



Forwarding technologies to collect harvesting residues for bioenergy use

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Introduction

The CRC for Forestry's 'harvesting and operations' program has conducted several studies examining the harvesting residues left on-site after conventional pulpwood and sawlog harvesting in Australian pine and eucalypt plantations. These studies (Bulletins 15, 16, 18, 19 and 23) indicated that in some operations and stands, the level of residual logs and branches left on the site was high, and could be considered as a potential resource for bioenergy generation. A preliminary cost analysis by the CRC for Forestry has shown that integrated harvesting methods (biomass combined with industrial wood recovery) are a viable option to recover these residues. This bulletin contains technical and economic information about suitable forwarder bin designs used overseas for extracting harvesting residues, and their potential application in Australia.

Available technology

Compared with solid logs, harvesting residues such as logs, tops, branches and needles/leaves, have a low bulk density. Because of this, it is necessary to modify the design of a forwarder's bin to maximise payload. Table 1 describes the technical and economic information of available biomass forwarding technology. Figures 1 and 2 show the Dutch Dragon press collector and Italian biomass collector. Figures 3 and 4 illustrate the ABAB carrier, and one of the Ponsse collectors is presented in Figure 5.



Figure 1. Dutch Dragon press collector (unloading)



Figure 2. Biomass collector Monchiero & C. Snc

Table 1. Modified forwarders for biomass collection

Model/type	Dutch Dragon press collector	ABAB carrier	Ponsse BTS (and BIO)
Abilities	<ul style="list-style-type: none"> • Transports a high quantity of residues • Presses materials during loading • Easy set-up and dismantling 	<ul style="list-style-type: none"> • High volume of transport material per hour • Effective unloading • Easy to mount onto a variety of forwarders 	<ul style="list-style-type: none"> • Increases payload by 50% per turn by compressing the residues • Saves transport due to loads not exceeding the outer diameter of the vehicle • Fixed heel for better loading control • Optional load optimiser scale
Load capacity (m3)	40-48	30-35	25-30
Payload (GMt)	10	9	7-8
Total weight of collector (kg)	3975-4015	3000-5400	N/A
Reference	www.dutchdragon.nl	www.allanbruks.se	www.woodbusiness.ca



Figure 3. ABAB carrier (transporting)



Figure 5. PONSSE BIO



Figure 4. ABAB carrier (transporting) (Eberhardinger et al., 2009)

Only limited research has been carried out on the combined use of carriers and forwarders for collecting harvest residues. The ABAB carrier, mounted on an Eco Log 554 forwarder, has been tested in Bavarian pine plantations in Germany (Eberhardinger et al. 2009). From two trial sites, harvest volumes of wood used to harness energy were about 185 and 260 loose cubic metres per ha respectively. After felling and processing, logs were transported by forwarders using standard bins. Setting up the ABAB carrier for residue extraction (crown, tops and branches) took 34 minutes. The average productivity for biomass recovery was about 11 GMt per hour for a range of forwarding distances from 140 m to 350 m. Taking into account the cost of both the forwarder and ABAB carrier, (85 Euro/h or 108 AUD/h), the average cost for

biomass recovery was 7.7 Euro/GMt (9.8 AUD/GMt). The study also confirmed that the ABAB carrier could increase average payloads when transporting residues (6.28 GMt), compared with a standard bin (4.79 GMt). No studies have been completed on the other types of carrier combined with a forwarder to collect harvest residues.

Potential application in Australia

As interest grows in Australia in using plantation residue for energy, plantation owners and managers need to identify economical methods to harvest and handle residues. In some Australian cut-to-length at the stump operations in pine or eucalypt plantations, the average amount of residual material was found to be about 100 GMt/ha (Bulletins 15, 16, 18, 19 and 23). The Bruks

mobile chipper and Pinox slash-bundler have been tested by the CRC for Forestry for residue collection, but there is real scope for considering modified forwarder bins as a viable option to integrate biomass recovery with conventional harvesting. Conventional forwarders have been tested near Tumut (NSW) for extraction of residual stemwood biomass (FibrePlus) in mixed loads with pulpwood (Bulletin 18). The next step in this research would be to test whether modified forwarder bins can improve operational efficiency in recovering residues in Australian operations.

An important consideration on many Australian sites is the retention of nutrients and organic matter. Recovery of biomass on these sites would need to focus on recovering the woody components while retaining on-site the high nutrient-content needles or leaves and small branches.

Take-home messages

- Previous CRC for Forestry studies have indicated that a significant volume of harvesting residue is left on-site after some operations, which could potentially be used as a resource for bioenergy generation.
- Modified forwarder bins could be tested under Australian conditions to improve the efficiency of biomass recovery integrated with conventional harvesting.

More information

CRC for Forestry website:

<http://www.crcforestry.com.au/research/programme-three/index.html>

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