

BIOMASS FOR BIOENERGY

Woody Biomass Crops Factsheet

What are woody biomass crops?

This factsheet examines what woody biomass crops are and could mean for renewable energy generation in NSW. Biomass crops are plants grown with the main purpose of harvesting the biomass fibre for energy generation. The concept of biomass crops is not new, with extensive research and interest internationally, including the International Energy Agency¹. In Australia, work carried out by the Future Farm Cooperative Research Centre² highlighted the significant potential for regional areas of Australia, including NSW. Delta Electricity has investigated growing woody biomass crops (eucalypt mallee trees) to supply their power station on the NSW Central Coast. Although there are several co-benefits associated with woody biomass crops, there has been limited uptake in Australia. Key factors determining their viability include selecting the right species for a region, proximity to processing facilities and provision of co-benefits.

Species selection

Many native species have already been identified as having potential especially for low rainfall areas as part of programs such as Florasearch³ in the early 2000s. These programs considered growing woody vegetation, including mallee species, for various product outcomes including bioenergy. However, only a few field trials have been conducted in NSW, with insufficient geographical coverage to inform widespread adoption of biomass crops. Some of the desirable features of selected species include fast growth, hardiness, resistance to drought and frost conditions, and potential for coppicing.

Mallees are multi-stemmed trees that are able to re-shoot or coppice numerous times. Most mallee species grow in very harsh and often semi-arid conditions. Blue mallee (*Eucalyptus polybractea*) is an example of such a species that has been cultivated extensively. Some mallees grow under higher rainfall conditions, though these have not

been tested or cultivated extensively. An alternative to mallees is eucalypts that would normally take on a tree habit but can also be managed on very short rotations. A disadvantage of the tree-habit eucalypts is that they have variable coppicing ability and decline in productivity per hectare after about two or three rotations. Acacias are another possibility, as they generally have rapid early growth. A further advantage of acacias is that they fix nitrogen, leaving open the possibility of alternate rotations of acacia or mixed-species cropping. A disadvantage of many of the acacias is that they generally do not coppice; however, some do re-shoot from the roots (root sucker).



Figure 1: Eucalypt mallee planting in Condobolin, NSW

Opportunities for landholders

Planting of woody biomass crops provides a significant opportunity for farmers to diversify their portfolio by using less productive and marginal areas on their farm. Biomass crops may also be an attractive option for re-vegetation in degraded mining lands. In NSW there may be opportunities in the

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Hunter Valley and also in the Central Tablelands.



Figure 2: *Acacia species* © NSW DPI

In addition to revenue from the sale of the biomass, there are a range of co-benefits that can be realised with the strategic placement of such crops, including:

- Livestock grazing between and below trees following establishment;
- Provision of windbreaks;
- Improved biodiversity outcomes;
- Increased carbon sequestration in the landscape;
- Soil improvement.

Short harvest cycles, typically 3-5 years, afford landholders flexibility to manage their land (in line with adaptive farm management), which may be increasingly important as the climate changes. Mallees typically have 50% of their carbon stored in their large root systems. As roots are not harvested, carbon sequestered as a result of the biomass crops can be significant, even following frequent harvest cycles.

What makes woody biomass crops suitable for renewable energy generation in NSW?

Woody biomass crops may be used for a variety of renewable energy applications. The use of woody biomass for electricity generation in power stations is of considerable interest, as it can substitute for coal and burn in the same furnace (co-firing). Establishment of dedicated biomass crops allows an increase in the amount of co-firing possible in NSW. Densification of the biomass (e.g. pelletising) allows for an increase in the amount of biomass that can be co-fired with coal compared to the use of raw biomass. Woody biomass crops may also be used for electricity generation at a smaller scale (e.g. hybrid solar-biomass systems), potentially allowing for regional communities in NSW to become self-sufficient. Use of local biomass for renewable energy generation contributes to energy security and allows for a gradual transition into solar and wind systems, which currently rely on expensive battery setups. Dedicated biomass crops would benefit various lands types and ownership and result in the creation of long-term job opportunities for regional NSW, across all parts of the supply chain (growing, harvesting, transporting and processing).

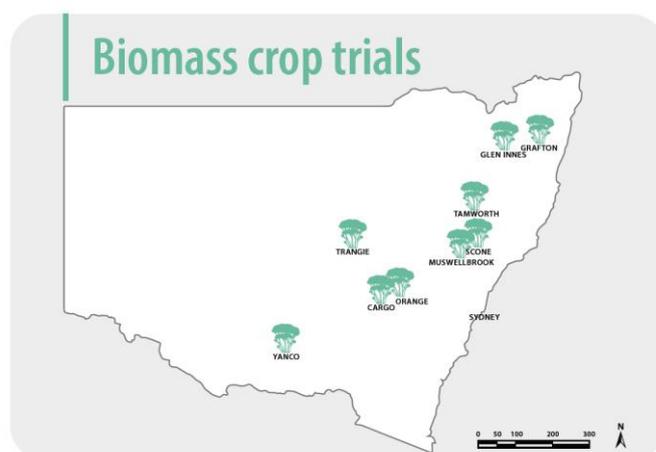


Figure 3: Location of biomass crop trials in NSW

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What research is NSW DPI doing on woody biomass crops?

NSW DPI Forest Science has partnered with CSIRO Australian Tree Seed Centre to investigate the productivity of prospective woody biomass crops grown under a variety of conditions. Trial sites will be mostly set up at DPI Research Stations, but also farm and mining sites (Figure 3).

Biomass crops	Species that will be trialled
Mallees	<i>E. castrensis</i> , <i>E. horistes</i> , <i>E. infera</i> , <i>E. polybractea</i> , <i>E. pumila</i> , <i>E. viridis</i> .
Eucalypts (tree habit)	<i>C. glauca</i> , <i>C. maculata</i> , <i>E. benthamii</i> , <i>E. camaldulensis</i> , <i>E. cladocalyx</i> , <i>E. macarthurii</i> , <i>E. moluccana</i> , <i>E. occidentalis</i> , <i>E. spathulata</i> .
Acacias	<i>A. dealbata</i> , <i>A. salacina</i> , <i>A. saligna</i> .

Table 1: Species included in the DPI research trials

The woody crops being trialled are several mallee species, more traditional forestry species and Acacias (Table 1). Blue mallee (*Eucalyptus polybractea*) will be used as a benchmark or control at each site as it is well established as a biomass and/or carbon sequestration species in southern Australia.

Potential impacts of the research

Improved knowledge on the performance of biomass crops may have the following impacts:

- Providing landholders with field-derived information on the productivity of a range of woody biomass crops, for a variety of sites with different climatic and biophysical properties;
- Demonstrated experience in the establishment,

management and harvest of the woody biomass crops, including costs;

- Quantification of the potential long-term carbon sequestration and other co-benefits of the introduction of biomass crops in the landscape.

For further information, please contact

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References

¹ <http://task43.ieabioenergy.com/projects/perennial-biomass/>

² Future Farm Industries CRC (2010) Energy Tree Crops: Renewable energy from biomass could be the driver to large scale adoption of woody crops and to structural improvement to dryland agricultural systems in Australia.

³ Hobbs, T., M. Bennell, D. Huxtable, J. Bartle, N. C. N. George, W. O'Sullivan and D. McKenna. 2007. Potential agroforestry species and regional industries for lower rainfall southern Australia. In Pub No. 07/082. FloraSearch 2, Canberra, p 120.

