



An Australian Government Initiative



Farm Forestry and Landscape Architecture

A Feasibility Study

A report for
the RIRDC/Land & Water
Australia/FWPRDC/MDBC
Joint Venture Agroforestry
Program

by John Winchcombe and
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December 2004

RIRDC Publication No 04/187
RIRDC Project No UWA-68A

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ISBN 1 74151 096 1
ISSN 1440-6845

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Published in December 2004

Printed on environmentally friendly paper by Canprint

Foreword

Our unique Australian rural landscapes are confronted by constant change, economically, socially and biophysically. Rising water-tables, erosion and salinity pose significant threats to the sustainability of these landscapes. However farm forestry, in its many forms, has a significant role to play in arresting the loss of productive agricultural lands from these causes.

Farm forestry developments, including broadscale plantations, aimed at ameliorating environmental degradation can have significant impacts on the character, visual amenity and aesthetic values of landscapes where it is practised. Landscape architecture, as a natural and cultural resource planning discipline offers an opportunity to design integrated agroforestry and farm forestry systems and management tools which capitalise on the management of the visual landscape, its character and associated values.

Experience shows that farmers are continually attempting new ways of managing their farms with significant effort being applied to achieve more with less. These attempts are often extremely focussed and often based on insufficient decision support, and applied at inappropriate points in the management process. Consequently, there is a need to investigate creative planning and design opportunities and constraints to develop decision support tools where resource and value conflict management can be exercised. Existing farm forestry planning and design visualisation tools that display and evaluate alternative farm forestry design schemes need to interface with other existing tools used to manage environmental and economic management paradigms.

This project investigates the feasibility of integration of visual landscape management with existing Farm Forestry Decision Support Tools, and the potential for creating a Farm Forestry Visual Landscape Management Design Tool. It is proposed that such a creative conflict management tool will give rise to a positive impact on the supply and demand for product; on the enhanced natural resource base, and on the 'spill-over' benefits flowing within and beyond the specific agroforestry enterprises and wider industry.

This project was funded by the Joint Venture Agroforestry Program, which is supported by RIRDC, Land & Water Australia, FWPRDC and the Murray-Darling Basin Commission. The R&D Corporations are funded principally by the Australian Government. Both State and Australian Governments contribute funds to the MDBC.

This report, a new addition to RIRDC's diverse range of over 1000 research publications, forms part of our Agroforestry and Farm Forestry R&D program, which aims to integrate sustainable and productive agroforestry within Australian farming systems.

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About the Authors

Over the past ten years, John Winchcombe and Grant Revell have worked together on a range of farm forestry design and research projects in rural landscapes across the south-west of Western Australia. As educators in rural design theory and practice they have collaboratively taught Applied Ecology and Environment and Cultural Development units to students of Landscape Architecture and Natural Resource Management at the University of Western Australia. Their teachings have involved local farming communities who have actively developed reciprocal learning pedagogies between themselves and the students. Winchcombe and Revell continue to develop and refine opportunities for the integration of design processes with natural resource management, including initiatives for revegetation and farm forestry of rural lands.

John Winchcombe has been involved in the development of CALM WA's Bluegum and Pine share-farming initiatives across the South-west of Western Australia. In 1999, he formed a free-lance consulting company focussing on providing natural resource planning and design, training and value adding services to farmers in Western Australia.

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Acknowledgements

The authors wish to extend their appreciation to Dr Amir Abadi, Mr John Bartle, Mr Don Cooper, Dr Richard Harper, Dr Ted Lefroy, Professor Bob Gilkes, Mr Kim Brooksbank, Mr Tim Osborne, Dr Helen Cleugh, Dr Richard Stirzaker, Dr Peter Carberry, Dr Philip Norman, Mr Jason Alexander, and staff of the Joint Venture Agroforestry Program for their collaboration on this project.

Abbreviations

AFFFM	Australian Farm Forestry Financial Model. Used in the text to indicate Harrison, S. and Herbohn, J. (2002). Draft. <i>A Whole-Farm and Regional Agroforestry Decision –Support System</i> . RIRDC Report.
AFFSS	Australian Farm Forestry Site Selection Manual.
APSIM	Agricultural Production Simulator. Used in the text to indicate Carberry, P. Huth, N. Poulton, P and Brennan, L. (2002). Draft. <i>Quantifying the trade-off between tree and crop productivity on farms</i> .
CAL-2A	Leonard, et al. (2000). <i>Adapting Computer Software To Evaluate the Visual Impacts of Farm Forestry Layouts</i> . RIRDC project No. CAL-2A.
FFDSTM	Farm Forestry Decision Support Tools and Models.
FFVLDT	Farm Forestry Visual Landscape Design Tool.
JVAP	Joint Venture Agroforestry Program.
MODSS	Multiple Objective Decision Support System, intrinsic to Harrison, S. and Herbohn, J. (2002). Draft. <i>A Whole-Farm and Regional Agro-forestry Decision –Support System</i> . RIRDC Report.
TFS	Trees for Shelter. Cleugh, H. (2003). <i>Trees for Shelter</i> . Joint Venture Agroforestry Program, RIRDC Publication No 02/059
TWS	Trees Water and Salt. Stirzaker, R. et al. (2002). <i>Trees Water and Salt: An Australian guide to using trees for healthy catchments and productive farms</i> . Joint Venture Agro-forestry Program. RIRDC publication No. 01/086.
VLM	Visual Landscape Management.
VLMC	Visual Landscape Management Criteria.

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Executive Summary

Advances in decision support tool capabilities, improvements in the availability of tree growth data, species selection and silvicultural management, and better integration of farm forestry with other benefits, could potentially see large areas of land being re-afforested – with significant social, economic and environmental impacts in rural landscapes. To manage this impact, better designs and layouts are needed that demonstrate not only a financial benefit from revegetation, but also integrated benefits in the farming landscape.

Management of the visual resource values of rural landscapes, including scenic quality, can help minimise adverse reafforestation impacts, while adding to the list of “other” benefits attributable to farm forestry and agroforestry developments at paddock, enterprise and regional scales.

Conflict with “visual landscape enhancement” arising from agroforestry and farm forestry establishment has had little or accidental opportunity for methodical resolution in the past. Some State forestry agencies have developed integrated visual landscape management policies and guidelines for pre-empting and ameliorating conflict when managing and developing forestry resources. Similarly, principles of landscape architectural planning and design, including managing scenic quality and visual landscape issues, have been applied to integrated farm forestry and natural resource management projects on a number of properties in the south west of Western Australia (Winchcombe, 1997, 1999, 2000b; Revell et al., 2000). It is from these projects and an interest in comprehensive integration of the multiple objectives of revegetation and farm forestry, while minimizing potential negative impacts, that this study has come about.

This report documents the findings of the Joint Venture Agroforestry Program project “*Farm Forestry and Landscape Architecture: A Feasibility Study*”. The prime aim of the project is to examine the feasibility of integrating the practices of Landscape Architectural Visual Landscape Management with other Farm Forestry Decision Support Tools and Models (FFDSTM) currently, or recently, under development. It is anticipated that outcomes from this project will be applied to existing agroforestry land management systems, including large-scale plantation and native forests as well as proposed agroforestry initiatives.

A range of Farm Forestry Decision Support Tools and Models were reviewed, and it was found that they could be separated into the following categories:

1. Models that could integrate Visual Landscape Management (VLM) providing techniques were available which allowed the visual resource to be valued, allowing analysis in economic models.
2. Models that could provide a platform for delivery of Visual Landscape Management modules.
3. Models which could assist in the development of Visual Landscape Management Criteria by spatially illustrating potential reafforestation layouts.
4. Models which could be used as a support tool to help generate real life visual landscape management plans and integrated visual landscape management.

Formal survey interviews with the key research personnel involved with the respective decision support models and research found that, either:

1. Their research was too far advanced to include the integration of Visual Landscape Management.
2. Visual Landscape Management was not part of their original study.
3. Visual Landscape Management could be integrated given further development.
4. Their research was a one-off and therefore not likely to be repeated, thereby avoiding any further opportunity for integrating Visual Landscape Management.
5. A Visual Landscape Management Design Guideline would be useful in informing an increasingly sophisticated agroforestry systems discussion.
6. Little is known of the processes involved in Visual Landscape Assessment, valuation or the development of management criteria and strategies and practices of landscape architecture.

However, this project has shown it is feasible to integrate Visual Landscape Management into the models and processes under review providing appropriate techniques are employed in defining VLM and their management. The level of sophistication built into this integration, and the usefulness of the result, is dependent upon the scale and intrinsic outcome of the model/process in question. Specifically, the management of the visual landscape in forested and environments proposed for reafforestation, including agroforestry, can be either complacent (disregard) or active (develop strategies to work with the visual resource). Active visual landscape management at the farm level can choose to maintain the integrity of visual landscape values, enhance those values or derive strategies that reduce some impacts while tolerating others.

The major finding of this research is that, while the integration of visual landscape management is feasible and perhaps warranted, further work is required to develop appropriate ways of valuing the visual resource, developing farm forestry visual landscape management guidelines suited to farm forestry, and developing three dimensional visualisation tools.

1. Introduction

Agroforestry, farm forestry, reforestation and vegetation management are systems of land-use, which aim to optimise the benefits of vegetation on farms. Potential benefits have been described in various publications, for example Abel et al. (1997), including:

- Financial returns
- Salinity and waterlogging control
- Soil conservation
- Shade and shelter for crops, pasture, livestock and water resources
- Fodder supplements
- Nature conservation and increased biodiversity
- Scenic quality enhancement
- Reduction in nutrient run-off

Potential negative impacts arising from the planting of vegetation include:

- Loss of productive agricultural land
- Time and labour costs
- Farm management impositions
- Changes to traditional landscape values
- Changes in ecological make-up of landscapes
- Introduction of potentially invasive species

The understanding, optimisation and integration of these benefits and minimisation of negative impacts is intrinsic to the Joint Venture Agroforestry Program's vision and guiding objective which is:

“A dynamic Australian agroforestry sector which is economically viable through its contribution to the sustainable production of agricultural and forests products, is managed to sustain land, water and biodiversity resources; and is designed to enhance landscapes valued by landholders at the regional and national level” (JVAP 1999).

A dynamic Australian agroforestry sector, when viewed in the context of ‘Plantations for Australia: The 2020 Vision’ (Commonwealth of Australia, 1998), which aims to treble the size of Australia's plantation estate by the year 2020, will have an industrial focus, be designed at large scales and have the potential to have significant impacts on social, biophysical and economic landscapes. Integrated processes of landscape architectural planning and design, including visual landscape management are seen as one way farm forestry decision making might consider the potentially negative impacts, while optimising the positive.

A range of decision support tools and research have been, respectively, developed and undertaken to assist the custodians of rural landscapes and their advisors to make informed choices on agroforestry systems, their management and layout. However, until this study, landscape and visual landscape management have received only brief consideration in the overall discussion on integrated farm forestry.

1.1 Study Aims and Objectives

The aims of this study are:

- 1) to investigate the feasibility of integrating the principles of landscape architectural planning and design, including visual landscape management, with existing and developing farm forestry decision support tools and research and,
- 2) to provide recommendations for that integration.

In this study the terms and professional practices of *landscape architecture* and *landscape planning* are used in the context of those landscapes operating in rural Australia with particular reference to the implications of farm forestry. This study defines *landscape* in visual terms only, the limitations of which will be discussed throughout this report.

The report is broken up into the following sections;

Section 1: *Introduction*

Study aims and objectives: sets out what the study aimed to achieve.

Project research methodology: covers the approach taken in this study.

Key terms: in which a range of terms used in the report are defined.

Subsequent chapters discuss:

Section 2: *Literature Review*

Landscape and Landscape Architecture: gives an overview of the application of landscape and visual landscape management in what is considered “best practise”.

Farm Forestry: considers the current state of play between farm forestry, landscape architecture and visual landscape management.

Section 3: *Farm Forestry Decision Support Tool Review*

Review methodology: sets out the process of investigation.

Tool description and analysis: describes the tools and analyses the opportunities and constraints for integration of visual landscape management.

Review summary: provides a summary of the opportunities and constraints for integration of visual landscape management.

Section 4: *Research implications and recommendations*

Provides a discussion on the design of an integrated farm forestry visual landscape management design tool. Future research opportunities are outlined

Section 5: *Project evaluation*

Notes some background observations the authors consider had a bearing on this research and its findings.

1.2 Project Methodology

The project research methodology (Figure 1.) uses systematic investigations that document the processes and outcomes of:

- Collating existing Farm Forestry Decision Support Tool and model data,
- Reviewing and describing the tools and models, including a discussion which analyses and identifies opportunities and constraints for the integration of visual landscape management and,
- The conceptual development of a integrated Farm Forestry Visual Landscape Design Tool.

Project Evaluation is included as part of this report

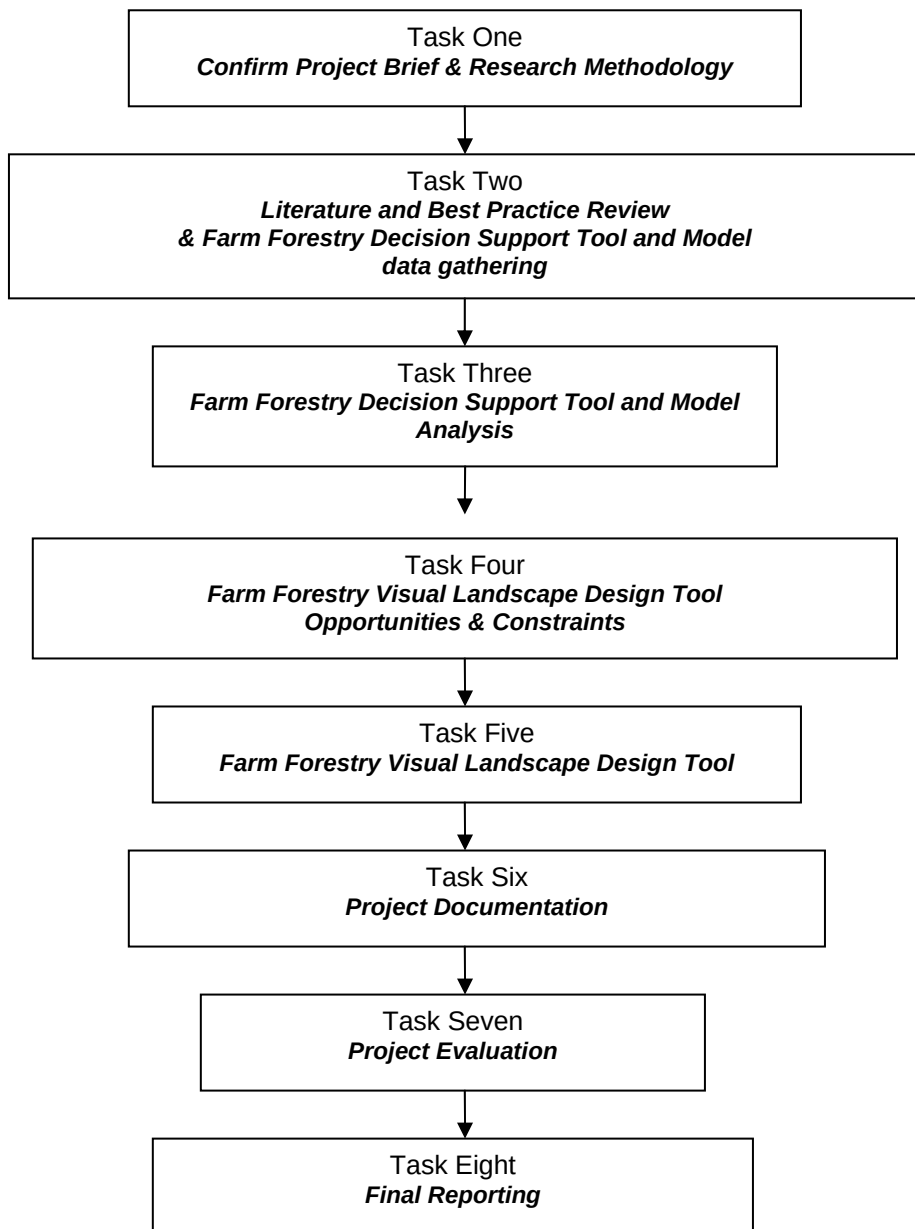


Figure 1. Project Research Methodology

1.3 Key Terms

Aesthetic Landscape Values are the experiential responses derived from a mosaic of elements of the environment. It includes natural and cultural attributes with visual and non-visual aspects such as sound, smell, sense of place, emotional response and all factors having a positive influence on human attitude (O'Brien and Ramsay, 1992).

Analysis is the process by which the landscape is broken down into components and understood in terms of its particular compositional elements and behaviours (Revell and Cleary, 1998).

Assessment is a process of synthesis. It is the expression of composite value based on the value of individual landscape components (Revell and Cleary, 1998).

Evaluation is the process where landscape assessment results are examined and used to make decisions about alternative landscape futures (Revell and Cleary, 1998).

Farm Forestry Decision Support Tools are those instruments that are used to assist people in making decisions about farm forestry.

Integrated Farm Forestry Visual Landscape Management Design Tool is a tool to assist people involved in visual landscape management, to integrate visual landscape issues with other farm forestry management tools.

Inventory refers to the identification and collection of landscape data. Inventory is without value judgements. (Revell and Cleary, 1998).

Landscape refers to a place or defined area of land exhibiting aesthetic, historic, scientific and social values (Stuart-Street and Revell, 1994).

Landscape Architecture is the development of a harmonious, sustainable and enriching fit between human systems and natural systems. Furthermore landscape architecture is art and science, both analysis and intervention (Riley, 1998).

Landscape Character is the combination of natural and cultural landscape characteristics which allow people to differentiate between one place and another.

Landscape Value is generally derived from a process of valuation and can be expressed numerically (Litton, 1979).

Participatory design typically involves a close working relationship between the designer, the client and other members of a community interested in the project at hand. Joint contributions are often made by all parties *throughout* the design process. It is very different from design *consultation* which often reinforces the 'designer' as the expert and ignores the design interests and talents of the land owner, manager and wider community. The educational and learning outcomes for all parties is often restricted in design consultation models.

Plug-in describes either a stand-alone facility which can be attached to an existing decision support tool or an integrated facility which is designed to analyse proposals against set criteria.

Scenic Quality is the relative visual character of a landscape, expressed as an overall visual impression or value held by society after perceiving a segment of land/water (Stuart-Street and Revell, 1994).

Sense of Place describes an holistic experience which defines a person's perception of place and their relationship with it.

Visual Landscape is that portion of the landscape falling within a person's view (Stuart-Street and Revell, 1994).

Visual Landscape Management is the act of managing the visual landscape.

Visual Absorption Capability is a rating of an area's ability to visually absorb or sustain change (Stuart-Street and Revell, 1994).

Visual Landscape Management Criteria are those criteria pertaining to the modification of the visual landscape. They can be used as a means to assess the implications of proposed actions or interventions on the visual landscape.

Visual Landscape Management Guidelines assist managers' design according to landscape management criteria.

2. Literature Review

2.1 Background

2.1.1 Landscape

Over recent years, *landscape* has become a generic term that can describe a set of broader environmental values such as political, economic, social, biophysical, hydro-geological etc. Correspondingly, *landscape* can be investigated and managed at various scales through the micro, macro, global, national, regional, district, local and paddock levels. For the purposes of this project, the term *Landscape* is defined as a visual aesthetic value pertaining to the following three main usages, in order of increasing participant interpretation:

1. A scene (as in a landscape painting);
2. An area which has a common pattern of biophysical features (as in landscape ecology); and
3. A reference to the interpretation and experience of the environment by people, which includes the particular landscape attributes of visual and non-visual overlays, including, light, sound, smell, color, spirituality and emotion, which contribute to “sense of place” and uniqueness (Kay and Alder, 1999).

2.1.2 Landscape Architecture

Landscape architecture involves an iterative process of inventory, analysis, assessment, valuation, definition of design opportunities and constraints and the actual conceptualisation, acts and outcomes of representing design. In terms of natural resource management and farm forestry, visual landscape management starts out by identifying and analysing the pertinent characteristics of the environment which define its particular sense of place. Values are then attached to these characteristics or combination of characteristics, either personally or collectively. These values combine attributes of scenic quality, landscape attractiveness, scenic beauty and aesthetic value. Through the integrated design process these social values can be conserved, preserved, enhanced or degraded through farm forestry related activities.

Once landscape character has been valued and mapped, visual landscape management criteria are developed to manage and prioritize these values. Visual landscape management guidelines can be developed to design and manage the landscape architectural outcomes.

Assisting in the development and application of visual landscape management guidelines is the process of visualisation. Currently, most visualisation of farm forestry is presented photographically in the literature or by visiting established farm forestry sites, however, the manipulation of still-photographs, drawings, drafting of two dimensional plans and the use of two and three dimensional computer graphics are all used as decision support tools for visual landscape management either directly or by default.

The visualisation or simulation process enables an assessment of the effect of proposals on previously identified landscape character and value, and allows modification to be made by adjusting the visual landscape management criteria, the visual landscape management guidelines and the actual design visualisations. Ideally, evaluations continue to be made throughout the implementation phases, with commensurate refinement of the knowledge and processes originally employed.

Principles of landscape architecture planning and design, including managing scenic quality and visual landscape issues, have been applied to integrated farm forestry and natural resource management projects on a number of properties in the south west of Western Australia. (Winchcombe, 1997; 1999; Revell 2000; Revell et al.,1999). These principles have also been applied to larger scale natural resource management and development projects across Australia (Cleary, 1999; Forestry Commission Tasmania, undated; Winchcombe, 2000a). However, visual landscape management and landscape architecture have yet to be applied rigorously and systematically to the analysis and design of existing and proposed farm forestry systems.

2.1.3 Landscape Assessment Models.

Landscape assessment, particularly of the visual component, is typically undertaken as part of the site investigation and inventory in the landscape planning and design process. The assessment often provides an understanding of the values requiring management. Lamb (1994) describes five models employed in assessing landscape aesthetic quality:

1. the component model,
2. the formal aesthetic model,
3. the psychophysical model,
4. the psychological model; and
5. the phenomenological/experiential model.

The component model and the formal aesthetic model assume that aesthetic value is intrinsic to the physical attributes of the landscape. These approaches are described as ‘descriptive inventory approaches’.

The psychophysical model assumes that the physical attributes of the landscape determine the psychological response of the viewer. The Forests Commission of Victoria and the Department of Conservation and Land Management in Western Australia, when developing management guidelines and management strategies for forests under their control have employed this approach.

The psychological model is more concerned with people’s experience of the landscape. It explores the reasons behind a viewer’s response and includes things such as memory, past experience, interests and cultural background, and ultimately gives more weight to [landscape] user preferences than the other approaches. It has been criticised for lacking an applied orientation or clear practical outcomes, from a problem solving point of view. It is considered as a hypothesis builder rather than an analysis type model.

The phenomenological/experiential model approaches landscape from the viewer’s experience, feelings and expectations. Through a systematic content analysis, common experiences are identified and used as a basis for gaining a deeper understanding of the perceived landscape.

Each model has its own strengths and weaknesses, arising from the critical elements used to describe a landscape’s quality, the objectivity of the evaluator and the repeatability of the result. They are included here to illustrate methods employed in assessing landscape attributes and determining their value and to provide the background to a potential approach for both the development and application of a Farm Forestry Visual Landscape Management Design Tool.

An example of “best practice” landscape assessment is the methodology developed by the Australian Heritage Commission outlined below. It is used to test the aesthetic value of a landscape for inclusion into the National Register, by which the landscape is required to meet certain pre-set criteria. It can be seen as an amalgamation of the models previously described.

In the context of farm forestry, the lower text box could read “*Significance of the proposed landscape modification to farm forestry visual landscape management criteria*”.

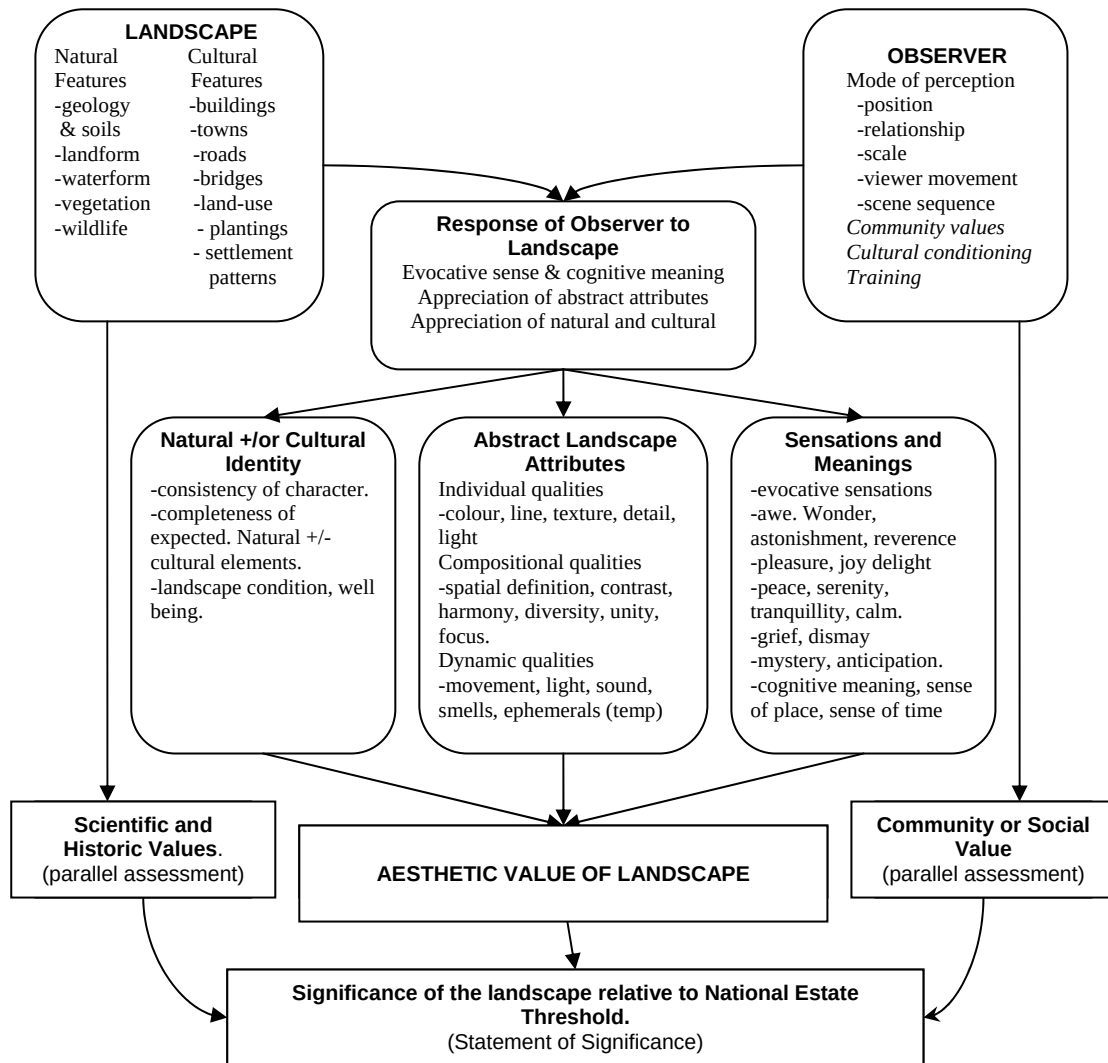


Figure 2. Landscape Assessment Process

Source: O'Brien and Ramsay, 1992

2.1.4 Landscape and Scenic Quality

Lamb (1994) explains the evolution of assessing aesthetic qualities of landscapes. He suggests that the major push behind this evolution came from the mandatory requirement for assessment of the aesthetic environment and associated community values in Environmental Impact Assessments for developments in the United States of America (National Environment Policy Act, 1969), and from similar requirements in other countries. Consequently, the subject area of aesthetic assessment developed rapidly, particularly in quantifying “visual quality” or “scenic beauty”.

The field of landscape perception research suggests that community preferences for landscapes differ according to how people actually interact with their environments, as well as the difference in their cultural background. A bushwalker, for example, may prefer different types of landscapes from say a farmer. Conversely, there is also a body of knowledge that suggests landscape preferences do not differ amongst humans and that there is an innate universal human preference for certain landscape types (Zube et al., 1982).

2.1.5 Managing Scenic Quality

In '*Design Principles for Farm Forestry*' (Abel et al. 1997), the section by Revell on 'Trees for Scenic Quality Management' (pp 73-79) identifies visual landscape management as 'a positive and integral component of agroforestry planning and management processes. Its prime goal is to ensure that all agroforestry uses and activities are planned and implemented so as to complement rather than detract from the inherent visual qualities of the environments in which they occur.' A range of landscape attributes are then discussed for assessing and designing for scenic quality in the farm landscape.

These include:

1. landform
2. water-form
3. land-use
4. naturalness
5. uniqueness and degrees of ruggedness
6. vegetation diversity and variety
7. transitions between land-uses, and
8. greater degrees of vegetation mixture (within a stand) age, height, density and edge diversity in plantations

Using these attributes as a base, a range of landscape design guidelines are then suggested as a means of improving scenic quality when designing farm forestry layouts. While efforts were made to integrate these guidelines into farm forestry management and design processes, possibilities still exist to improve the level of integration. Potentially unacceptable levels of social, environmental and economic impact can occur, as well as reducing the potential multiple use value of agroforestry resources (Abel et al., 1997).

Potential conflicts arising from single-use design objectives include:

- The visual impact of standard silvicultural prescriptions and harvest operations which might lower scenic quality;
- The reduction in scenic quality through poor tree growth and death;
- The straightness and regimentation of windbreaks might conflict with natural 'organic-shape' lines evident in the existing landscape.

These potential conflicts have been addressed by various government forestry agencies who have developed and adopted guidelines for managing the visual attributes of forests and forestry practices under their control (Revell, 1994; Forestry Commission Tasmania, undated).

'*A Manual for Forest Landscape Management*', by Forestry Commission Tasmania (undated) sets out an assessment methodology and schematic guidelines for the visual landscape management of forest landscapes (see Figure 3). Here the underlying objective is 'to recognize the important visual characteristics of land managed by the Forestry Commission and to ensure that landscape is managed in a manner which complements the conservation of other forest values.' The Manual aims to provide 'forest managers with a comprehensive range of visual principles, procedures and practices to guide their planning and management of the forest'. The manual is unashamedly based on the principles developed previously by the United States Forest and Agriculture Departments and the Forest Commission of Victoria (DCFL) during the sixties and early seventies. The Manual provides a standard, which removes some subjectivity from the definition of 'scenic quality'.

As noted in Figure 3 below, the visual attributes of a landscape are one group of landscape elements and characteristics that can be considered to determine a landscape's aesthetic quality. A landscape may have attributes that give it a negative value aesthetically, while still being visually attractive. For example, stark images of dead timber fringing salt affected land

against thunder clouds lit by a late afternoon sun, upset the aesthetic sensibilities of those who read the picturesque in greater depth than the purely visual (a farmer or hydrologist) yet provide stunningly attractive images of the Australian landscape. The dilemma of managing landscapes simply in the visual context is further compounded by the viewer profile as described by Itami (1994) who suggests that human values (aesthetic values) for landscape relate to the outcome of perception. The formation of these values are derived from the viewer's familiarity with, experience of and accessibility to the landscape, as well as their cultural links and beliefs, education and understanding, age and gender. Differences in landscape preference and aesthetic value increase with increasing numbers of viewers.

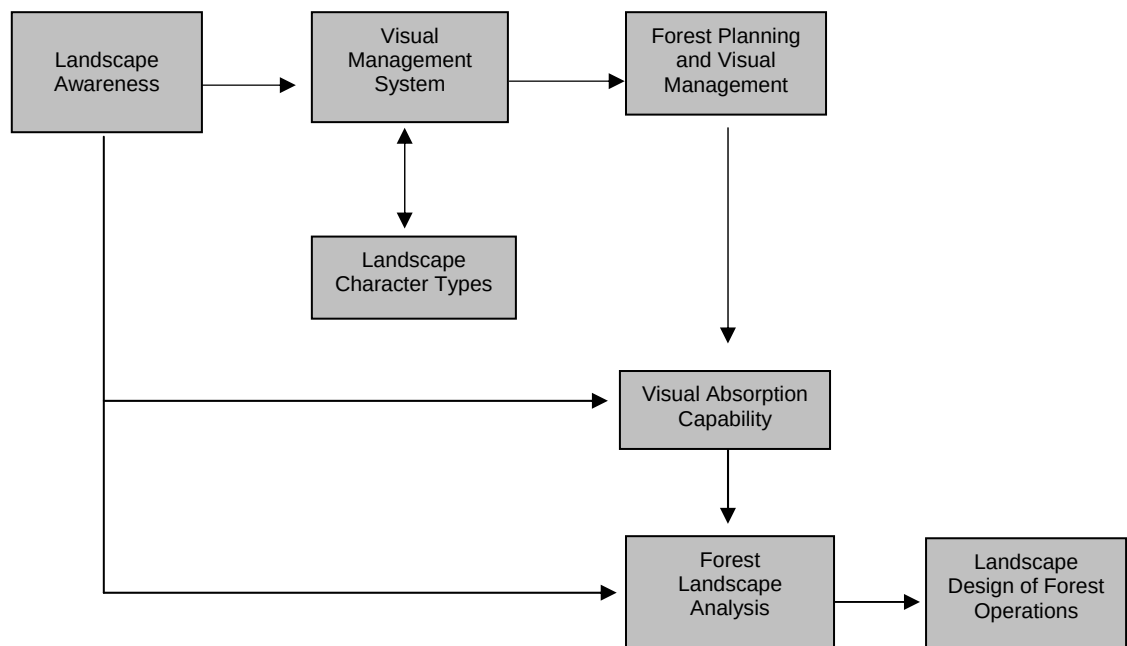


Figure 3. Procedural and Chapter Links in 'A Manual for Forest Landscape Management'

Source: Forestry Commission Tasmania (undated)

Similar forest landscape design guidelines have been developed for visual landscape management in Western Australian forests. These are found in Revell, G. (1994) *Guidelines for Managing Plantation Landscapes*.

Both the above forest landscape design publications provide the opportunity for land managers to optimize positive benefit/cost outcomes by:

1. ameliorating negative economic and social impacts of forest management activities,
2. providing forest managers with an opportunity to visually integrate their operations into the landscape with a positive visual effect,
3. assisting natural resource planners to methodically appreciate landscape opportunities beyond the immediate objective (i.e. weigh up the other values of a log, tree or forest).

Most importantly, in these publications, Visual Landscape Management is incorporated as part of an integrated process in the development of visual landscape management criteria, visual landscape management guidelines and the formation of comprehensive, holistic forest operational plans.

2.1.6 Landscape and Aesthetic Value

Scenic quality and landscape values are considered intrinsic to a landscape's aesthetic value, as shown in Figure 2. Aesthetic value is an abstract concept which is given meaning by the viewer. It is concerned with the valuation criteria a viewer brings with them to a landscape and how these are applied to what is seen.

The assignment of landscape quality attributes and value can be produced from any number of viewpoints (Sec. 2.1.3) in the investigation stage of developing landscape management strategies. These strategies can be applied at a range of scales from regional to paddock, depending upon the scale of the landscape under study and the perceived values in question. Once visual landscape attributes are identified and valued, criteria can be developed for their management. Typically, the determination of appropriate visual landscape management criteria can be generated by the "expert outsider" approach or from the land custodian's or "insider" position, or a combination of both.

2.1.7 Visual Landscape Management

Regionally, visual landscape management can add to the economic performance of a landscape, by providing visual diversity and attractiveness to the travelling public and increasing a community's sense of place and feeling of wellbeing. Managing the visual landscape involves an assessment of landscape attributes and values, which can be used to develop appropriate management strategies. These strategies can choose to either maintain, enhance or degrade visual landscape values. Previously mentioned forest management guidelines provide a useful starting point for developing visual landscape management guidelines targeted at farm forestry.

2.1.8 Integrated Landscape Management Planning

In the works of Revell (2000) and Winchcombe (1997), visual landscape management has been applied to landscape planning on several farm forestry projects in the south-west of Western Australia. At the farm level, community and community perception primarily involves the immediate farming family, although the perception of neighbours, the local community, catchment groups and the general travelling public is also considered. Visual landscape management decisions are then made in a manner which is aesthetically pleasing from a range of perspectives, while meeting reafforestation and vegetation management objectives.

In these works the participatory design methodology applied the following key steps:

1. Data inventory, including visual resource
2. Site investigation (landscape and environmental audit)
3. Data and site analysis
4. Planning and design; opportunities and constraints
5. Design development and representation
6. Design analysis
7. Design modification and representation
8. Implementation strategy (mapping and documentation)

The Landscape Audit, or landscape assessment as it is often described, identifies the things that make farm landscapes unique and the 'natural' and cultural resources and activities that have created them. Identifying those attributes that contribute to both positive and negative landscape character and the values placed on them by owners and observers provide the tools by which planners can develop a consensual or participatory approach to the further modification of these landscapes and their ecology within an integrated environmental system.

It should be noted that in the projects by Revell (2000) and Winchcombe (1997), economic analysis and water use simulations were included as part of the design process. These included the application of, variously, FARMTREE (Loane, 1997), the Agroforestry Estate Model (New

Zealand Forest Research Institute, 1997), the Agroforestry Calculator (RIRDC 1997), the Farm Forestry Toolbox (Private Forests Tasmania 1997) and Blue-belts (Eckersley, 1997) decision support softwares. Water-use modelling employed the Water Authority of Western Australia's MAGIC hydrology model.

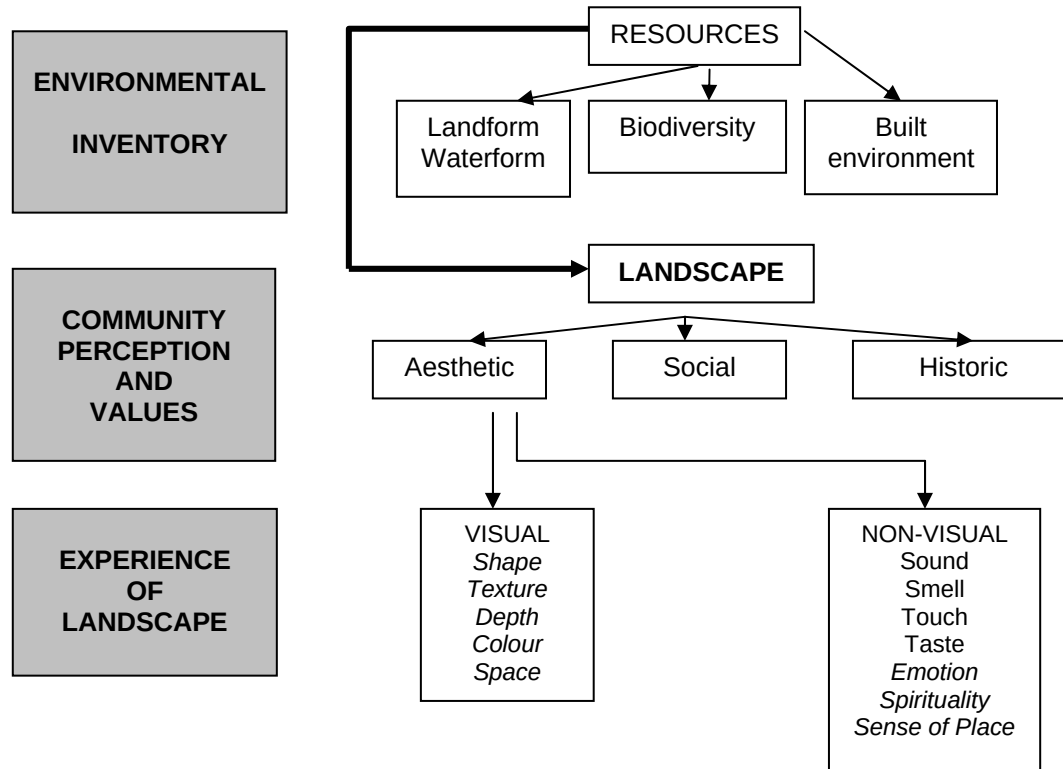


Figure 4. Relationships between Environment, Landscape and Community Values and Experience involved in a Landscape Assessment Process

Source: Winchcombe, 2000a

Figure 4 displays a relational diagram between elements of the landscape assessment process, with bold text showing the relative position of each phase. It has been expanded to include cultural cues (*in italics*), which add to people's perception and helps form the basis for making landscape value judgments. Property and farm forestry design conceptualization flows from this analysis and assessment of existing landscape conditions.

Representing the visual implications of a farm forestry design or operation allows full consideration of the impact such activities will have on the pre-existing landscape character from a farm level perspective. Design opportunities and constraints are then considered in the development of visual landscape management criteria. Designs options are then formed that apply appropriate layouts for the criteria decided upon.

In the *Shark Bay World Heritage Landscape Study* undertaken by Cleary (1999), landscape management is informed using the methodology shown in Figure 5, which assists in the development of landscape management guidelines and management priorities.

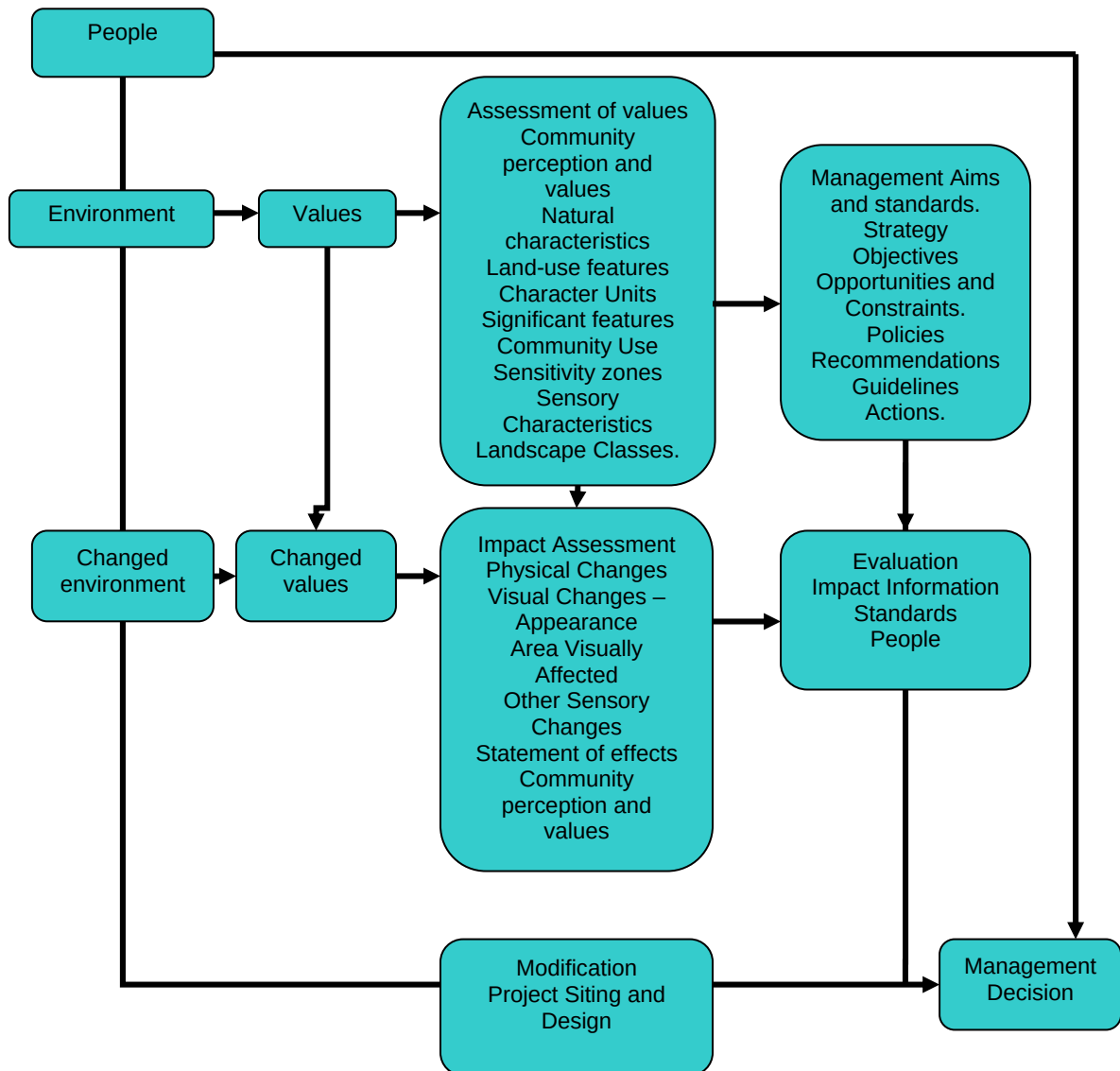


Figure 5. Overview of the Landscape Management System.

Source: Cleary, 1999

In the Shark Bay study example, significant effort was taken to maintain a participatory approach in the development of the Management Plan. This is possibly due to the area's unique heritage, ecology and increasing tourism. Its iterative process of *propose, assess, modify* is carried out within a rigorous assessment of landscape quality and value.

In terms of agroforestry development and integration, the above landscape assessment and management approach lends itself to a far greater understanding of community landscape values, with commensurate gains in shared management decisions leading to changed community values. Management decisions derived from publicly developed criteria can be equally used to inform coastal developments, highway construction and timber haulage programs.

2.2 Farm Forestry

Farm Forestry and Agroforestry are terms employed to describe the planting and management of trees on farmland for economic gain. The term is also used to describe broad-scale plantations that have been analysed for their social effects by a number of studies. For example, the study by Tonts et al. (2001) recommended, amongst other things that:

“State government agencies responsible for land-use planning, [should] collaboratively establish and maintain regional databases that provide information on the environmental/landscape changes attributable to farm plantation forestry. ... Such resources would provide a more thorough basis for land use planning and other policy decisions.” (Recommendation 4).

Recommendations of this nature aim to pre-empt adverse impacts arising from large scale land-use change, particularly through the establishment of contiguous plantations. Similarly, environmental implications can arise which can potentially affect socio-economic factors at the regional level through over use of surface and sub-surface potable water supplies. This is evident with *Pinus pinaster* plantations on the Gnangara water supply mound north of Perth, and in the Denmark catchment in the south-west of Western Australia. Another potentially adverse impact is that increased planting levels in higher rainfall areas of larger catchments could reduce the amount of run-off that would normally dilute saline stream flows (O’Connell, pers. comm.).

On the positive side, integrated farm forestry has the potential to ‘capture’ wider, ‘non-commercial’ benefits of trees in the landscape. These benefits can be seen to have overcome, in some places, ‘poor information on financial returns and economic impediments’, described by Harrison and Herbohn (2002), with substantial reafforestation occurring across rural Australia for landcare outcomes. Landcare revegetation, biodiversity plantings, riparian restoration and remnant rehabilitation bear testimony to the planting and management of trees in the landscape based on an ‘economy’ which is not purely financially driven (Norman, pers. comm.).

Biodiversity, aesthetic and intergenerational ‘land-care’ values remain significant reasons for the establishment and management of trees on farms. This is specifically illustrated by the case of the farmer in the ‘Brigalow’, for example, whose remnant bush has been assessed as ‘costing’ the enterprise upward of \$50 000 per annum (Carberry, pers. comm.).

In a functional sense management of the visual landscape can assist in making farm forestry designs perform with a greater degree of operational integrity at the farm level. This can involve maintaining visual access through layouts so as not to impede or encumber or hinder the day-to-day management of farming operations.

2.2.1 Visual Landscape Management Criteria for Farm Forestry

The development of visual landscape management criteria for farm forestry, i.e. maintain, enhance or degrade visual landscape values, is dependent upon the direct assessment and valuation of visual landscape attributes. The magnitude and significance of these values can then be used to inform the decision maker about appropriate management strategies.

For example the farmer might choose to do one of the following:

1. Nothing (the complacent position)
2. Maintain (manage in sympathy with the incumbent landscape)
3. Enhance (take active steps to maximise positive visual outcomes)
4. Degrade (take action that has a negative visual impact)

Actions from these management positions might include not planting trees that obscure popular tourist vistas or internally important visual access and view-sheds used in day-to-day farm operations. Similar priorities might be applied to the harvest or fuel reduction of existing agro-forests.

Figure 6 illustrates a range of options for the design of logging areas in a forested landscape. It gives the landscape planner an opportunity to explore the visual impact of various scenarios and to discuss these with the landscape custodians and those people who may have a strong aesthetic connection to the place. This discussion can then be used to develop visual landscape management criteria upon which designs and management decisions are made.

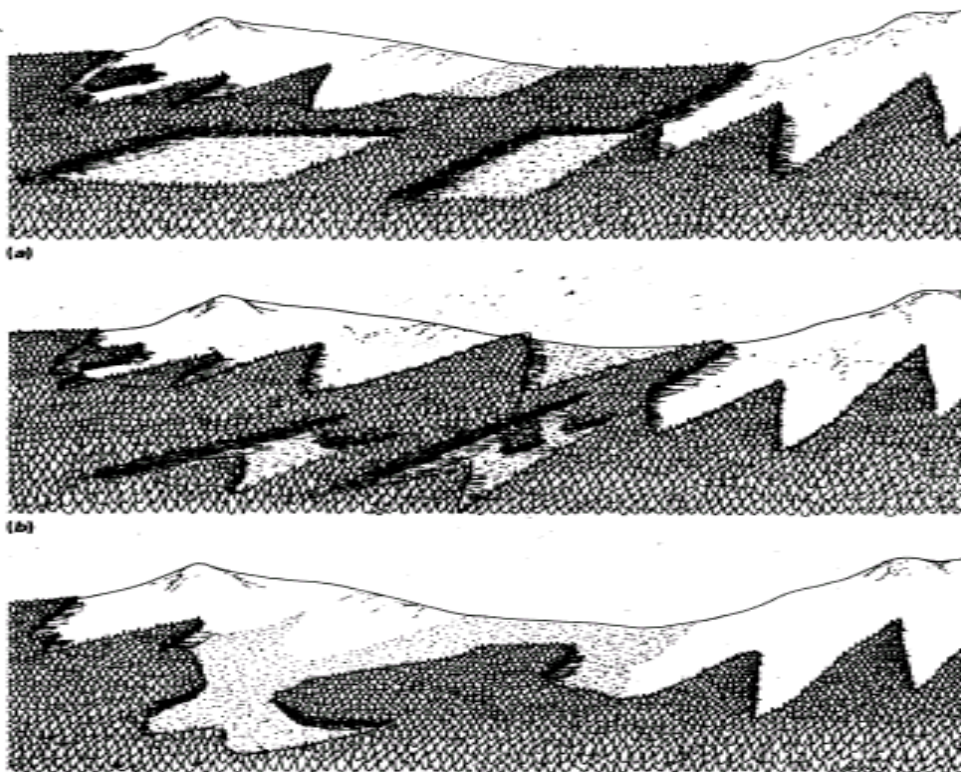


Figure 6. Guidelines for spatial arrangement of forestry logging coupes

Source: Oliver (1991)

2.2.2 Visual Landscape Management Guidelines

The development of visual landscape management guidelines for farm forestry should be determined by the clear definition of which preferred landscape resources are able to be managed. The farmer's landscape preferences, operational capabilities and financial opportunities need to be confirmed and described as part of the design opportunities and constraints. Once this is decided and values ascribed, then alternative management strategies can be applied using 'what-if scenarios' to evaluate potential impacts on those predetermined values.

The Victorian and Western Australian guidelines previously referred to offer 'expert' suggestions on management techniques applicable to forested landscapes and plantation layouts and design.

3. Review of Farm Forestry Decision Support Tools and Models

The identification of research works and models relevant to this feasibility study arose during preliminary discussions with research personnel from the Joint Venture Agroforestry Program. The following models and research works were recommended for review.

Table 1. Reviewed models and research.

Research work / model	Principal Author and date	RIRDC No.
IMAGINE	Abadi, A. 2002	UWA-63A
Quantifying the Tradeoff Between Tree and Crop Productivity on Farms	Carberry, P. 2002	CST-6A
Farm Forestry Tool Box	Osborn, T. 2002	Private For. Tas.
Trees for Shelter	Cleugh, H. 2002	
A Whole Farm and Regional Agroforestry Decision Support System	Harrison, S. & Herbohn, J. 2002	QDN-4A
Trees, Water and Salt	Stirzaker, R. 2002	
The Australian Farm Forestry Site Selection Manual	Harper, R. 2002	
Adaptation of Computer Software To Evaluate The Visual Impact of Farm Forestry Layouts	Leonard, L. 2000	CAL-2A
Joint Venture Agroforestry Program	Prinsley, R., O'Connell, D., & Bruce, S. 2002	RIRDC Agrofor. Management

3.1 Review Methodology

The review of the farm forestry decision support tools and models (FFDSTM) was undertaken in two parts. Firstly, a desktop study was undertaken which analysed opportunities for integrating visual landscape management into or with the tools listed above. Secondly, the authors interviewed a range of key personnel to discuss their thoughts on the opportunities for integrating visual landscape management into or with the tool and to clarify our understanding of a particular tool, why it was developed, how it is used and what it hoped to achieve. Interviewees were selected due to their involvement with a particular tool or tools and participation in the research and development of Australian farm forestry generally. The two approaches are combined in section 3.3.

3.2 Model Review Questionnaire

In order to gain a greater understanding of the models in question and to assess the feasibility of integrating visual landscape management, a questionnaire was developed to standardize the questions asked (see Appendix 2).

Interviews were recorded with fifteen respondents (Table 2).

Table 2. List of interviewees.

1.	Dr Amir Abadi	Department of Agriculture Western Australia
2.	Mr John Bartle	Department of Conservation and Land Management Western Australia
3.	Mr Don Cooper	Department of Conservation and Land Management Western Australia
4.	Dr. Richard Harper	Department of Conservation and Land Management Western Australia
5.	Dr. Ted Lefroy	Commonwealth Science and Industry Research Organisation Perth
6.	Professor Bob Gilkes	Department of Geology, University of Western Australia
7.	Mr. Kim Brooksbank	Department of Agriculture Western Australia
8.	Mr. Tim Osborne	Forestry Tasmania. Hobart
9.	Dr. Helen Cleugh	Commonwealth Science and Industry Research Organisation Land and Water Canberra
10.	Dr Richard Stirzaker	Commonwealth Science and Industry Research Organisation
11.	Dr. Peter Carberry	Commonwealth Science and Industry Research Organisation Sustainable Ecosystems Queensland
12.	Dr. Philip Norman	Environmental Protection Authority Queensland
13.	Ms. Sarah Bruce	Joint Venture Agroforestry Program
14.	Mr. Jason Alexander	Joint Venture Agroforestry Program
15.	Dr Roslyn Prinsley	Joint Venture Agroforestry Program

3.2.1 Questionnaire Design

The design of the questionnaire aimed to explore the respondent's understanding and perception of visual landscape management, landscape architecture, landscape planning and farm forestry best practice, while providing an opportunity for feed-back on the potential and benefits of integrating visual landscape management into respective tools and models. The critical questions asked are shown below (Table 3).

Table 3. Critical interview questions.

Number	Question
Q13	Are you familiar with the discipline and practice of Landscape architecture or Landscape planning?
Q14	Are you familiar with Visual Landscape Management? If so, in what context?
Q15	Have you considered the inclusion of Visual Landscape Management Criteria in your model?
Q16	Do you think it would be possible? If so, how? If not, why?
Q17	Do you think it would be beneficial? If so, how? If not, why?
Q18	Has Visual Landscape Management cropped up during the development of this model? In what way?
Q19	How would you define landscape?
Q20	Are you aware of the project ' <i>Adaptation of Computer Software To Evaluate The Visual Impact of Farm Forestry Layouts</i> ', Leonard, L. et al. (2000) RIRDC/JVAP, CAL-2A.
Q21	What would you consider "Best Practice" in terms of farm forestry planning and design?

3.2.2 Questionnaire Results

Of the fifteen interviews, only one project had considered the integration of visual landscape management into their project (AFFFM) however, the idea was discarded due the perceived complexity of adding another variable to the model. Generally it was found that an investigation into, or the inclusion of visual landscape management, was not part of the project design.

Table 4. Survey analysis

Question	Yes	No	Some aware-ness	Some potential	Comment
Are you familiar with the discipline and practice of Landscape Architecture or Landscape Planning?	2	5	8		A little familiarity through reading. Direct knowledge through having training or experience.
Are you familiar with VLM,? In what context?	1	14			One respondent had worked as a Landscape Architect.
Was VLM considered for inclusion into your study?		14	1		Decided against due to increasing complexity.
Would it be possible?	4	7		4	Uncertainty due to little knowledge of VLMC
Would it be beneficial?	11			4	Generally considered a good idea, even if not in the current project.
Has VLM cropped up during your project?	2	12	1		Not directly. One project indirectly. Two JVAP responses involved in this study
Can you define landscape.					15 differing answers
Are you aware of Cal 2-A?	4	11			
Can you describe “Best Practice” in Farm Forestry Planning and Design.					15 differing answers. Including ‘we don’t yet know what it is’ and ‘the application of the most up-to-date information’.
N=15					

The survey (see Table 4) showed a confessed level of unfamiliarity with VLM techniques and processes and this questions the inherent validity of the responses as to whether including VLM into the tool or model in question would be possible or beneficial. In one instance, two respondents discussing the same tool gave opposite indications on the feasibility of integrating VLM into the tool.

Most respondents had no knowledge of Visual Landscape Management (VLM), yet seven felt it would be possible to integrate VLM into a particular model or approach, although the details of how this integration could be achieved and supported remain open to further discussion.

Survey responses to the benefits or otherwise of integrating VLM included:

‘it wasn’t what we were doing’
‘it’s not practical’
‘it could become part of my reality’
‘it’s not in my realm’

However, an equal number of responses were given indicating that the integrating VLM into farm forestry planning would be a good idea, even if a particular model wasn't considered the right application, including:

'now is the time to start considering these issues, before it's too late'

Interestingly, defining 'landscape' was the survey question which caused the most hesitation. A rapid response was to indicate what the respondent thought another's description might be, say an hydrologist or a member of the 'public', before proffering their own definition. This would suggest that there is an ambiguous understanding and articulation of *landscape*, as a physical and social farm environmental resource and its applicability into integrated planning and design processes for farm forestry activities.

The suggestion that landscape will be defined according to the viewer's perception is further identified in the user surveys of Leonard et al. (2000), which indicated that the characteristics of visual landscape quality were, in fact, in the eyes of the beholder. These differences in the perception of beauty (landscape quality) and its value are critical to the integration of the visual landscape with farm forestry planning, design and management and the development of visual landscape management criteria.

Obviously, completed projects and those nearing completion would have some difficulty in integrating VLM, nevertheless, eleven respondents felt that some form of integration of VLM into farm forestry planning, design and management would be beneficial.

The general attitude and disposition toward VLM in natural resource management and farm forestry of those people interviewed exhibited a normal distribution between the idea that once a farm forestry industry had established itself in an area then visual landscape management issues would be dealt with, and the opinion that now is the time to start the inquiry, not only to add to the farm forestry land-use systems development discussion but to be more informed about potential on and off site visual landscape impacts.

3.3 Farm Forestry Decision Support Tool Description and Analysis

Each farm forestry decision support tool is described in the following terms:

1. Name / descriptor
2. Model Type, (Economic, Biophysical, Social, Integrated, Guideline)
3. Author
4. Date of development
5. Model objectives (main client target area)
6. Dimensionality (numerical, spatial, temporal)
7. Inputs (user defined, modeled)
8. Outputs (graphical, numeric)
9. Data sources (real, estimated)
10. Scale of Operation
11. Rainfall Zone
12. Discussion, including the opportunities and constraints for integration of visual landscape management.

The discussion includes further information on the intricacies of a tool, particularly when a tool appears to fit a system of landscape planning best practice. Responses from the questionnaire pertaining to each tool are included at this point.

3.3.1 Analysis Criteria

Given that none of the tools being reviewed was specifically designed to include visual landscape management issues, the evaluation and analysis concentrates on a tool's ability to integrate visual landscape management, based on 'best practice' models.

For example:

1. Does the tool spatially represent landscape?
2. Can the tool be used to inform landscape management criteria?
3. Can the tool be modified to incorporate visual landscape management?

Schematically, the analysis is shown in Figure 7 below, which illustrates how it is thought visual landscape management can be integrated into and analysed by existing tools.

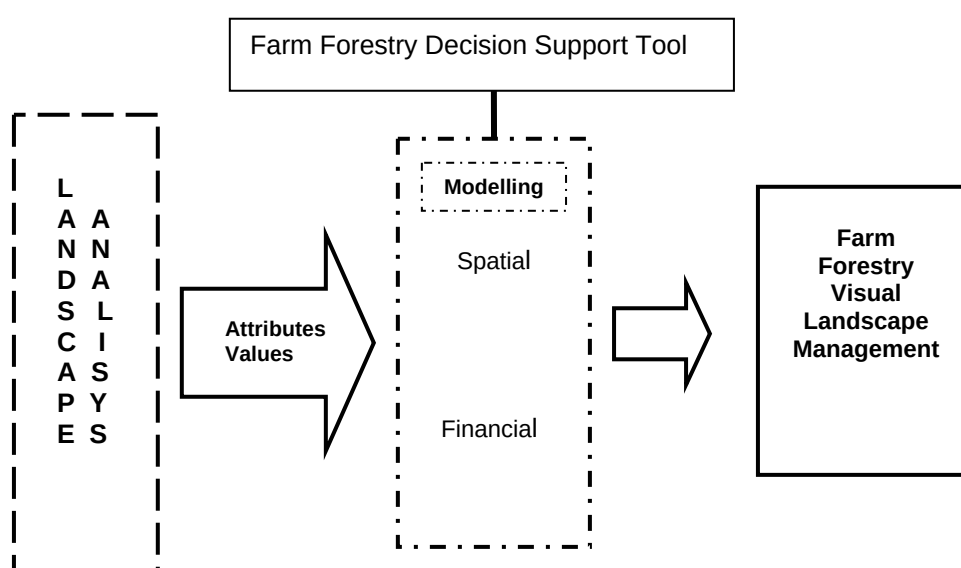


Figure 7. Determination and integration of landscape attributes and value

3.3.2 IMAGINE

Model Type: Economic/Financial Spreadsheet
Author/s: Dr. Amir Abadi, Mr. Don Cooper, Dr. Ted Lefroy
Date of development: 2001
Model objectives:

To predict the economic viability of establishing deep rooted perennial vegetation in cropping systems over a period of up to fifty years. The model has been principally used to focus research into the forestry prospects of low rainfall agroforestry systems.

Dimensionality (numerical, spatial): Temporal and Spatial interface
Inputs (actual, predicted): User defined
Outputs (actual, predicted): Predicted Net Present Value
Data sources (real, estimated): Predicted/historic
Scale: Paddock
Zone: IMAGINE is not restricted to any one region or system

Discussion:

While having the capability to graphically illustrate a rectangular configuration of colour on the computer screen, IMAGINE concentrates on analyzing the competition effects between

forestry and agricultural land-uses over time, within any particular paddock. IMAGINE analyses the financial implications of user-generated land-use systems and financial data over a period of up to 50 years. This is achieved through manipulating crop/pasture rotations in combination with spatial arrangements of vegetation at the paddock level. Input values are generated from historic data and predictions of future costs and yield from each part of the system. A particular cost is associated with the zone of influence exerted as competition by the vegetation.

As for the largely conceptual value used for the zone of influence between trees and agriculture, and positive yield benefits which are adjusted as the trees grow, an *opportunity* exists to add to the analysis by applying an aesthetic or landscape value into the equation. This could be a user choice module. The *constraints* against this are the lack of a tool which can be used to generate a quantified landscape value, and that IMAGINE would require further work to accommodate the landscape value variable albeit at a fundamental level.

Questionnaire responses from four people involved with the development of this tool ranged widely. This was largely due to the range of perceptions on what constituted visual landscape management and how it could be analysed and managed. IMAGINE remains a potential candidate for integrating and analyzing the economic value of visual landscape management.

3.3.3 Quantifying the Trade-Off between Tree and Crop Productivity on Farms (Draft)

Type: JVAP Research Report

Author: Carberry. P., et al.

Date of development: Current, in press

Model objectives:

To provide landholders with the capability to assess the commerciality and risk of agroforestry investments on Australian grain farms. This is achieved by simulating tree-crop competition and quantifying the potential economic risks and benefits of planting trees in association with cropping land through a simulated analysis of crop and tree yields based on climate records. These simulations can be used to design and implement action learning activities exploring viable agroforestry investments with farmers on their farms.

Dimensionality, (numerical, spatial): Numerical (Tables, charts)

Inputs (actual,predicted): Predicted

Outputs (actual,predicted): Simulated

Data sources (real, estimated): Estimated

Scale: Paddock/enterprise

Zone: Northern cropping region (although can be adapted to elsewhere)

Discussion:

The APSIM modelling framework has many advantages. The main benefit and one of the most important design specifications is the ability to integrate models derived in fragmented research efforts. This enables research from one discipline or domain to be transported to the benefit of some other discipline or domain. It also facilitates comparison of models or sub-models on a common platform. This functionality has been achieved via the implementation of a 'plug-in-pull-out' approach to APSIM design. APSIM has been developed in a way that allows the user to configure a model by choosing a set of sub-models from a suite of crop, soil and utility modules. Any logical combination of modules can be specified by the user 'plugging-in' required modules and 'pulling out' any modules no longer required.

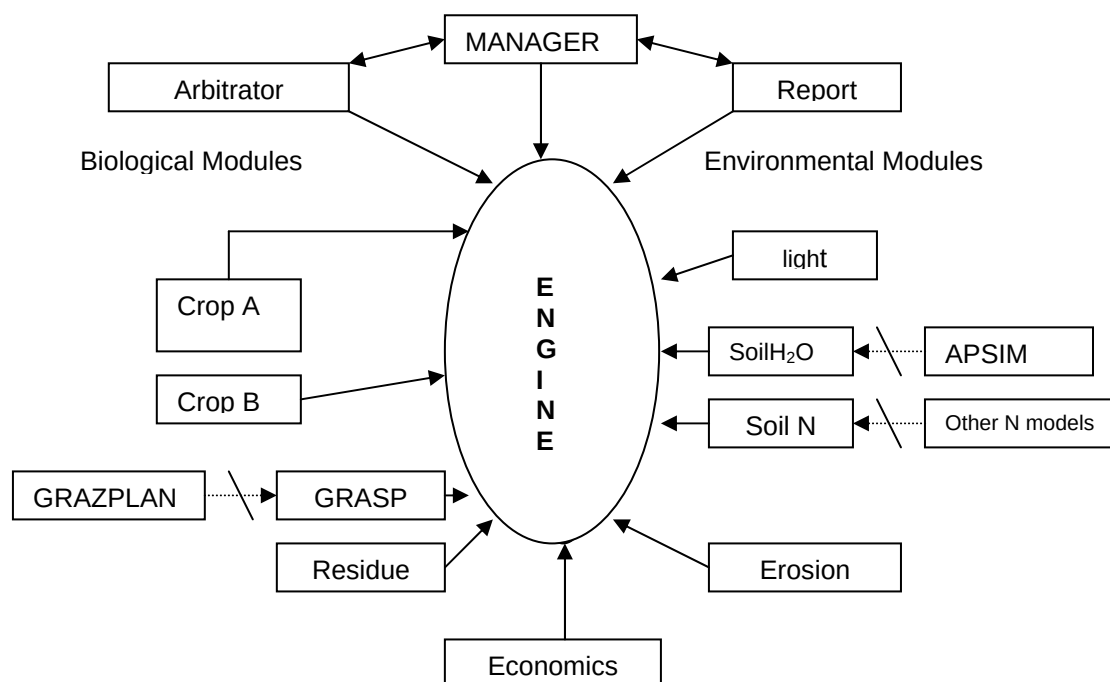


Figure 8. Schematic Representation of APSIM Modulation

Source: www.apsim-help.tag.csiro.au

Note: Crossed arrows indicate either/or plug-ins

As with any system there are logical boundaries in that the simulation will require the necessary elements (in this case, modules) of that system to be valid, but the possible valid permutations of sub-models are many and varied. For example, APSIM could easily allow the user to simulate a cropping system using 2 different water balances, 2 different soil Nitrogen balances and 3 separate wheat models. The user would be able to try all 12 permutations of cropping system sub-models. However, it would be nonsense to try a simulation without a water balance (or surrogate). The simulation would fail due to lack of information for other modules. It is possible to create this invalid system in APSIM but it is destined to fail due to specification inadequacies.” (Source: www.apsim-help.tag.csiro.au)

APSIM allows for the addition of plug-in modules to inform the analysis of other parameters associated with the proposed agroforestry investment.

APSIM offers an *opportunity* to plug-in a landscape value module to its simulation, with relatively little modification being required to the “engine”. This integration is *constrained* due to the lack of a farm forestry landscape valuation technique. However, due to the continuing application and deployment of the tool it is considered a potential opportunity for further discussion.

The questionnaire responses covering the feasibility of integrating visual landscape management were strongly positive and encouraging.

3.3.4 Farm Forestry Tool Box

Type:

Author:

Date of development:

Electronic Forestry Analyser

Private Forests Tasmania

Version 3, 2001.

Model objectives:

To provide a range of computerized calculation capabilities for people with existing forests. It provides capability to assess stand economics versus silvicultural inputs, forest production against product classes and prices, stand assessment and inventory, forest health, and log volumes.

Dimensionality (numerical, spatial):	Numerical
Inputs (actual,predicted):	Both
Outputs (actual,predicted):	Actual, data dependent
Data sources (real, estimated):	User defined
Scale:	In-forest
Zone	All

Discussion:

The Farm Forestry Toolbox provides an *opportunity* to attach a module covering visual landscape management, conceptually like the Stand Health section. The widespread utilization of this tool brings with it significant extension *opportunities* for integrated visual landscape management. The integration is *constrained* due to the lack of a suitable visual landscape management design tool.

The interview identified the potential for the Farm Forestry Tool Box to act as a deployment platform for visual landscape management.

3.3.5 Trees for Shelter: a guide to using windbreaks on Australian farms.

Type:	JVAP Research Report/Design Guidelines Series
Author:	Cleugh, H.
Date of development:	published 2003

Model objectives:

To describe the benefits and costs associated with windbreak layouts, based upon the findings of the National Windbreaks Program.

Dimensionality (numerical, spatial):	Illustrations
Inputs (actual,predicted):	Conceptual
Outputs (actual,predicted):	Conceptual
Data sources (real, estimated):	National Windbreak Program
Scale:	National/paddock
Zone:	All

Discussion:

The Trees for Shelter Design Guideline acts as a stand alone or companion decision support reference for people wishing to make informed decisions about tree placement for shelter benefits.

As a published guideline 'Trees for Shelter' provided little *opportunity* for integrating visual landscape management per se. However, it provides critical design considerations for developing farm forestry layouts and management strategies.

The questionnaire responses indicated a strong preference for a design guideline on visual landscape management and an integrated farm forestry landscape management design tool.

3.3.6 A Whole Farm and Regional Agroforestry Decision Support System (Draft)

Type: JVAP Research Report
Author: Harrison, S. & Herbohn, J.
Date of development: 2002

Model objectives:

To provide farmers and policy makers with a multi-purpose decision support system, allowing a comprehensive assessment of the forestry options.

Dimensionality (numerical, spatial): Financial/social
Inputs (actual,predicted): Actual
Outputs (actual,predicted): Actual(maps)/predicted
Data sources (real, estimated): Both
Scale: Multi-scaled process
Zone: Northern Australia

Discussion:

Components of this project were found to have benefits as decision support tools for the expansion of farm forestry in Northern Australia. Specifically, the Australian Farm Forestry Financial Model (AFFFFM) supports financial analysis at a business level and at a feasibility research level for predicting financial performance of prospective agroforestry systems. The Multi-Objective Decision Support System (MODSS) process was found 'to be a powerful method of integrating economic, environmental and social analyses, to produce a holistic analysis of natural resource and land management issues, including farm forestry issues' (Harrison and Herbohn, 2002). Multiple Objective Decision Support Software provides a predictive simulated environment with graphic capability. A multi-faceted project combining:

- the development and refinement of a whole farm agroforestry model
- a survey of farmer participation and attitudes to farm forestry
- the construction and evaluation of regional farm forestry case studies

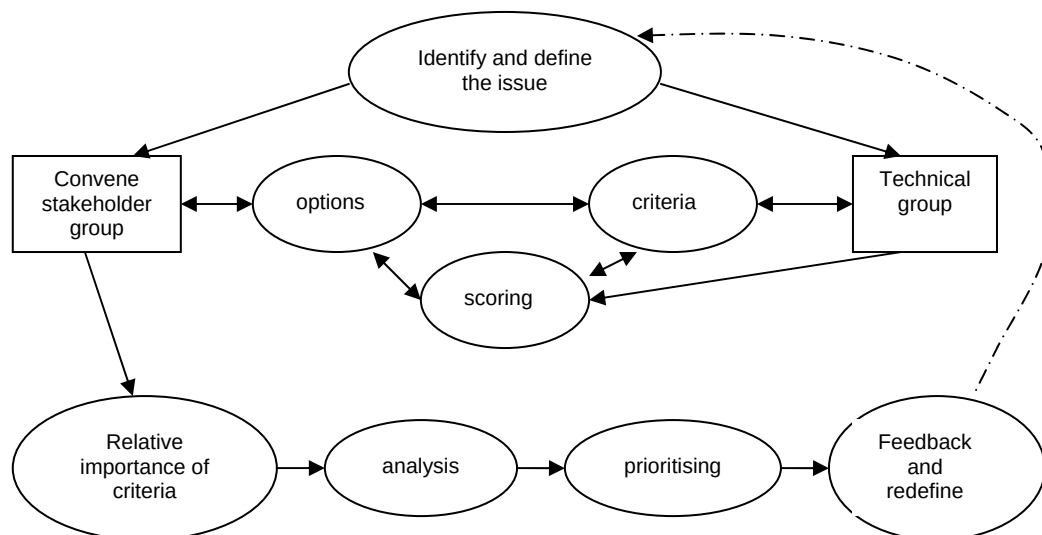


Figure 9. Issue framing and analysis using the MODSS process

Source: Jeffreys, 2002

The MODSS multi-criteria analysis (MCA) process illustrated above shows the potential for application of this process with a range of stakeholders at a variety of scales and its participatory research approach. The broken line has been added to illustrate the iterative nature of the process.

The graphical interface of the MODSS approach allowed representation in a map form of several regional farm forestry scenarios. These were used to stimulate discussion about possible options and outcomes thereby heightening the level of debate and understanding of the group. The spatial representation was limited in accuracy by insufficient or inadequate natural resource inventory data.

This tool offered the most *opportunity* as a vehicle for the integration of participatory visual landscape management. Its graphical illustration of possible farm forestry layouts using maps provides an opportunity to discuss what it was about particular scenarios that was aesthetically not pleasing and thereby begin the discussion of landscape value and visual landscape management.

Constraints include the one-off nature of the project, the lack of a visual landscape management design tool and lack of a three dimensional simulation capability.

In this instance the interviewee had worked as a landscape architect and was able to respond in the affirmative to most questions in the survey.

3.3.7 Trees, Water and Salt

Type:	JVAP Publication. Design Guidelines Series.
Author:	Stirzaker; R. et al.
Date of development:	2002
Model objectives:	To provide guidelines on the placement of perennial vegetation for salinity and water control.

Dimensionality (numerical, spatial):	Spatial
Inputs (actual,predicted):	Actual
Outputs (actual,predicted):	Predicted
Data sources (real, estimated):	Research
Scale:	Paddock
Zone:	All

Discussion:
As a published Design Guideline, 'Trees, Water and Salt' acts as a stand alone or companion decision support reference for people wishing to make informed decisions about tree placement for salinity and water-table control and management.

Having been published the guideline provides little *opportunity* for integrating visual landscape management per se

The responses to the interview questionnaire suggested that an integrated design guideline including visual landscape would be worth considering.

3.3.8 The Australian Farm Forestry Site Selection Manual (Draft)

Type:	JVAP Publication. Design Guidelines Series
Author:	Harper, R. et. al.
Date of development:	In press
Model objectives:	To increase the level of successful site/species matching in revegetation establishment across Australia.
Dimensionality (numerical, spatial):	Spatial, resource inventory
Inputs (actual,predicted):	Actual
Outputs (actual,predicted):	Predicted
Data sources (real, estimated):	Both
Scale:	Regional – paddock
Zone:	All
Discussion:	The AFFSSM acts as a stand alone or companion decision support reference for people wishing to make informed decisions about tree placement for both improved forestry yield and water use.

Due to its imminent publication, the guideline provides little *opportunity* for integrating visual landscape management per se.

Two interviews were concluded covering this tool. While visual landscape management was not part of the research design, both interviewees expressed the opinion that some form of landscape management guideline and visual landscape management simulation tool would be worth pursuing.

3.3.9 Joint Venture Agroforestry Program

Type:	Research Corporation
Author:	Prinsley, R., O’Connell, D., & Bruce, S.
Date of development:	On-going
Model objectives:	The JVAP has the following key roles: • Initiating, coordinating and communicating agroforestry research and development • Assisting in the removal of policy and institutional impediments • Assisting in the development of new tree-based industries • Designing large-scale commercial agroforestry systems in lower rainfall areas to address environmental issues
Dimensionality (numerical, spatial):	See Figure 8
Inputs (actual,predicted):	Research and extension based
Outputs (actual,predicted):	Extension
Data sources (real, estimated):	Research based
Scale:	Paddock – policy
Zone:	Australian
Discussion:	Although not specifically identified as a key component of its research strategy, visual landscape management provides an <i>opportunity</i> for the JVAP to continue at the forefront of research into enhancing farming landscapes for sustainable social, environmental and economic outcomes.

No *constraints* to the integration of visual landscape management with farm forestry were observed.

Although the three interviewees confessed little knowledge of the key ingredients of visual landscape management, all were of the belief that some form of integration would be beneficial to farm forestry in general.

3.3.10 Adaptation of Computer Software to Evaluate the Visual Impact of Farm Forestry Layouts

Type: JVAP Research Report. Project No CAL-2A
Author: Leonard, L. et al.
Date of development: 2000
Model objectives: To provide a method of adapting design software that realistically simulates the visual effects of farm forestry layouts and their associated impacts on landscape character, visual amenity and agricultural management.
Dimensionality (numerical, spatial): Simulated computer graphics
Inputs (actual,predicted): User defined
Outputs (actual,predicted): Simulated
Data sources (real, estimated): User defined
Scale: Landscape
Zone: All
Notes:

The research concluded that within hardware and software limitations, useful visual products can be generated for farm forestry layouts. The study provides a valuable basis for continued development of this technique for producing 'legible' images of simulated farm forestry layouts. The technique requires considerable computing power and computer literacy and is therefore currently restricted in its application.

An *opportunity* exists to explore the potential for integrating the findings and recommendations of this study with some of the existing tools and the development of an integrated farm forestry visual landscape management design tool.

3.4 Review Summary - Is Integration Feasible?

Gilkes (pers comm.) confirms the often repeated question from farmers of 'what will it [the tree planting] look like?'. There is a compelling need for such integrated farm forestry decision support tools and models to embrace and satisfy this every-day farmer request.

Much of the reviewed literature uses the term *landscape*. However, few of the studies under review take a comprehensive view or are specifically involved in the determination of Visual Landscape Management Criteria or guidelines. Illustrations which can be used to inform the development of VLMC are sometimes used, yet fail to provide discussion on the management of Visual Landscape Criteria as part of the research or Design Guideline. Other landscape considerations are generally referred to as aesthetic and biodiversity values. These values when combined can often be seen to make up the difference between an economically "commercial" farm forestry arrangement and one which currently, is not.

This study found that while not directly involved in the rigorous assessment and management of the visual landscape resource (excluding the work by Leonard et al. 2000), the models and research under review could be separated into categories which could:

1. Integrate Visual Landscape Management Criteria, providing techniques were available which allowed the visual resource to be given a value, which could then be entered into an economic spreadsheet.
2. Provide a platform for delivery of Visual Landscape Management modules.

3. Develop Visual Landscape Management Criteria by spatially illustrating potential reafforestation layouts.
4. Be used as a support tool to help generate real life Visual Landscape Management plans.

In summary, interviews with the key people involved with the models and research found that:

1. It was considered that the research was too far advanced to include Visual Landscape Management Criteria.
2. Visual Landscape Management was not part of the original study.
3. Visual Landscape Management could be integrated given certain assumptions.
4. The research was a one-off and therefore not likely to be repeated thereby voiding any further opportunity for integrating other values.
5. A Visual Landscape Management Design Guideline would be useful in informing an increasingly sophisticated agroforestry systems discussion.
6. There is little more than passing knowledge of the processes of visual landscape assessment, valuation and the development of visual landscape management criteria and associated management strategies.

These findings are further illustrated in Table 5 below, which shows the relative capability of each reviewed tool and models to integrate visual landscape management.

Table 5. Tool integration capability.

Tool	Inventory	Analysis Modelling	Design Opportunities	Design Constraints	Modification/addition required
IMAGINE		X	X	X	X
AFFSSM	X			X	
AFFFM		X	X	X	X
APSIM	X	X	X	X	X
FFTb Tas	X	X	X	X	X
TFS			X	X	
TWS			X	X	
CAL-2A		X			X
Sh. Bay	X	X	X	X	X
JVAP			X		

AFFSSM: Australian Farm Forestry Site Selection Manual.
 AFFFM: Australian Farm Forestry Financial Model. MODSS
 APSIM: Agricultural Production Systems Simulator
 Farm Forestry Toolbox.- Private Forests Tasmania.
 JVAP: Joint Venture Agro-forestry Program.
 TFS: Trees for Shelter.
 TWS: Trees Water and Salt.
 CAL-2A: Adapting Computer Software To Evaluate the Visual Impacts of Farm Forestry Layouts
 Shark Bay: *World Heritage Property Landscape Study*.

Table 5 also shows how each tool might be applied in an integrated planning process, where it supports the process and if further modification is required to integrate visual landscape management.

Models which allow for interactions between agriculture and forestry can conceivably accept a scenic quality dollar value in the zone of influence exerted by the trees. The zone of influence is currently accepted as the area of impact the trees have on the neighboring agriculture. Models which require an internal productivity value or yield can accept a scenic quality value added to that intrinsic forestry value.

With the exception of ‘best practice’ visual landscape management guidelines and techniques and possibly AFFFFM/MODSS, none of the models/documents under review specifically take into consideration Scenic Quality or Visual Landscape Management Criteria. Needless to say, each decision support model has the capability to integrate Visual Landscape Management Criteria at the level of its intrinsic analysis. For example, IMAGINE could incorporate a value for the visual component of the tree belts in the zone of influence. Likewise the Farm Forestry Toolbox could either assign a ‘Scenic’ value in the non-timber values calculations and/or provide a module not unlike the Forest Health component covering Visual Landscape Management.

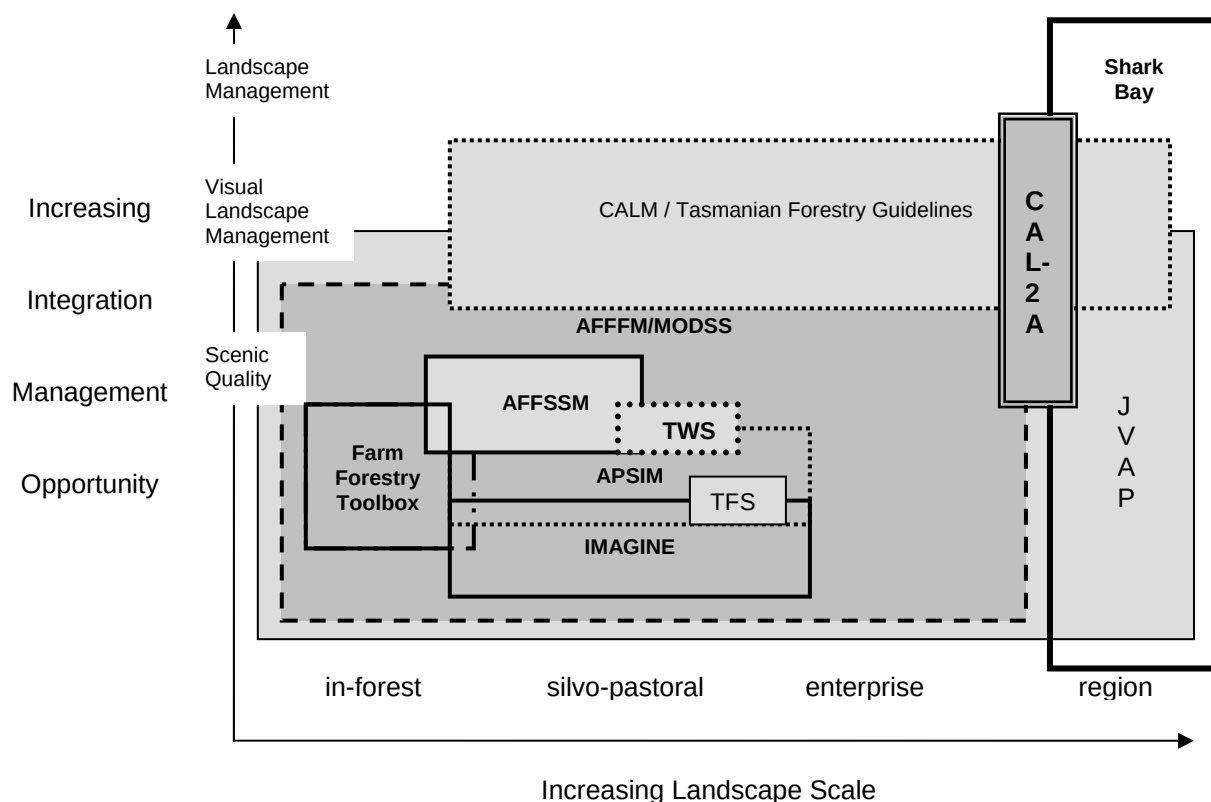
More sophisticated visualization outputs could be generated as a component of the AFFFFM/MODSS software/process, while to a lesser extent a VLM module could be ‘plugged-in’ to APSIM.

Quantifying visual landscape values can be a simple exercise in producing what if ‘with-or-without’ scenarios, from which Visual Landscape Management Criteria can be derived. The management of this value and the visual landscape can potentially attract an extensive as yet intangible array of aesthetic benefits.

It should be noted that only rarely will rural landscapes be altered for purely aesthetic reasons, although, as mentioned aesthetic value is both a personal and community-based judgement and manifests itself in the landscapes apparent today. It is more likely that the process of designing agroforestry systems will be informed to some extent by all of the models and paradigms described above, albeit non-integrated.

Agroforestry proposals can be analysed for their potential impacts on any identified visual landscape attributes and appropriate modifications then determined. As an example, a landowner developing a ‘best bet’ re-forestation/vegetation management strategy for salinity control who wishes to introduce Visual Landscape Management Criteria would find it necessary to further develop their understanding of what visual values they were concerned with. Guidelines like ‘Design Principles for Farm Forestry - a guide to assist farmers to decide where to place trees and farm plantations on farms’ (Abel et al. 1997), would help determine what is best practice.

Figure 10. displays a conceptual arrangement of the information provided in the models under review in terms of information overlap, interrelationships and application in farm forestry and natural resource management planning. It also illustrates the current acknowledgement by each model of criteria used in visual landscape management. Most significant, are the areas where little or no overlap exists, which is particularly evident between the nest of JVAP projects and higher level landscape and natural resource management projects.



AFFSSM: Australian Farm Forestry Site Selection Manual
 AFFFM: Australian Farm Forestry Financial Model. MODSS
 APSIM: Agricultural Production Systems Simulator
 Farm Forestry Toolbox: Private Forests Tasmania.
 JVAP: Joint Venture Agro-forestry Program
 TFS: Trees for Shelter
 TWS: Trees Water and Salt
 CAL-2A: Adapting Computer Software To Evaluate the Visual Impacts of Farm Forestry Layouts
 Shark Bay: *World Heritage Landscape Study*

Figure 10. Schematic Representation of Relativity Between Management Systems and Studies under Review

Table 6 gives feasibility rankings to each model/tool based upon the feasibility of integrating visual landscape management. A weighting is given, either upward or downward, based upon the author's assessment of feasibility indicated in responses to the questionnaire, and the overall position of a tool in day to day farm level discussion on farm forestry management.

A more detailed description of the ranking is shown in Appendix 1, which combines the application of visual landscape management processes with the perception of the interviewee. This was complicated due to differing responses received from interviewees about the same work, regarding the potential for integrating visual landscape management.

Table 6. Integrated visual landscape management criteria feasibility rating.

Model	Ranking	Opportunities	Constraints
IMAGINE	2	Additive economic value	Scale
Farm Forestry Tool Box	1	Visual and economic outputs	Scale
APSIM	2	Additive economic value	-
AFFFM/MODSS	1	Process oriented	-
Trees, Water and Salt	5	Introduces landscape elements	Published
Trees for Shelter	5	Introduces landscape elements	In-press
Australian Farm Forestry Site Selection Manual	4	Introduces landscape elements	In-press
CAL-2A Adaptation of Computer Software for Farm Forestry Layouts	1	Visualisation framework developed	Hardware and software limitations
JVAP	1	Interest in integrated NRM and FF development	-

1 = High Feasibility

5 = Low Feasibility

4. Implications and Recommendations

Extensive financial modeling and analysis of the economic benefits of revegetation has been undertaken on agroforestry systems across Australia. The potential for the integration of visual landscape management, scenic quality and landscape architecture to add greater depth to the modeling and analysis of farm forestry benefits can only increase the understanding, acceptance and adoption of re-forestation and farm forestry systems in rural landscapes.

However, the realisation of this potential has many positive implications extending across a range of scientific disciplines and land-use paradigms which may be brought to fruition from the following recommendations.

4.1 Development of an Integrated Farm Forestry Visual Landscape Management Tool

As an overlay applied to farm forestry decision making, visual landscape assessment, involving attributes previously described, can be used to generate an idea of and help quantify landscape value. Having taken the time to become aware of the visual landscape and its properties, planners, can then develop visual landscape management criteria based on these values. Development plans can then be assessed against these criteria and appropriate landscape management guidelines developed and applied.

In order to integrate visual landscape management with existing farm forestry management approaches and farm forestry decision support tools, the following landscape assessment model is proposed:

1. Undertake the inventory, analysis and documentation of existing visual landscape attributes including:
 - Natural characteristics
 - Land-use features
 - Character Units
 - Significant Features
 - Sensory Characteristics
 - Community Perception and Values
 - Community Use
 - Public & Private Sensitivity Zones
 - Landscape Classes.
2. Assess overall landscape values, including scenic quality & aesthetic value
3. Representation of values in graphic form – plans & perspective images, etc.
4. Generate visual landscape management criteria
5. Propose modified landscape
6. Assess impacts on visual landscape values (financially or visually)
7. Modify proposal
8. Apply visual landscape management guidelines (Using published guidelines)
9. Assess impact of managed proposal

The assessment and application of visual landscape values in generating visual landscape management criteria and guidelines is illustrated in Figure 11, below.

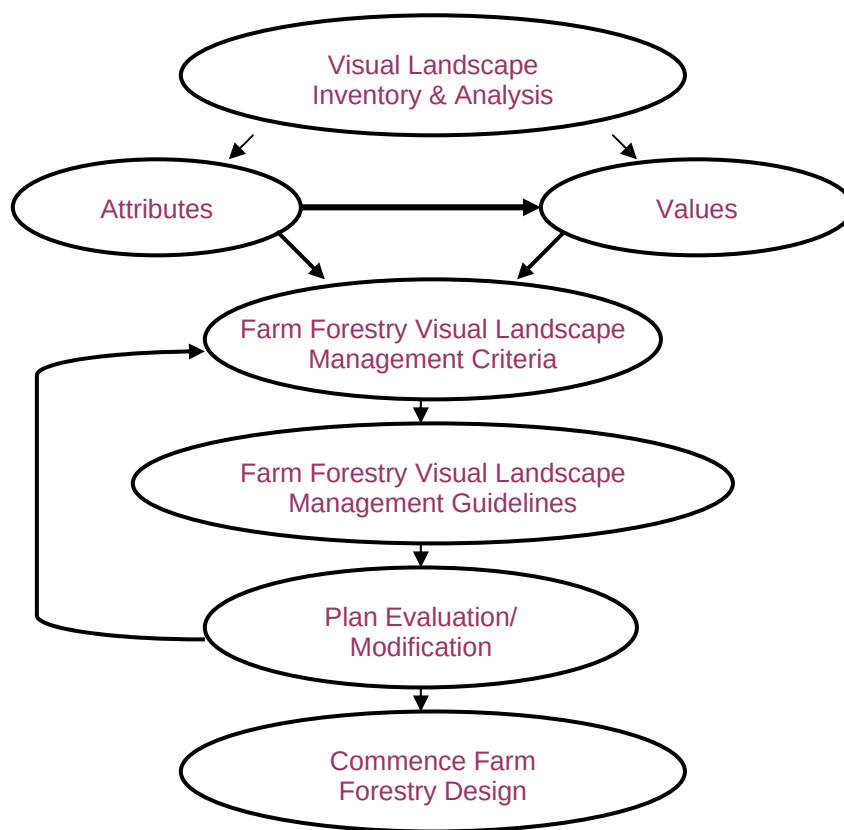


Figure 11. Application of Visual Landscape Management Principles within the Planning and Design Process

The attributes and values derived from the landscape inventory, analysis and planning process can then be integrated with or into the reviewed tools and research. Dependent upon the Visual Landscape Management Criteria adopted by the landscape custodian, management strategies can be developed which suit those criteria using either existing forestry visual landscape management guidelines or by development of a set of guidelines relevant to a particular landscape and its characteristics. Quantifying the value of visual resources and their management allows the introduction of those values into financial calculators. This could include an allowance for the impact and financial value of a farm forestry scenario to change over time. This modelling can assist generation of visual landscape management criteria once the implications of plans have been evaluated. For example in Figure 6, potential visual landscape ‘costs’ associated with clear-felling activities can be evaluated. Criteria can also be used to recognise and manage community and tourism aesthetic values as a level of assessment.

Integrating visual landscape management becomes a matter of determining its benefits and costs. Quantifying scenic quality values and visual landscape management criteria for inclusion into these models can either be based on existing techniques of assessment or specifically created at a regional level to increase the range of benefits able to be captured in farm forestry designs. This argument is strengthened by the fact that several of the survey respondents suggested that ‘The Agroforestry Design Principles’ manual series would benefit from a Visual Landscape Management and Design Manual. This manual would complement the production of an Integrated Australian Farm Forestry Design Manual. Such a proposed manual would need to be based on holistic and integrated landscape planning and design procedures.

Prior to developing visual landscape management guidelines for farm forestry projects, the research needs to resolve the issues set out by Lamb (1994) viz;

1. The definition of what constitutes landscape quality.
2. The determination of the relevant aesthetic attributes of the landscape, in this case its visual attributes.
3. The nature and role of the evaluators.
4. The objectives of the study, in this case to minimize negative visual impacts, maximise the positive and enhance the given visual landscape.
5. The nature of the results or output of the study.
6. The credibility of the output, which raises the question of the nature and role of the evaluators in managing the quality.

4.2 Opportunities

Opportunities for farm forestry from the integration of visual landscape management include:

1. Visual landscape management can stimulate revegetation by adding to the list of 'economic' values captured by revegetation, and provide aesthetic and managerial opportunities to land managers. These opportunities include design layouts which add to the "scenic quality" of a farm and its potential real estate value and the management of view-sheds and visual amenity to improve visual access through a farm forestry layout .
2. Enhance existing revegetation programs through the wider engagement of the community in the development of visual landscape management guidelines at regional scales.
3. Offer an opportunity to input into spreadsheet and simulating computer packages a quantified visual landscape value, which would add further "economic" advantage to farm forestry proposals.
4. Visual landscape management processes can be applied at varying scales and involve the requisite number of decision makers in their application, increasing the sense of participation and ownership of decisions.
5. The visual landscape can be modelled electronically to simulate a revegetation layout three dimensionally. This has been done in South Africa (Norman, pers. comm.) and is currently being investigated by Forestry Tasmania involving World Constructor Set computer software (Osborn, pers. comm.).
6. A Visual Landscape Management Guideline and the Integrated Australian Farm Forestry Design Manual would add to the current Joint Venture Agroforestry Program Farm Forestry Design Guidelines Series.
7. Landscape assessment can help farm forestry activities to understand how and why visual landscapes are important; promote an appreciation of landscape issues; successfully accommodate new forestry development within the landscape; and guide and direct acceptable levels of landscape change.

4.3 Constraints

1. A lack of landscape management planning and design guidelines relevant to Australian Farm Forestry, setting out the methodology required to generate criteria and their management.
2. Little knowledge of the application of Visual Landscape Management Criteria and their management in actual farm forestry situations.
3. Development of a simulated three dimensional computerised Farm Forestry Design Modelling Package, while feasible, is reliant on the establishment of an Integrated Farm Forestry Visual Landscape Management Design Tool to provide

- input into the model.
4. The lack of farm scale operational research models that are being monitored systematically for their landscape management values and associated performances.

The continued development and discussion on the findings of this project will ultimately support the vision of Alexandra and Campbell (2002):

“Drawing on the R&D funded by Land & Water Australia and other R&D Corporations through the Joint Venture Agroforestry Program (JVAP) and other initiatives over the past decade, we argue that the prospects for plantations will be abundantly improved if plantation-related policies support landscape restoration through multifunctional forestry. The research we fund through JVAP integrates environmental and commercial drivers of revegetation. Through this and related work we are improving Australia’s capacity to develop plantations that produce more than wood fibre – landscape sustainability.”

4.4 Research Opportunities

The researchers of this project would highly recommend that a national forum be convened to brain-storm a research plan to prepare an integrated farm forestry planning and design model. This ‘seminal’ study would attract a small group of researchers and practitioners who are able to collaborate effectively and are aware of both the rational analysis (scientific) and intuitive innovation (art) practices associated with the integrated planning and design of farm forestry environments.

A possible objective for such a forum could be the development of a project to identify a framework for the application of visual landscape management in a number of key focus areas around Australia. This project would ultimately generate a simple set of clear, concise guidelines. For example a broad national guideline on integrating VLM into farm forestry could give some clear direction and assistance on what it all means and how to go about collecting, collating and using VLM in farm forestry related land management activities. Specific guidelines could also be developed for particular areas or situations and landscapes.

5. Project Evaluation

This project sought to interview, and assess the candid opinions of a number of key national players in the development of farm forest decision support tools. Their knowledge and attitudes towards landscape management and its potential integration was a prime focus of the study. These research players can be described as follows:

1. Those who had moved on, or planned to move on from the Joint Venture Agroforestry Program. They had little opportunity to become more actively involved in this study.
2. Those who felt that as a ‘scientist’, landscape architecture and visual landscape management was not quite important enough for them to become involved.
3. Those who had some experience of Landscape Architecture and were quite positive about its potential benefits to farm forestry.
4. Those who, while not completely conversant with Landscape Architecture, were willing to provide the names of people, if not on their respective project teams, then close enough to provide more coherent comment and feedback.

The personnel involved came from a variety of disciplines and experiences and were able to offer personality and depth to the research hypothesis being tested. It is important to note however, that most research collaborators assumed an “expert” position during the interviews and survey sessions. This stance often stood in the way of full and creative discussions about the opportunities for the integration of visual landscape management into farm forestry land management.

Finally, given the limited available resources, this project was more constrained than the researchers would have wished. Additional resources would have attracted an essential participant farmer study group, for example. The subsequent research opportunities identified in Section 4.4 above – in particular those that involve the potential ‘hands-on’ workshopping of proto-typical issues and creative ideas for tool integration should be thoroughly investigated.

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8. Appendices

Appendix 1. Visual Landscape Management Criteria (VLMC) Feasibility rating of models and research under review

Model	Rating	Opportunities	Constraints	Iterative	Comments
Imagine	2	Additive economic value 1,5,7,9	Scale 6,10	Based on multiple runs	Could allow for the input of a scenic quality value or landscape aesthetic value.
Farm Forestry Tool Box	1	Visual and economic outputs 1,2,3,4,7,9	Scale 6,	No	Can tolerate the introduction of a visual landscape management module.
APSIM	2	Additive economic value 1,2,4,7,9	6,10	No	As for Imagine plus internal manipulation for maximizing scenic values based on predetermined VLMC
AFFFM/MODSS	1	Process oriented 1,2,3,4,7,9	6,8	yes	Can readily accept visual landscape management planning as part of the process, with the added value of economic manipulation and assessment of spatially modeled plans against predetermined VLMC
Trees, Water and Salt	5	Introduces landscape elements, 4,9	Published 5,6,7,8	No	Provides a conceptual framework for the development of farm forestry layouts.
Trees for Shelter	5	Introduces landscape elements 4,9	In-press 5,6,7,8	No	As for Trees, Water and Salt.
Australian Farm Forestry Site Selection Manual	4	Introduces landscape elements 4,9,	In-press 5,6,7,8	Based on yield predictors	Attempts to provide the knowledge for assessing site yield and species selection. Fundamental information for tree growing.
Adaptation of Computer Software for Farm Forestry Layouts	1	Visualisation framework developed 3,4	Hardware and software limitations	No	Useful concepts in assessing visual impacts once layouts have been developed.
JVAP	1	Interest in integrated NRM and FF development 9,	-	Yes	Is involved in developing farm forestry systems which capture multiple benefits.

Opportunity and Constraint Categories:

1. Integrate Visual Landscape Management Criteria, providing techniques were available which allowed the visual resource to be given a value, which could then be entered into an economic spreadsheet.
2. Provide a platform for delivery of Visual Landscape Management modules.
3. Develop Visual Landscape management criteria by spatially illustrating potential reafforestation layouts.
4. Be used as a support tool to help generate real life Visual landscape management plans.
5. It was considered that the research was too far advanced to include Visual Landscape Management Criteria.
6. Visual Landscape Management was not part of the original study.
7. Visual Landscape Management could be integrated assuming certain givens.
8. The research was a one-off and therefore not likely to be repeated thereby voiding any further opportunity.
9. A Visual Landscape Management design guideline would be useful in informing an increasingly sophisticated agro-forestry systems discussion.
10. Little more than passing knowledge exists of processes of Visual Landscape Assessment, Valuation and the development of Management criteria and strategies.

Appendix 2. Model Review Questionnaire

UWA-68A
Farm Forestry and Landscape Architecture.

Model Review Questionnaire

Interviewee..... Interviewer.....

Date.....

- 1 Introduction
I am involved with a feasibility study looking at the integration of Visual Landscape Criteria into various decision support tools being developed to assist farm forestry. Would it be possible to take an hour or so of your time to talk about this study and some of the work you have been involved in.
Y/N
- 2 Are you comfortable with having this conversation tape recorded?
Y/N
- 3 Project Background
- 4 Project Methodology
- 5 Why your particular model/research was selected?
- 6 Please tell me about your model
- 7 What would you say led to the development of the model/research in the first place?
- 8 (If appropriate) what would you say is driving its further development.?
- 9 Is it relational? i.e. how would you describe its mode of operation?
- 10 Who is the target user of your particular Decision Support Model or Research?
- 11 How widely is it used/will it be used?
- 12 By which users?
- 13 Are you familiar with the discipline and practise of Landscape Architecture or Landscape Planning?
- 14 Are you familiar with Visual Landscape Management? If so, in what context?
- 15 Have you considered the inclusion of Visual Landscape Management Criteria in your model?
- 16 Do you think it would be possible?
If so, how?
If not, why?

- 17 Do you think it would be beneficial?
If so, how?
If not, why?
- 18 Has Visual Landscape Management cropped up during the development of this model? In what way?
- 19 How would you define landscape?
- 20 Are you aware of the project '*Adaptation of Computer Software To Evaluate The Visual Impact of Farm Forestry Layouts*', Revell, G. Leonard, L. & Delaney, J. (2000) RIRDC/JVAP, CAL-2A. ,
- 21 One final question:
What would you consider 'Best Practise' in terms of farm forestry planning and design?
- 22 Is there any thing further you'd like to add or questions you'd like to ask?

Thanks for your time.