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Plantation-grown eucalypts for high-value solid-wood products: a decision support framework

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Summary

This report presents a framework for the selection and timely application of decision support systems (DSS) to the management of eucalypt plantations for high-value solid-wood products, that is, sawn timber and veneer free of value-limiting defects.

The framework is intended for use by forest owners and investors, managers and/or processors, rather than scientists. The framework is designed to:

- provide an overview and context for the information required at each stage of product development,
- assist discussion and interaction between those working at each stage of product development, and
- identify the information that needs to flow between each stage of product development.

Further development of the framework will consider more fully the information needs and associated feedback loops at each stage of product development. This will include:

- a review of current DSS and existing knowledge gaps,
- an update on progress within the current CRC for Forestry towards new DSS, and
- identification of where and how this progress will be integrated, and ultimately accessed, within the framework.

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Introduction

In Australia there is a growing interest in sourcing high-value solid-wood products – that is, sawn timber and veneer free of value-limiting defects – from hardwood plantations. This is largely due to concern regarding the finite nature of native forests for timber production, a growing awareness of non-timber outcomes (carbon storage, biodiversity and amenity) and, not least, an increase in the proportion of this potential wood resource now protected in reserves. Furthermore, recent improvements in silviculture and processing technologies have presented new opportunities to develop a plantation-grown equivalent to the timber products traditionally sourced from native forests.

This paradigm shift represents a significant challenge to forest managers given:

- the large temporal and spatial scales involved in forest management,
- the dynamic nature of stand performance, and
- broader environmental, regulatory, economic and technological considerations.

To optimise the social, economic and environmental outcomes in the above context, forest managers have at their disposal a growing arsenal of planning or decision support systems (DSSs). Typically computer based, these systems facilitate the integration of data stores with analytical and operational models to provide expert systems for selecting appropriate courses of action.

The decision support framework

A framework for the selection and timely application of DSS to the management of hardwood plantations (eucalypts) for high-value solid-wood products is presented in Figure 1. For either a proposed or existing stand, (a) several components of the framework may run simultaneously depending on the entry point and (b) the entry point may vary depending on the user, though, ultimately, each component must be considered.

Whilst the end goal is high-value solid-wood products, any framework pertaining to wood production, including the one presented in this report, must consider the full range of products. This includes lower quality and/or lesser value products arising over the course of a rotation, such as those following later-age thinning operations[1] where prescribed, which, over the course of a single rotation, typically constitute a significant proportion of the total merchantable volume. This is particularly important where, for example, the premium paid for high-value solid-wood products, and/or the volume recovered at the end of a rotation, are not sufficient such that a direct regime[2] can be applied and the lower quality and/or lesser value products disregarded.

[1] A later-age, or 'commercial', thinning operation involves delaying thinning until a merchantable volume is available.

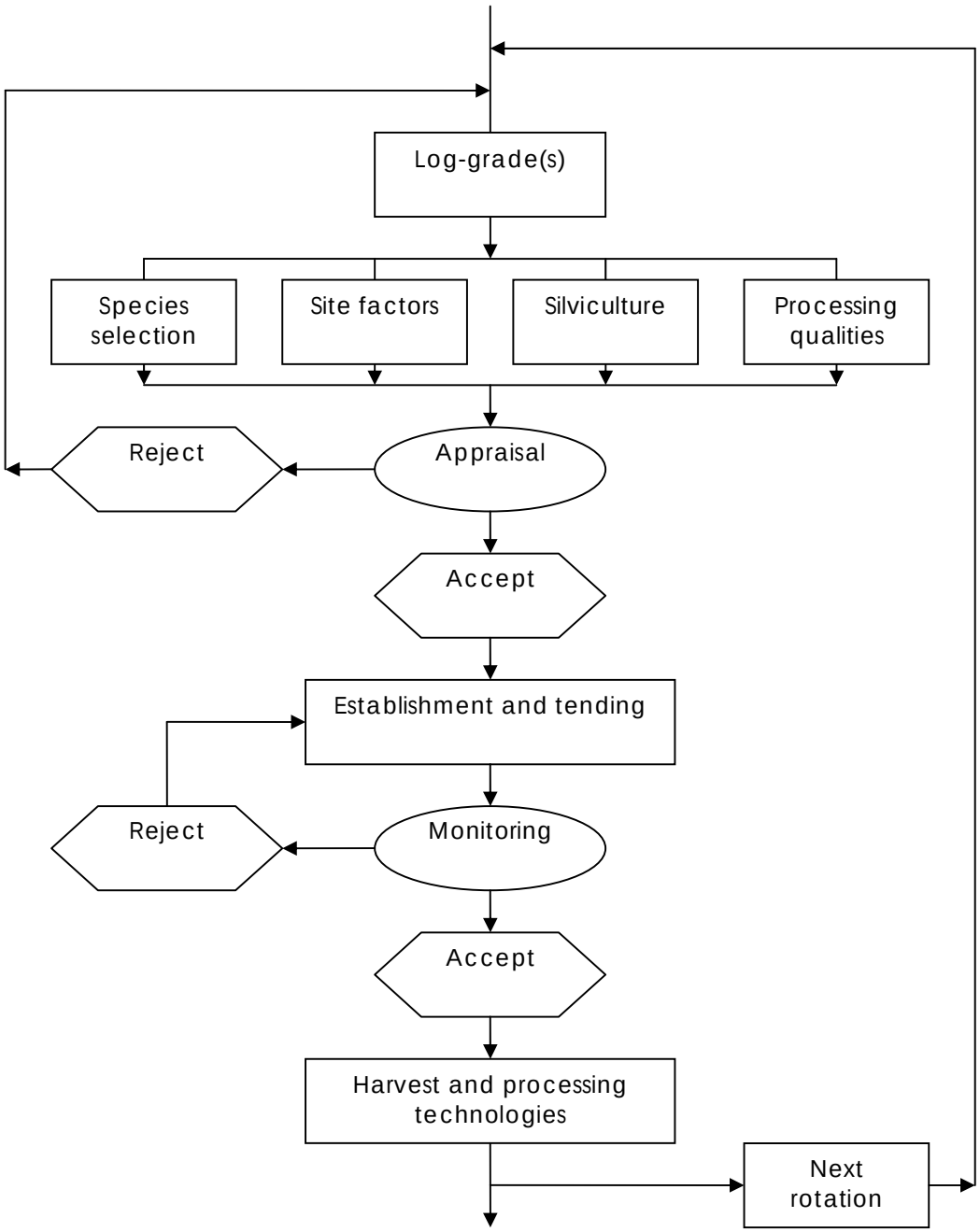
[2] A 'direct' regime may include thinning 'to waste', typically applied early in the rotation, when the volume and/or piece size are insufficient to return a profit on the thinning operation.

The framework is intended for use by forest owners and investors, managers and/or processors, rather than scientists. The framework is designed to:

- provide an overview and context for the information required at each stage of product development,
- assist discussion and interaction between those working at each stage of product development, and
- identify the information that needs to flow between each stage of product development.

The framework applies at the site level, the end goal being site-wide and/or estate-wide optimisation. It is expected that each stage of product development will be serviced by existing and/or new decision support systems resulting from previous and/or current CRC and/or private-sector endeavours.

Figure 1 Decision support system framework



Log-grade(s)

The choice of log-grades sought (pulpwood, knotty and/or clear sawlogs and/or veneers) is a function initially of existing and/or anticipated markets and product value. The volume and/or quality of each log-grade at rotation will then be affected by species selection, site factors, silviculture and processing qualities.

Species selection

The species must be compatible with the log-grades sought and well matched to the site(s) available. Other factors that must also be considered include:

- the impacts of genetic improvement,
- the availability and/or quality of seed (including ease of propagation) and/or seedlings,
- the response to establishment practices and longer term silvicultural needs, and
- processing qualities.

Site factors

It is critical to understand the nature of and variation in key factors driving site productivity (temperature, rainfall and evaporation, soil water and nutrient supply, etc.) and their influence on growth rates, stem form and wood quality. This in turn moderates species selection and the log-grades sought at clearfall, whilst defining appropriate silviculture. Additional risks, biotic (e.g. pests and diseases) and abiotic (e.g. fire regimes and windthrow), may also be considered at this stage.

Silviculture

Tree and stand characteristics (growth, stem form and wood quality) that are linked to the log-grades sought, species selection and site factors, and the relationships between silviculture and processing qualities, determine appropriate silvicultural management, notably establishment practices, weed control and nutrition, pruning and/or thinning regimes.

Processing qualities

Species selection, site factors and silviculture will influence processing qualities. This represents a complex series of interactions, each with implications for the choice of log-grade(s) and the total volume and/or quality of log-grade(s) recovered.

Appraisal

Prior to planting, an appraisal of the scheme should take place in which the anticipated silvicultural and economic outcomes are assessed relative to any associated risks (see *site factors* above). This should include careful scenario or 'what if' analysis of the implications of likely improvements in silviculture or processing technologies, and/or changes in markets (new opportunities) during the lifetime of the scheme. This is critical given the long-term nature of forest investment schemes where, typically, high initial investment costs are carried over 10 to 15 years prior to any return on that investment.

Establishment and tending

Once the scheme is deemed satisfactory, establishment and a program of tending (based on the silvicultural regime determined above) should commence.

Monitoring

Monitoring (stand performance, quality standards and sustainability indicators) and, where appropriate, operational certification, ensure that progress towards to the original aims of the scheme are considered at key stages of each rotation (pre- and post-planting, pre- and post-pruning, pre- and post-thinning, and pre-harvest). This should include careful analysis of any improvements in silviculture, processing technologies and/or changes in markets (new opportunities) since inception of the scheme. Where necessary, steps may be taken to adjust silvicultural management and/or the volume and/or quality of the log-grades sought in response to any new opportunities.

Harvest and processing technologies

The final harvest or clearfall (may also include thinning operations) should be scheduled as per the silvicultural and economic considerations described above. At harvest, consideration should be given to appropriate harvest, transport and processing technologies, and also, any advances made in their effectiveness since the inception of the scheme, and any new opportunities these may present.

Conclusion

The framework described above is designed to (a) provide an overview and context for the information required at each stage of product development (b) assist discussion and interaction between those working at each stage of product development and (c) identify the information that needs to flow between each stage of product development.

The next report will consider more fully the information needs and associated feedback loops at each stage of product development. This will include:

- a review of current DSS and existing knowledge gaps,
- an update on progress within the current CRC for Forestry towards new DSS, and
- identification of where and how this will be integrated, and ultimately accessed, within the framework.