the participants as there were no queries about them raised during the survey. The items were listed in alphabetical order within each set to avoid any suggestion of imposed preference (Appendix 2).

Activities, wants, products and emotions associated with publicly owned forests can be identified as many different items and allocated to many different categories (Bengston et al., 1999; Lamb and Morris, 1996; Putney, 2003; Winter and Lockwood, 2005; Worboys et al., 2003). The items chosen in this study and how they were initially organised into seven categories was based on the over 40 years’ of forest management experience of the author, providing a comprehensive and useful guide to the range of peoples’ values and wants about publicly owned forests. Such a comprehensive listing of 176 items may also make people aware of the wide variety of values and activities associated with forest management, and may in turn help to overcome the divisive community debate about forests focussed almost exclusively on timber extraction and old growth protection (Williamson, 1981).

In reporting the results, the original 7 categories were merged and re-categorized using the four categories used by Bengston et al. (1999), plus a fifth, ‘Managing The Forest’ (MTF) (also see Table 6.3). These have been shown in previous research to cater for all expectations associated with public forests in sufficient detail to be useful for management planning purposes (e.g., Bengston et al., 1999). Nonetheless, the categories themselves and the allocation of items to categories is less important than their heuristic role. The objective was to produce a comprehensive list of all the component activities, values, wants and things associated with public forests and to get the most complete picture of the community’s expectations. A sensitive response to the community’s wishes could then be achieved when developing forest policy.

Further study could well result in grouping the component items into different categories, or adding more items to each category. As Worboys et al. (2003, p. 78) put it “*Many values are multi-faceted, and could be located within several categories.*” A possible alternative grouping of conservation, recreation, and commercial utilisation falls short of covering the aesthetic and inspirational aspects of forests, although these might be accommodated in a recreation grouping. Putney (1998) used categories based on the World Commission on Protected Areas (WCPA) approach. The WCPA approach used categories that focus on justifying why the area should be set aside for protective purposes.

As noted above, a Likert scale was chosen as it enabled measurement of the extent to which the respondent was in favour or against the question associated with each of the 176 items. Two simple methods of analysis were used. Firstly, the mean and standard deviation for the response for each item was calculated. Each response was coded 1 to 5 where: 1 = strongly against, 2 = against 3 = neutral, 4 = in favour, and 5 = strongly in favour. Second, the results were also presented as a percentage of agreement (CIF%), representing the sum of the respondents using either ‘in favour’ or ‘strongly in favour’ as a response relative to the total number of responses for that item.

6.3.2 Results and Discussion from the Written Questionnaire

Table 6.7: Strength of support for the 176 items from the questionnaire organised using the same five value categories used to analyse the interviews (see Table 6.3 and main text). The mean and standard deviation (SD) are presented based on the five point scale from ‘strongly against’ (1) to ‘strongly in favour’ (5). CIF%=combined-in-favour percentage (see further text). N = 69

Natural Environment Values (NEV)

Item	Mean*	SD	CIF%	Item	Mean*	SD	CIF%
Conservation	4.7	0.7	100%	Soil protection	4.5	0.6	92%
Healthy ecosystems	4.7	0.7	100%	Heritage	4.4	0.9	90%
Catchment protection	4.6	1.0	98%	Information	4.3	0.9	90%

Natural Environment Values (NEV) (cont.)

Item	Mean*	SD	CIF%	Item	Mean*	SD	CIF%
Education	4.6	0.8	98%	Nesting sites	4.3	1.1	90%
Habitat for living things (native)	4.7	0.5	98%	Wilderness values	4.3	1.2	87%
Oxygen	4.7	0.6	98%	Climate amelioration	4	1.4	84%
Shade	4.6	0.7	98%	Wind break	4.4	0.8	84%
Birds	4.6	0.8	97%	Coolness	4.2	0.9	82%
Maintaining biodiversity	4.6	0.8	97%	Lichen	4.2	0.9	82%
Regeneration	4.6	0.6	97%	Discovery centres	3.9	0.9	76%
Wetlands	4.6	0.6	97%	Leaf litter	4.1	1.1	76%
Ecosystems	4.4	1.0	95%	Snakes	3.6	1.7	75%
Native plants	4.1	1.6	95%	Carbon sequestration	3.8	1.3	73%
Wildlife conservation	4.4	1.1	95%	White ants	3.6	1.6	69%
Reduction of noise	4.5	0.8	94%	Algae	3.5	1.1	44%
Shelter	4.4	0.8	94%	Smoke from forest fires	3	1.3	35%
Special places	4.5	0.7	94%	Bushfires	2.6	1.5	31%
Preservation of culture	4.4	1.0	93%	<i>No. of items in category</i>	37		37
Biodiversity	4.3	1.0	92%	NEV category mean	4.2		86%
Insects	4.4	0.9	92%	NEV category range	2.6-4.7		31-100%

Aesthetic Values (AEV)

Item	Mean*	SD	CIF%	Item	Mean*	SD	CIF%
Beauty	4.7	0.7	100%	Photography	4.5	0.7	94%
Scenery	4.6	0.5	100%	Recharging the batteries	4.5	0.8	94%
Tranquility	4.6	0.8	98%	Solitude	4.5	0.9	92%
Communion with nature	4.6	0.8	97%	Landscape vistas	4.4	0.9	90%
Views	4.4	0.8	97%	Wilderness experience	4.3	1.1	87%
Aesthetics	4.6	0.8	95%	Spirituality	4.4	0.9	85%
Emotional attachment	4.5	0.8	95%	<i>No. of items in category</i>	<i>14</i>		<i>14</i>
Inspiration	4.6	0.8	95%	AIV category mean	4.5		94%
				AIV category range	4.3-4.7		85-100%

Managing The Forest (MTF)⁺

Item	Mean*	SD	CIF%	Item	Mean*	SD	CIF%
Dumping rubbish (prevention)	5	0.2	100%	Forest management	4.2	0.2	89%
Dumping stolen cars (prevention)	5	0.2	100%	Fire management	4.3	0.2	87%
Feral cats (removal)	4.9	0.3	100%	Prescribed burning	4.1	1.0	79%
Feral pigs (removal)	4.9	0.3	100%	Fire suppression	4.1	1.1	77%
Foxes (removal)	4.9	0.3	100%	Ecosystem based forestry	3.9	1.2	73%
Pest animals (removal)	4.9	0.3	100%	Boardwalks	3.7	1.1	71%
Dumping dead bodies (prevention)	4.7	0.8	97%	Controlled burning	3.5	0.8	69%
Rehabilitating the forest	4.6	0.7	97%	Bridges	3.2	1.3	58%
Research	4.6	0.6	97%	Airstrips for fire fighting	2.7	1.5	51%
Weeds (removal)	4.7	0.8	97%	Roads	3.1	1.3	48%
Rabbits (removal)	4.8	0.5	95%	<i>No. of items in category</i>	22		22
Regenerating the forest	4.5	0.8	94%	MTF category mean	4.3		85%
				MTF category range	2.7-5.0		48-100%

Recreation Values (RECV)

Item	Mean*	SD	CIF%	Item	Mean*	SD	CIF%
Bush walking	4.6	0.5	98%	Caving	3.7	1.3	75%
Walking	4.6	0.8	98%	Picnic spots	3.9	0.9	74%
Admiring large/tall trees	4.7	0.6	97%	Visitor centres	3.3	1.6	72%
Hiking	4.5	0.6	95%	Driving through the forest	3.4	1.2	69%
Long distance walking	4.4	0.6	95%	Rock climbing	3.8	0.9	68%
Nature study	4.5	0.7	95%	Rogaining	3.6	1.1	66%
Admiring the wild flowers	4.6	0.6	94%	Fishing	3.6	1.1	65%
Bird watching	4.4	0.7	90%	Amorous assignations	3.9	0.9	63%
Cultural experience	4	1.2	90%	Commercial tourism	3.2	1.2	52%
Painting (artistic)	4.2	1.0	90%	Marroning	3.4	1.2	51%
Picnicking	4	1.2	90%	Accommodation	3.1	1.2	45%
Sight seeing	4.3	0.7	90%	Horse riding	3	1.2	45%
Canoeing	4.2	0.7	89%	Mountain bike riding	3	1.3	44%
Recreation	4.2	0.8	89%	Protest sites	2.9	1.4	39%
Trails	3.8	1.0	87%	4 wheel driving	2.3	1.3	27%
Ecotourism	4	0.8	85%	Rally driving	1.9	1.3	16%
Tracks	3.7	1.0	80%	Trail bike riding	2	1.2	16%
Camping	4	0.9	79%	Hunting	1.9	1.2	14%
Swimming	4	0.8	79%	Paint balling	1.8	1.0	10%
Visiting visitor centres	4	0.9	79%	<i>No. of items in category</i>	<i>41</i>		<i>41</i>

Recreation Values (RECV) (cont.)

Item	Mean*	SD	CIF%	Item	Mean*	SD	CIF%
Orienteering	4	0.9	78%	RECV category mean	3.7		70%
Self reliance	4.1	1.1	77%	RECV category range	1.8-4.7		10-98%

Resource Use Values (RUV)

Item	Mean*	SD	CIF%	Item	Mean*	SD	CIF%
Antiseptics	3.5	1.3	75%	Sawlogs	2.5	1.5	38%
Medicinal values plants	3.7	1.1	74%	Royal show log-chop logs	2.8	1.4	36%
Employment	3.9	1.0	73%	Tannin	2.6	1.4	34%
Furniture wood	3.6	1.2	70%	Scantling	2.5	1.5	33%
Job creation	3.8	1.1	69%	Fauna	2.5	1.4	32%
Eucalyptus oil	3.3	1.4	68%	Shingles	2.5	1.4	32%
Honey	3.4	1.3	67%	Old growth forests	2.2	1.6	31%
Bush tucker	3.6	1.1	66%	Paper	2.4	1.4	31%
Clean water	3.5	1.4	64%	Poles	2.5	1.3	31%
Products from trees	3.2	1.5	64%	Chipwood	2.3	1.4	28%
Renewable resources	3.4	1.4	63%	Rafters	2.4	1.4	28%
Craft wood	3.3	1.3	61%	Piles	2.4	1.3	27%
Sandalwood oil	3.1	1.4	57%	Pulpwood	2.2	1.4	27%
Gum nuts	3.4	1.1	55%	Railways	2.6	1.2	26%
Wood sculptures	3.2	1.4	50%	Utility corridor-water supply	2.5	1.3	26%
Mushrooms	3	1.3	48%	Christmas trees	2.3	1.4	25%
Roads	3	1.2	48%	Mining timber	2.1	1.4	22%
Firewood	3	1.4	46%	Railway sleepers	2.2	1.4	22%
Fish	3	1.2	46%	Protesters' platforms	2.1	1.5	21%

Resource Use Values (RUV) (cont.)

Item	Mean*	SD	CIF%	Item	Mean*	SD	CIF%
Gum	3.2	1.2	46%	Native animals	1.7	1.3	20%
Perfumes	2.8	1.5	46%	Collecting things	2.3	1.1	19%
Marron	3	1.3	45%	Defense force training	2.3	1.2	19%
Flora	2.8	1.4	44%	Utility corridors-irrigation	2.3	1.2	18%
Fungi	2.9	1.2	44%	Gravel	2.1	1.2	16%
Leaves	3	1.3	44%	Utility corridors-electricity	2.2	1.1	16%
Utility corridors	3.1	1.3	42%	Utility corridors-gas	2.2	1.0	15%
Veneer	2.8	1.5	42%	Grazing	1.9	1.0	13%
Bark	2.7	1.5	41%	Minerals	1.9	1.1	11%
Charcoal	2.7	1.4	41%	Utility corridors-bauxite	1.9	1.0	8%
Logging	2.7	1.5	41%	Mining	1.6	0.9	6%
Timber products	2.8	1.4	40%	<i>No. of items in category</i>	62		62
Wildflowers	2.8	1.5	40%	RUV category mean	2.7		38%
				RUV category range	1.6-3.9		6-75%

⁺ Category added for items related to forest management.

* Five point scale from strongly against (1) to strongly in favour (5)

Given that both the CIF% and mean scores for all items showed similar relative trends (Table 6.7), for simplicity only the CIF% is discussed here although both are presented for all items in Table 6.7. Of the 69 people surveyed, not all responded to every item, with responses to each item ranging from 53 to 63 in number. As for the interview component, the questionnaire component revealed that a broad range of strongly favoured values was attributed to public forests, including natural environment, aesthetic, recreation and resource use. Managing the forest was also strongly favoured. Aesthetic values (AEV) received the greatest support, with a mean CIF of 94% (Table 6.7). There was also strong support for natural environment values (86%; NEV, Table 6.7) and for managing the forest (85%; MTF). Recreation (RECV) was next with a CIF of 70%, with resource use (RUV) the least favoured with a CIF score of 38% (Table 6.7). For RUV, only 15 of the 62 items in Table 6.7 had a score of 50% CIF or higher.

A number of value items from the above-listed categories had combined-in-favour percentages of 100%, emphasising the wide range of expectations and the strong support for them. The natural environment items of nature conservation and healthy ecosystems, the aesthetic items of beauty and scenery, and the items of prevention of dumping rubbish and removal of feral and pest animals as part of managing the forest all had CIFs of 100% (Table 6.7). None of the resource use (RUV) items had CIFs of 100% (Table 6.7). A CIF% of 50% or greater meant an item was favoured to strongly favoured and 70% of all the items were assessed as such by respondents, including some of the resource use items (Table 6.7).

Participants suggested an additional 85 value items that could be considered for inclusion in a future survey (Appendix 3). It must be noted that the participants were not necessarily in favour of each additional item that they suggested, with some important and supported and others important and not supported. Additional items suggested by respondents were mostly variations on items in the existing list. For example *goats* could be included in feral animals, *bauxite mining* could be included in mining, and *blackberries* could be included in weeds (Table 6.7), although it may be appropriate to include these and other suggested items separately depending on the purpose of the survey.

Cooee contests and *bullock wagon races* were added by a participant with a known sense of humour. More seriously, the indigenous participants suggested new items that could be part of future surveys. These included aboriginal men's and women's cultural sites, dreaming trails and burial sites as well as aboriginal smoking ceremonies and meeting places. This suggested a need to expand the category natural environment values (NEV) to include cultural values.

The broad range of expectations about forests and the strong support expressed for them in this study complemented findings from other research. For example, Manning et al. (1999) found that most values surveyed in the Green Mountain National Forest study in Vermont were judged to be relatively important by respondents. Of their 11 values of interest, 8 received an average rating of at least moderately important (a value of 4 on a 6-point scale) (Manning et al., 1999). In their study almost two-thirds (64%) of items were regarded favourably to very favourably (Manning et al., 1999).

The early work by Bengston (1994) developed the idea of forest values from a multi-dimensional perspective. He argued that given this perspective, forest values are unable to be reduced to a single dimension. The many values in that study encompassed natural environment, aesthetic, recreation, and resource use values. Other studies have similarly emphasised multiple values. Webb et al. (2008) based their analysis on three value categories: commodity, ecological and moral/spiritual/aesthetic. Xu and Bengston (1997) identified and coded economic/utilitarian, life support, aesthetic and moral/spiritual values, and Bengston et al. (1999) worked with four statistically significant forest values (significant in their contribution to explaining respondents' attitudes to forest management): ecological (NEV in this thesis), moral/spiritual/aesthetic (AEV), commodity (RUV) and recreation (RECV).

As was the case from this study and other research, the multi-dimensionality of public forest values were apparent, with some more favoured than others. Clearly favoured in our study were the natural environment, aesthetic, managing the forest and recreation values with CIF% means of 70% or greater (Table 6.7). Resource use had the lowest mean CIF% (38%). Manning et al. (1999) similarly found aesthetic and ecological values as most important with economic values least important.

Aesthetic values had the highest mean CIF% (94%) of all the categories in this study (Table 6.7) and scenery, conservation and beauty were supported by all those in the survey. Xu and Bengston (1997) research on the national forests of the United States emphasised the importance of aesthetic and spiritual values. Natural environment values, including the items of conservation and biodiversity, also had a high mean CIF% (86%) in this study of forests in the South West of Western Australia. Webb et al. (2008) noted the important place of natural environment values in today's forestry in Australia.

Recreation values also had a moderately high mean CIF% (70%) in this study (Table 6.7) as also found by Bengston et al. (1999), who found that by 1996, the last year of their study, recreation was more frequently mentioned in the media than all other values combined. The category 'managing the forest' (MTF) in this study also had a high mean CIF% of 85%. This was largely because of strong societal expectations regarding active management to remove threats to forests, such as feral animals, and preventing activities damaging to forests, such as rubbish dumping. Both of these MTF items had CIF% scores of 100% (Table 6.7).

Even though the number of participants was small (69) they represented a wide variety of backgrounds and their responses produced some considerations that could well warrant further study as indicated by the following examples. Items receiving the greatest support are of particular interest (Table 6.8). A total of 10 of the 176 items had a CIF score of 100%, with six of these with a mean score of 4.9 or 5.0.

Table 6.8: Value items with the greatest support based on highest CIF% scores.

Item	Mean*	CIF%
Dumping rubbish (prevention)	5.0	100%
Dumping stolen cars (prevention)	5.0	100%
Feral cats (removal)	4.9	100%
Feral pigs (removal)	4.9	100%
Foxes (removal)	4.9	100%
Pest animals (removal)	4.9	100%
Conservation	4.7	100%
Healthy ecosystems	4.7	100%
Beauty	4.7	100%
Scenery	4.6	100%

* Five point scale from strongly against (1) to strongly in favour (5). N = 69

It was evident from these ‘most supported’ items that it is important to everyone that the forest is not used as a rubbish dump nor should feral animals be allowed to continue to live in it. *Dumping rubbish* gets the award for the most disliked activity in forests. All participants supported preventing dumping of rubbish. The first six items were ‘managing the forest’ (MTF) category items and are needed to ensure that the remaining four ‘natural environment’ (NEV) category items (*conservation, healthy ecosystems, beauty and scenery*) survive. It is encouraging when a survey produces such logically consistent results and indicates that most of the participants were aware of the connection between the need to manage the forest to protect the natural environment values that they strongly support. This was also consistent with the responses to Question 8 of the interview component of the survey (Table 6.6) indicating support for management.

Items with the least support are shown in Table 6.9. *Mining* and *utility corridors* are both destructive uses of the forest and clearly not supported. There were four recreation items - *paint balling, hunting, rally driving, and trail bike driving* - that were also not supported. This indicates that it was a wise decision to make the Munda Bididi trail (a mountain bike trail) quite separate from the Bibbulmun walk trail, likely used by people representing different values towards these major recreational uses of the forests of South West Western Australia.

Table 6.9: Value items with the least support based on lowest CIF% scores.

Item	Mean*	CIF%
Mining	1.6	6%
Utility corridor-bauxite	1.9	8%
Paint balling	1.8	10%
Mineral extraction	1.9	11%
Grazing	1.9	13%
Hunting	1.9	14%
Utility corridor-gas	2.2	15%
Rally driving	1.9	16%
Trail bike riding	2.0	16%
Gravel-taking	2.1	16%

* Five point scale from strongly against (1) to strongly in favour (5). N = 69

Bushfires under the severe summer conditions of high temperature, heavy fuel and strong wind are destructive to biodiversity, destroy infrastructure and sometimes kill people. Such is the dominant effect of bushfires that if they are not prevented or their damage minimized then no forest values can remain unscathed. Therefore, it is interesting to note the responses to items associated with forest fire by the participants in the questionnaire (Table 6.10).

Table 6.10: Fire in forests value items.

Item	Mean*	CIF%
Fire management	4.3	87%
Prescribed burning	4.1	79%
Fire suppression	4.1	77%
Controlled burning	3.5	69%
Airstrips for fire fighting	2.7	51%
Smoke from forest fires	3.0	35%
Bushfires	2.6	31%

* Five point scale from strongly against (1) to strongly in favour (5). N = 69

Respondents' attitudes to *fire management*, *prescribed burning*, *fire suppression* and *controlled burning* were all very favourable (Table 6.10). This supports those who would manage forest fire by fuel reduction burning under mild weather conditions, a

practice successfully carried out in the public forests of South West Western Australia for over 30 years following the development of fire research after the disastrous 1961 Dwellingup bushfires.

Because prescribed burning, as a descriptive term, means the same thing as controlled burning, and over twenty years ago replaced controlled burning then in common use to describe the practice of fuel reduction burning under mild conditions, the difference in their scores appeared to indicate that the situation has not been well explained to the public. An information program to do this may therefore be warranted. Smoke is not well liked; neither is the intrusiveness of airstrips for firefighting. The neutral response to bushfires, with a mean of 2.6, is intriguing (Table 6.10).

Given the attention given to timber removal in much of this thesis, the following results have been extracted for review here. Only 5 of the 16 timber resource use items in Table 6.11 have a CIF score of 50% or higher. Even an essential product like paper had a mean score of only 2.4 and a CIF of 31%. The lowest CIF% score for timber resources was 21% for *protesters' platforms* (Table 6.11).

Table 6.11: Selected timber resource use value items.

Item	Mean*	CIF%
Furniture wood	3.6	70%
Products from trees	3.2	64%
Renewable resources	3.4	63%
Craft wood	3.3	61%
Wood sculptures	3.2	50%
Firewood	3.0	46%
Veneer	2.8	42%
Logging	2.7	41%
Timber products	2.8	40%
Sawlogs	2.5	38%
Royal show log-chop logs	2.4	31%
Old growth forests (harvesting)	2.2	31%
Paper	2.4	31%
Chipwood	2.3	28%
Railway sleepers	2.2	22%
Protesters' platforms	2.1	21%

* Five point scale from strongly against (1) to strongly in favour (5). N = 69

It is important to consider the different responses in this questionnaire to things associated with the removal of trees as this reveals subtle differences in policy expectations. The following four items are all concerned with the removal of trees: *harvesting old growth forests, logging, sawlogs and products from trees*. Table 6.11 shows they all had slightly different responses. This could simply be due to the ‘survey error’ when participants give inconsistent responses to similar situations or it could reflect real differences in expectations. It is worth considering the possibility of real differences.

On the one hand it is reassuring to note that the mean scores (Table 6.11) are similar as one might expect from items that are themselves very similar - they all involve removal of trees. Their similar scores for mean and CIF% are an indication that the participants had a clear concept of what was being asked. However, there are intriguing differences. While *harvesting old growth forests* had the lowest mean score of 2.2 and a low CIF of 31% it had the highest standard deviation of 1.6 (RUV; Table 6.7), indicating people

strongly against, but also in favour of logging these forests. *Harvesting old growth forests* continues to rouse heated public debate, but is not a straightforward issue.

It was no surprise that *logging* and *sawlogs* had such similar low mean scores as they both prompt a picture of trees being felled and overall devastation. Only those who work in the forest are likely to also have a picture of the regeneration that follows logging. Compared to the others in this set of 16 items *furniture wood* had the highest mean score of 3.6 and the highest CIF of 70%, yet most products from trees require the tree to be cut down. It should be noted that the higher value and lower impact of timber use for furniture compared to wood chips, for example, is likely to capture the perspective of those who recognize that some tree felling is reasonable.

Overall, resource use values were not well supported by the respondents. Timber and wood products have a long way to go to become acceptable renewable resources. These kinds of scores for timber resources could well prompt an information and education program about, for example, the carbon storage and renewable qualities of timber products as a by-product of sustainable forest management.

Recreation values (RECV) were solidly supported by the respondents. Most of the items in Table 6.7 (32 out of 41) have a CIF score of 50% or higher. On the one hand, commercial tourism is a way of visiting the forest under supervision and it generates a commercial return out of the forest. On the other hand, it brings a lot of people to attractive places and this creates noise, reduces the tranquillity of the locality and may harm the environment. For this group of 61 respondents, it rated a mean score of 3.7 and a CIF score of 70% in favour (Table 6.7).

Forest recreation is clearly popular, with *bushwalking* having a 98% CIF score (Table 6.12). *Fishing* with a score of 65% CIF was just slightly more favoured than *amorous assignations* with a score 63% CIF. The recreation items not favoured, such as *protest sites*, *rally driving*, and *paint balling* (Table 6.12), have very intrusive characteristics that are not consistent with the strongly supported aesthetic values of this survey community such as *beauty* and *scenery* (Table 6.8). The same reason may explain why *picnicking* was more strongly favoured than *picnic spots* (Table 6.12). Picnicking is associated with a single group in an undeveloped area, and is much less intrusive than picnic spots, which are associated with many groups in designated sites with developed

facilities. Altogether, the survey indicated that recreation is viewed upon favourably, but should be supervised carefully.

Table 6.12: Selected recreation value items.

Item	Mean*	CIF%
Bushwalking	4.6	98%
Nature study	4.5	95%
Bird watching	4.4	90%
Picnicking	4.0	90%
Picnic spots	3.9	74%
Fishing	3.6	65%
Amorous assignations	3.9	63%
Commercial tourism	3.2	52%
Protest sites	2.9	39%
Rally driving	1.9	16%
Paint balling	1.8	10%

* Five point scale from strongly against (1) to strongly in favour (5). N = 69

Trails, tracks and roads responses provide an interesting study of consistency of response declining with degree of perceived intrusion and an indication of preference for less disturbance of the forest (all three kinds of access - trails, tracks, roads) (Table 6.13) compared to the more substantial clearing associated with *utility corridors* (8%: RUV, Table 6.7). The support for *trails* was very slightly greater than for *tracks* and they are both much more strongly supported than *roads*. *Trails* can be considered slightly less intrusive than *tracks* and they in turn are much less intrusive than *roads* (Table 6.13). This was consistent with the clear preference by the participants in the questionnaire for non-intrusive values associated with forests.

Table 6.13: Value items related to trails, tracks, and roads.

Item	Mean*	CIF%
Trails	3.8	87%
Tracks	3.7	87%
Roads (things associated with forests)	3.1	48%
Roads (access in or through forests)	3.0	48%

* Five point scale from strongly against (1) to strongly in favour (5). N = 69

6.3.3 Conclusions from the Questionnaire Component of the Survey

This part of the survey produced a comprehensive list of what the participants want from public native forests. The strongly in favour response to getting rid of feral animals indicated a wish to maintain original forest qualities including the fauna and flora. The strong response against the dumping of rubbish, especially but not only, exhibited by indigenous participants, indicated a wish for the forest not to be desecrated and suggested a spiritual ‘don’t spoil these sacrosanct areas’ component in contemporary community attitudes towards forests. The support for aesthetic values of the forest such as *beauty*, *scenery*, and *tranquillity* was very clear. The fact that *harvesting old growth forests* and *logging* are not favoured was consistent with the change in community values that began about 40 years ago.

The response to commercial tourism sat in the middle indicating that commercial tourism was perceived as not being as harmful to the forest. The surprise was the relatively favourable response (79%) to *prescribed burning*, which has for some time been a controversial practice, not generally supported by some sectors of the conservation movement. It appeared from this survey that there may not be as much opposition to prescribed burning as the conservation movement and the press would suggest, although, as indicated above, this survey was not designed to represent broad community values, but rather to identify a potential list of such values.

The questionnaire component of the survey provided an indication of how strongly supportive or opposed the participants were to the 176 items presented to them. The additional 85 value items that the participants suggested as being associated with forests confirmed the generally non-commercial values that this community had of public forests (Appendix 3). These additional 85 values consisted mainly of ones dealing with the intrinsic values of forests, a few dealing with anti-social behaviour, and some dealing with aboriginal concern for native forests (Appendix 3). The 21 additional value items relating to resource use varied from minor uses such as medicinal plants, seeds and fallen wood to more substantial uses such as beekeeping, log trucks and survival of forest industries (Appendix 3).

6.4 Concluding Discussion of the Results from the Survey

The results from this survey gave an indication of the present day attitudes towards native forests of the 69 participants who took part. The number who took part was too small to say with confidence that the results show conclusively what the full range of present day attitudes of the community of Perth and South West Western Australia are towards public forests. Nonetheless, the results seemed consistent with one's general impressions and it would not be surprising if a much larger survey produced similar results, considering the wide range of backgrounds and ages, the nearly equal representation of females and males and the inclusion of young people and indigenous people among the 69 participants. Comparisons of the results from this study with those conducted previously and elsewhere have been provided previously, in section 6.3.2.

The responses indicate concern for the forest itself, its naturalness and its ability to provide a peaceful ambience in contrast to the perceived chaos of urban life, and the perceived destructiveness of using the forest for commercial purposes. The interview component provided a good introduction for the participants to begin thinking about forests so that the responses to the questionnaire component that followed immediately afterwards represented their considered attitudes. The questionnaire component revealed the degree of support for each of the 176 items and this kind of survey based on many more participants could provide a useful guide for assessments informing forest policy development. The approach is potentially applicable worldwide, but each forest region should have a customised comprehensive list of value items. The survey responses also suggested where certain value items were not well supported, indicating where attention, refinement, and potentially education programs to make the current forest management practices more transparent for the public are needed.

This kind of survey would also need to be repeated whenever it appears that attitudes have changed or at least repeated at regular intervals (e.g., every decade) in order to maintain credibility and to detect any emerging trends that may require a change in what is measured and assessed in forests. Furthermore, just because an item is supported in a survey does not mean it should be automatically included in forest policy. All of the values identified in any survey, whether supported or not supported, by people well informed or ill informed about forests, should only be accepted as part of forest policy

after first being scrutinized to ensure that they are environmentally sound, socially acceptable, and economically viable. Such scrutiny will ensure that politically motivated public opinion will not replace best science. It could also highlight yet another need for an information and education program concerning relevant items.

The responses showed a strong preference for the non-economic values of forests - the tranquillity, the aesthetic appeal, the opportunity to relax and unwind. There are two public perceptions underpinning this preference. One is that there has been enough clearing of forests for farms in WA so that the forest that remains is precious. In this perception, logging and regeneration of the forest causes such a change that it is a transformation almost equivalent to clearing for farms. The change from a forest of mainly large trees to one with young trees growing on their way to maturity is too big a change for many people to accept. The other perception is that present day city and urban life has a great deal of chaos associated with it - job security, financial security, health, housing and other costs, are some of the pressures of present day living. In pleasant contrast to this, the existence and sanctity of an untouched forest presents a perception that 'all is right with the world'. Any changes to the forest would only be perceived as adding an adverse level of pressure to a lifestyle that is already felt as having quite enough pressure.

This study also enabled the usefulness of a questionnaire based on a comprehensive list of items expressed in everyday language and covering community expectations regarding public forests to be considered. Collectively, the items capture the extent and complexity of societal expectations regarding public forests in South West Western Australia in the first decade of the 21st century. They provide a readily accessible overview of societal concerns and expectations that can be used as one of the essential sets of social data informing forest planning and policy development.

Several opportunities for future research, building on the approach taken in this study and acknowledging its limitations, are evident. To progress to widespread use of a mail- or web-based questionnaire, a reduction in the number of items is essential. This could be achieved by a larger survey than the one conducted for this study, accompanied by factor analyses to reduce the number of items for use in subsequent surveys. Revision of the items to produce variables amenable to quantitative measurement (Lantz, 2008) is another potential development. Additionally to investigating expectations, Tindall

(2003) and Ford et al. (2009) recommended investigating the underlying beliefs and assumptions of the participants.

How people visualise the forest greatly affects their responses to its management (Williams and Cary, 2002). As such, the qualitative parts of this study could be further improved by providing simulations of different forest scenes and using these as part of the interview process. In this way, how respondents perceive forest management (e.g. perceptions of harvesting versus clearing, expectations regarding 5 year old regeneration) as well as how their expectations are associated with such management could be obtained.

Chapter 7 Forestry at a Crossroad

The history of Australian forestry has always contained tensions, contradictions and paradoxes that it has faced as best it could by adapting to, resisting or being overcome by changes as they arose (Dargavel, 2005, p. 42).

This has been an account of the assessment and management of forest values, and the factors that have shaped those values in the Western Australian South West. 'Value' is entirely a concept of human construction, whether it reflects the wealth aspects of commercial application or the perceived conservation and intrinsic values of preservation. All values are those that humans ascribe to forest preservation and use, whether these values are considered ephemeral or sustainable.

The five phases associated with the history of exploitation of the New World by Botkin (1995) are closely reflected in this history of forest exploitation and forestry practice in these Western Australian forests, namely (i) discovery, (ii) intense exploitation, (iii) awakening conservationism, (iv) environmentalism, and (v) an eventual synthesis between humans and their new environment (becoming 'native' to a place). This is associated in the current age with a number of trends in science, management, values and metaphysics (Perley, 2003).

These phases are also reflected in forest value attribution. Initially, forest management was presumed to be superfluous, with the forests representing little more than an obstruction to farming and settlement during which time the timber industry was only a by-product of clearing, and the timber itself not recognised or accredited. A second phase enabled by mechanisation and trade opportunities saw forests become a valuable commercial resource, with significant economic multipliers throughout the young settlement. This phase was initially one of intense and unsustainable exploitation. Valuing forests at that time, was understood as a technical matter, relying on increasingly sophisticated analyses and survey technologies to estimate timber volumes and regeneration rates and was focused on the sustainability of the timber industry. To undertake the management of forests to ensure sustainability of the industry required professional foresters and inventory that *inter alia* could provide reliable data for policy

and regulation. This tangible and relatively uncomplicated environment prevailed in Western Australia until the 1960s, when fundamental changes in social values ushered in the third phase identified by Botkin (1995).

This third phase saw a separation of social values (including biodiversity and recreational values) from commercial values - these two value sets had hitherto been aligned. The third phase was quickly followed by the rise of environmentalism, Botkin's (1995) fourth phase. This was accompanied by an intensified divergence between social and commercial values, where forest management shifted to a multi-use philosophy of allocated activities, which in turn faced growing conflict associated with different social values within society. The cultivation and emergence of social values separate from commercial interests in Australia had support from the highest ranks in the community, including the Governor General Sir B.C. Munro Ferguson as the first President of the Australian Forests League, Sir John Forrest who was the Western Australian representative on the League in 1914, Sir William Ellison-Macartney (Governor General 1917), Sir Garfield Barwick (Chief Justice as the first President of the Australian Conservation Foundation 1966) and also Sir Paul Hasluck (Governor General 1970).

It was the divergence between the social and commercial values of forests that placed forestry at a crossroad (Perley, 2003, p. 16):

The forestry profession faces a crossroads. Professions have always been about technical as well as ethical standards. Those standards were once about maintaining a sufficient quality and quantity of forest goods and services ... Then it was about standards of 'sustainable yield' and wise use so that future generations could derive as much benefit as the present generation claims. The current dichotomy of preserves and commerce marginalises culture, with doubt about whether such a segregation will meet any long-term objective. The current international trends suggest that integrating people and culture into forests will be ever more important. The forestry profession can either embrace it ahead of the public, or reject it along with the preservation and hard resourcist interests.

Regardless of the degree to which an integration or segregation prevails, the management environment has become significantly more complex.

The fifth phase of Botkin's (1995) was adopted by Perley (2003) as the challenge for forestry - that of a synthesis between culture and nature. Such a phase is not clearly discernible in Western Australia, although the Regional Forest Agreement process suggests its nascence. These authors are not alone in this perception of the challenge to forestry. The very idea of managing forests for 'less tangible' social values held by the public, such as intrinsic, aesthetic and spiritual values, is related to recent ideas about 'sustainable forest management', which present a challenge to the 'multiple use' approach which has guided many forestry professionals in recent decades (Lane and McDonald, 2002). It also "*...raises questions about the role of forest professionals in processes that aim to reflect broader social values in forest management*" (Ford, 2013, p. 47).

Similar sentiments, challenging the role of foresters, have been expressed by Brack (2010), Petheram et al. (2004), Bengston (1994), O'Brien (2003), O'Neill and Spash (2000), Dargavel (2009), Endter-Wada et al. (1998), and Levins and Lewontin (1985). Although other scholars might have overlooked this intrusion of social values and social sciences into the traditional forestry realm of science (e.g., Grumbine, 1997; Abbott and Christensen, 1994; 1996; Turner, 2011 and Endter-Wada et al., 1998), it is evident that changes are imminent and will happen.

7.1 Re-inventing the Measures and Assessment of Value

Inventory in the conventional sense that applied for 130 years after settlement was very largely concerned with commercial value, much of which was the value assigned by external populations in the UK and elsewhere, manifested as market demand. Management objectives aligned with the need to protect these considerable commercial values and required data relevant to this imperative. Regulation and expertise were applied to ensure intergenerational equity, industry stability, and to address the loss of commercial value in the conflict with agricultural clearance practices.

7.1.1 Sources of Data

Forest inventories reflecting these objectives were undertaken with increasing sophistication and coverage, based firmly in the natural sciences to determine the sustainability of the rates of cut, as well as the threats to sustainability. For much of this time, forest management was undertaken more through legislation than scientific management, with the Forests Department having a minimal staff such that even thirty years after its creation there were reports noting a lack of forest information (Royal Commission, 1951).

Table 7.1 summarises the evolution of inventory and the sources of information that have been used in forest management in Western Australia. Inventory techniques had been evolving at least since the eighteenth century in other parts of the world, so that the techniques were available and well understood by the time that the need arose for their application in Western Australia.

From the 1960s in Western Australia, as elsewhere, social values moved to the fore, and needed to be reconciled with the existing management regime for commercial values. Unlike commercial values, it is impossible to measure or understand social values as an accounting construct (Dargavel, 2005; Ford, 2013; O'Neill and Spash, 2000). Instead, these values can only be assessed or identified from non-market sources and through direct consultation and negotiation.

Table 7.1: Window into forest inventory in Western Australia (schema adopted from Brack 1997)

Sources of information and collection techniques	Year	Requirements and technologies affecting forest inventory
<i>Ad hoc</i> geographic reviews regarding timber and waterways	1825	Logging required water transport, otherwise ringbark and burn for agricultural clearance.
Unsubstantiated impressions, <i>ad hoc</i> ocular estimates	1850	Opportunistic logging for domestic requirements of a small population. Minor investments required for pitsaws.
Systematic ocular estimates by experienced foresters (Von Mueller, 1879)	1875	Introduction of industrial-scale technology in extraction requires capital-raising and better inventory.
Revised ocular estimates mapped by experienced foresters (Brown, 1899) Royal Commission estimates	1900	Emerging demand for large area information.
Land classification scheme surveys Forest Act statutory requirements Strip line surveys	1925	Forests Department required to respond to sustainability policy and management requirements.
Army aerial photographs	1950	Increasing demand for management information regarding bushfires and cut volumes, and aerial photography adopted.
Computers and GIS become readily available	1975	Social values diverge from commerciality and become political mainstream.
Multi-phase, multi-stage surveys Ecological sampling, Social survey techniques	2000	Increasing concerns for biodiversity, ecological sustainability and social values.

These shifts in values revealed within society through a variety of modes, posed questions as to whether forest inventories that focussed on the natural sciences are incomplete and need to be integrated with assessment methodologies and accompanying techniques from the social sciences. Some have considered that this was indeed the case (Endter-Wada et al., 1998, p. 891):

Most of the ecosystem management literature assumes that scientific understanding of ecosystems is solely the purview of natural scientists...this view is incomplete. The social science aspect of ecosystem management has two distinct components: one that concerns greater public involvement in the ecosystem management decision-making process, and one that concerns integrating social considerations into the science of understanding ecosystems. ... Objective social science analysis should be included on an equal basis with ecological science inquiry and with data from public involvement.

7.1.2 Analytical Techniques and Capacity Development

The incorporation of social values into forest inventory and assessment, science and policy is today a core issue facing forestry: “*It is important generally that either the concept of ‘science’ is expanded to include such (i.e., social) values and a range of methods and data types, or that some other way to formally acknowledge and include such values be found*” (Ford, 2013, p. 46). The paradigms for forestry are (i) preferences towards quantification of values adopting a common metric such as willingness to pay and quantification of preferences; (ii) metric-neutral analytical methods, which do not require common measures of value but can undertake prioritisation between values through techniques such as multi-criteria analysis; and (iii) stakeholder negotiation, which for some is based on a lack of legitimacy of the first two paradigms and may even see those as threats. None of these paradigms are incompatible with one another.

These aforementioned paradigms include an array of requirements, such as how to recognise what the values are, and how to incorporate these into policy and decision-making. O’Neill and Spash (2000, p. 3) have explored what these options are for environmental policy-making generally including:

- *Adopting a variety of different modes of identifying and articulating individuals' values;*
- *Incorporating into policy-making, constraints on the use of efficiency criteria-meaning that consultation and policy development should not be handicapped by, for example, regulated time constraints;*
- *Use of institutions such as citizens' juries, deliberative polling, surveys and collaborative conferences that promote public participation and debate about forest values;*
- *Incorporation of multi-criteria tools with deliberative approaches;*
- *Incorporating justice principles into the deliberative and policy-making processes; and*
- *Developing the capacity of agencies and decision-making institutions to incorporate new deliberative approaches.*

In relation to this, Ender-Wada et al. (1998, p. 901) focused especially on the aspect of capacity development of professionals and institutions:

In the short term, this challenge might best be addressed through implementation of intensive interdisciplinary training programs designed to give practicing resource management professionals a basic, foundation-level exposure to a broad array of disciplinary learning applicable to ecosystem management.... Over the longer term, there is a need for significant redirection of academic training programs away from traditional disciplinary specialization and toward broad-based interdisciplinary learning that will allow social and natural scientists to more effectively communicate with one another in the pursuit of integrated ecosystem analyses.

Ender-Wada et al. (1998) also consider that forestry needs to become multidisciplinary and that simply incorporating social value data into inventory will not be adequate because of the democracy issues discussed previously, and the survey design and application biases that are almost inevitable. They further state (Ender-Wada et al., 1998, p. 900): “*due to its uncontrolled partiality, public involvement processes are usually inadequate sources of data for describing the richness and breadth of human responses*” implying that social sciences and accompanying assessment methodologies

need to be part of the policy-making discipline as well as a source of data. Similarly, several authors have recognised a requirement for the democratisation or decentralisation of ownership of planning, data, consultation, and value negotiations (Brown, 2002; Petheram et al., 2004; Ford, 2013), which also would seem to require a role-change for professional foresters.

The what extent forestry becomes more multi-disciplinary (Endter-Wada et al., 1998) or foresters acquire broader skill sets (Ford, 2013; Brack, 2010) is to be seen, but either way, it seems certain that there will be ongoing refinement of tools to assess social values, just as the past has seen physical inventory techniques become increasingly sophisticated. These tools can form part of the policy development and decision framework, which, if well targeted and sensitive to social expectations, might be expected to minimize value conflicts. The survey approach demonstrated in Chapter 6 offers potential to sensitize policy in this way.

7.1.3 Informed Negotiations

Where policy refinement cannot adequately address value conflicts, then stakeholder negotiations would seem to represent the next step. Data collections including inventories should continue to provide input into those negotiations. There is a substantial literature on aspects of the negotiation process for ecology and social values of forests (e.g., Brown, 2002; Trainor, 2006; Ford, 2013; Lane, 2004; Petheram et al., 2004). Lessons regarding the crafting of negotiation processes are especially illustrative of the difficulties and risks involved, such that foresters could embrace a constructive lead role, creating, as far as possible, the conditions whereby negotiations are constructively informed (Trainor, 2006; Brueckner et al., 2006; Gross, 2008; Petheram et al., 2004). Negotiations also have a better chance of success when there are well-informed social networks in place particularly to provide transparency in consultation, policy development, and decision-making (O'Neill and Spash, 2000; Hadari, 1988; Petheram et al., 2004; Ford, 2013; Brueckner et al., 2006). A sharing of power between parties is also critical (Brown, 2002; Trainor, 2006). Such sharing is both a consequence of and a condition for collaborative participatory processes (Petheram et al., 2004; Brueckner et al., 2006; Baber and Bartlett, 2005; Ford, 2013; Brown et al., 1995; Innes and Booher, 2004; Trainor, 2006; Gutmann and Thompson, 2002; Parkins and Mitchell,

2003). Because of intrinsic difficulties, a collaborative approach with an equitable balance of power has not been widely explored, and a preference has been instead for the application of justice/fairness principles (Innes and Booher, 2004; Gross, 2008; Menzel et al., 2012; MacCoun, 2005; Syme et al., 2000; Skitka et al., 2003). These studies found that for forest and ecological negotiations, an area of significant complexity and difficulty has been the scoping of negotiation criteria themselves. In response, a number of commentators have proposed negotiations and multi-criteria analyses to address this issue prior to further negotiations on resource use (Trainor, 2006; Leeuwis, 2004; Lane, 2004; Brueckner et al., 2006; Ford, 2013; Brown, 2002; Lockwood, 1999; Bryan et al., 2010). This challenge has been, in part, the focus of chapter 6, which offers a survey instrument as a guidance tool that can assist in this complex process.

7.2 Conclusions

This history has been one of learning by all stakeholders, from ignorance about Australian timber and forests, to scientific management and professionalization, commercial excess, social, cultural and political turmoil, and eventually the emergence, elevation and preservation of social values in addition to commerciality. The influence of social values has transformed the management and policy framework for the forests from one that was firmly anchored within the natural sciences to one that is increasingly incorporating public opinions and drawing from social science research.

The forests have been a core part of the broader environmental movements that have involved conflict and the development of new models and instruments of negotiation that go beyond the natural sciences to include uniquely human attributes that have resisted quantification but have demanded prioritisation. This study has documented the emergence of commercial forest values and then social forest values, identified the conflict between and within these value-sets, and developed an instrument for identifying, assessing, and addressing some of these conflict areas. To be fully compatible with public thinking and expectations, foresters must continue to acquire and develop insights from community involvement, both as a source of data, and for the guidance of negotiation and resolution of conflicting goals.

APPENDIX 1. Interview Questionnaire

In this interview I would like to learn about your thoughts, your experiences and your expectations about our South West forests.

There are no right or wrong answers. What you think and feel about forests is what is important. You are free to say what you want about forests in this interview.

I would like you to focus on the forests of the South West of Western Australia, but your thoughts about other forests that you have visited or heard about are also of interest to me.

Question 1. What do you think about when you see or hear the word “forest”?

Importance of forests

Question 2. Are forests important to you or not and why do you think that way about forests?

Experience of forests

Question 3. Could you please tell me about any visits you have had to the forests in our south-west? When? Where? What did you do in the forest? What did you think about the forest? What did you think about the visit?

Feelings about forests [if not covered by Q1 or Q2]

Question 4. What do you like about forests?

Question 5. What do you dislike about forests?

Hypothetical situations

Question 6. Now I would like you to consider a hypothetical situation.

Supposing you revisited one of your favourite spots in the forest after 5 years, how would you feel if: (6A) it had been logged and there was now healthy natural regrowth 5 metres tall; or (6B) it had been cleared and there was now a farm there?

Knowledge of forests

Question 7. How much do you consider that you know about forests? Choose between “nothing at all”, “very little”, “a little”, “quite a bit”, and “a great deal”.

Management of forests

Question 8. Do you consider that forests can be left alone to look after themselves, or do they need to be managed? Why do you think that?

Forests-Wants and Needs

Question 9. What would you *like* forests to provide for you?

(You can name as many things as you like. Can you please put a priority on these.)

Question 10. What things (values) associated with forests must you have-you cannot do without them?

Question 11. What things (values) associated with forests do you not want-you can do without them?

Question 12. How do you suggest we could find out what the community wants from forests?

Demographics

These details retain your privacy. Your individual answers are not known. Your answers are grouped with others to give a general idea of what people want from forests.

Question 13. What age group do you fit into? 18-25; 26-30; 31-50; 51-60; 61+

Question 14. What is your postcode?

Question 15. Which of the following groups do you feel fits your situation most closely? Academic, citizen, conservationist, forester, indigenous person, journalist, politician, primary producer, professional, public servant, timber industry, tourist, other (please specify)

If you feel you fit into more than one group please put 1 for the closest fit, 2 for the next closest, 3 for the next and so on.

If you feel that no category fits your situation, please add more categories and number them in order of importance.

Thank you for your time and interest in being part of this research program.

APPENDIX 2. Original format of the questionnaire with the 176 value items grouped into seven categories

<i>ACTIVITIES</i>	Strongly	Against	Neutral	In favour	Strongly
<i>IN FORESTS</i>	against				in favour
4 wheel driving					
accommodation					
admiring the wild flowers					
admiring large or tall trees					
amorous assignations					
bird watching					
boardwalks					
bush walking					
camping					
canoeing					
caveing					
collecting things					
commercial tourism					
cultural experience					
defence force training					
discovery centres					
driving through the forest					
dumping dead bodies					
dumping rubbish					
dumping stolen cars					
ecosystem based forestry					
ecotourism					
fire management					
fire suppression					
fishing					
forest management					
hiking					
horse riding					
hunting					
logging					
long distance walking					
marroning					
mining					
mountain bike riding					
nature study					
orienteering					
paint balling					
painting					
photography					
picnicking					
prescribed burning					
protest sites					

rally driving					
regenerating the forest					
rehabilitating the forest					
rock climbing					
rogaining					
sight seeing					
swimming					
trail bike riding					
visiting visitor centres					
walking					
<i>Can you add any more?</i>					

<i>PRODUCTS</i>	1	2	3	4	5
<i>FROM FORESTS</i>	Strongly	Against	Neutral	In favour	Strongly
	against				in favour
bush tucker					
clean water					
fauna					
fish					
flora					
fungi					
gravel					
honey					
marron					
medicinal values					
minerals					
mushrooms					
native animals					
old growth forests					
products from trees					
renewable resources					
wildflowers					
<i>Can you add any more?</i>					

<i>THINGS ASSOCIATED WITH FORESTS</i>	1	2	3	4	5
	Strongly against	Against	Neutral	In favour	Strongly in favour
algae					
biodiversity					
birds					
bushfires					
carbon sequestration					
climate amelioration					
coolness					
ecosystems					
grazing					
habitat for living things(native)					
insects					
job creation					
landscape vistas					
leaf litter					
lichen					
native plants					
oxygen					
picnic spots					
prescribed (controlled) burning					
regeneration					
research					
roads					
scenery					
shade					
shelter					
smoke from forest fires					
snakes					
soil protection					
special places					
utility corridors					
visitor centres					
wetlands					
white ants					
wind break					
<i>Can you add any more?</i>					

<i>VALUES</i>	1	2	3	4	5
<i>OF FORESTS</i>	Strongly	Against	Neutral	In favour	Strongly
	against				in favour
aesthetics					
beauty					
catchment protection					
communion with nature					
conservation					
education					
emotional attachment					
employment					
healthy ecosystems					
heritage					
information					
inspiration					
maintaining biodiversity					
preservation of culture					
'recharging the batteries'					
recreation					
reduction of noise					
self reliance					
solitude					
spirituality					
tranquility					
views					
wilderness experience					
wilderness values					
wildlife conservation					
<i>Can you add any more?</i>					

<i>ACCESS</i>	1	2	3	4	5
<i>in or through</i>	Strongly	Against	Neutral	In favour	Strongly
<i>FORESTS</i>	against				in favour
airstrips for fire fighting					
bridges					
railways					
roads					
tracks					
trails					
utility corridors-bauxite					
utility corridors-electricity					
utility corridors-gas					
utility corridors-irrigation					
utility corridors-water supply					
<i>Can you add any more?</i>					

PRODUCTS	1	2	3	4	5
FROM TREES	Strongly	Against	Neutral	In favour	Strongly
	against				in favour
antiseptics					
bark					
charcoal					
chipwood					
christmas trees					
craft wood					
eucalyptus oil					
firewood					
furniture wood					
gum					
gum nuts					
leaves					
mining timber					
nesting sites					
paper					
perfumes					
piles					
poles					
protesters' platforms					
pulpwood					
rafters					
railway sleepers					
royal show log-chop logs					
sandalwood oil					
sawlogs					
scantling					
shingles					
timber products					
tannin					
veneer					
wood sculptures					
<i>Can you add any more?</i>					

<i>FERALS</i>	1	2	3	4	5
<i>IN FORESTS</i>	Strongly	Against	Neutral	In favour	Strongly
	against				in favour
<i>How do you feel about getting rid of these?</i>					
feral cats					
feral pigs					
foxes					
pest animals					
rabbits					
weeds					
<i>Can you add any more?</i>					

APPENDIX 3. Additional value items as identified by the survey participants

Natural Environment Values (NEV)

Aboriginal smoking ceremonies	Sacred places of Nyungah
Places for women's business	Birds
Places for men's business	Sounds of the forest
Aboriginal men's dreaming trails	Wind
Aboriginal ritual ceremonies	Climate change
Aboriginal burial sites	World preservation
Aboriginal cultural men's sites	Sounds of the forest
Aboriginal cultural women's sites	March flies
Aboriginal meeting places	Forests for eternity

Aesthetic Values (AEV)

Sanctuary	Maintaining sanity
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Managing The Forest (MTF)⁺

Pesticides	Signs to indicate don't enter
Spikes in trees	Blackberries
Tyres	People
Dieback disease	Murdering people
Shooting feral animals	Blackberries
Survival of forest communities	Reducing salinity
Dumping dead animals	Destructive humans
Litter (rubbish)	Domestic cats and dogs
Goats	Community awareness
Growing marihuana	Community information
Jarrah dieback	

Recreation Values (RECV)

Motor bikes	Writing poetry
Abseiling	Walking with one close friend
Balloonng	Signs
House boats	Signs against plant type
Star gazing	Signs with friendly explanations
4 wheel driving off tracks	Target shooting
Spot lighting	Bullock wagon races
Tree climbing	Cooee contests
Open camp fires	Singing
Toilets	Tree top walks
Composing music	Visiting after logging
Dreaming	

Resource Use Values (RUV)

Log trucks	Mineral exploration
Portable sawmills	Petroleum exploration
Kangaroos	Bauxite miners
Seeds	Burls
Survival of forest industries	Mineral exploration
Insect collecting	Fallen trees
Birds eggs	Fallen wood
Beekeeping	Introduced bees
Dams	Medicinal plants
Museum to display forest products	Research into medicinal values
Floor boards	

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