Estimating decay rates for *Eucalyptus obliqua* coarse woody debris in Tasmania using a chronosequence approach

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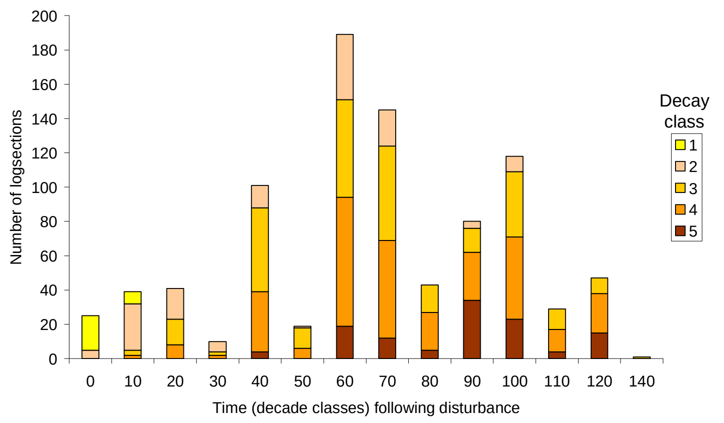
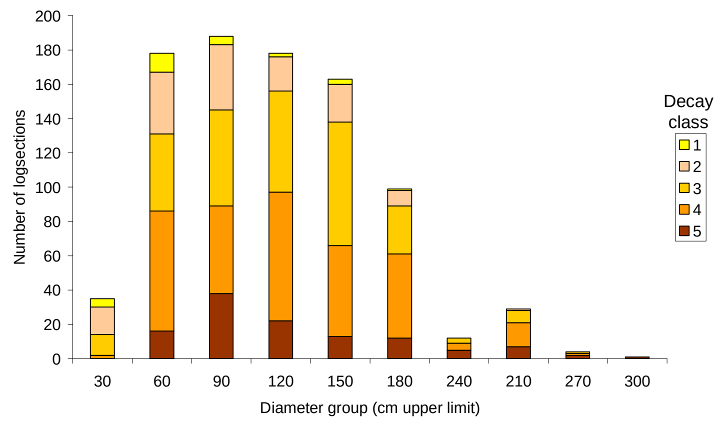
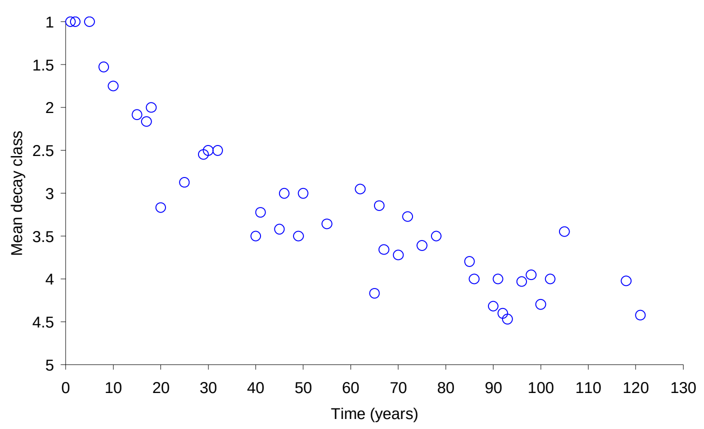
In this study we examined fallen *Eucalyptus obliqua* logs (coarse woody debris, CWD), at a range of wet forest sites in Tasmania's southern forests that represented different lengths of time since the wildfire or logging disturbance event that generated the CWD. We assigned log-sections to decay-classes, and plotted the relationship between decay-class and time since disturbance. Since decay-class is directly related to relative mass, and since mass loss is a measure of decay, we have been able to develop an overall decay rate estimate for *E. obliqua* CWD. We have now incorporated decay-class residence times derived from this relationship into our CWD models.



1. Data collection

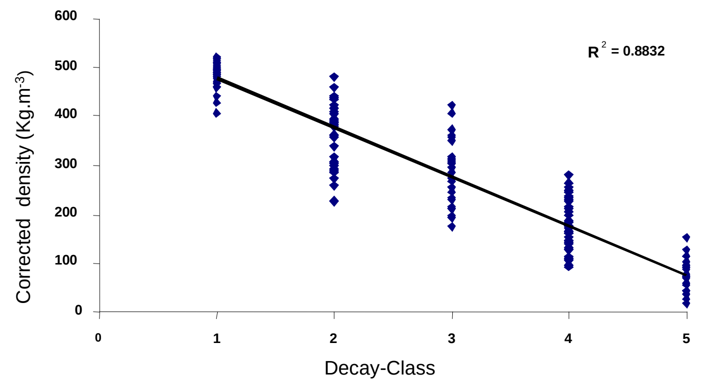
In total, 415 logs were examined, spanning about 150 years of post-disturbance decay (left). Since one log may host more than one decay-class and may cover a range of diameters, multiple sample-points were examined on many logs, resulting in records for 887 'log-sections' ranging in diameter from 10 cm to nearly 300 cm (right). Each log-section was assigned to one of five decay-classes based on external characteristics.





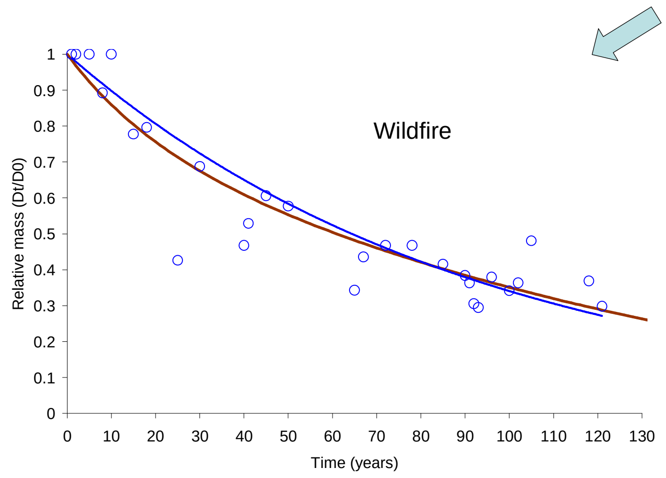
2. Data conversion

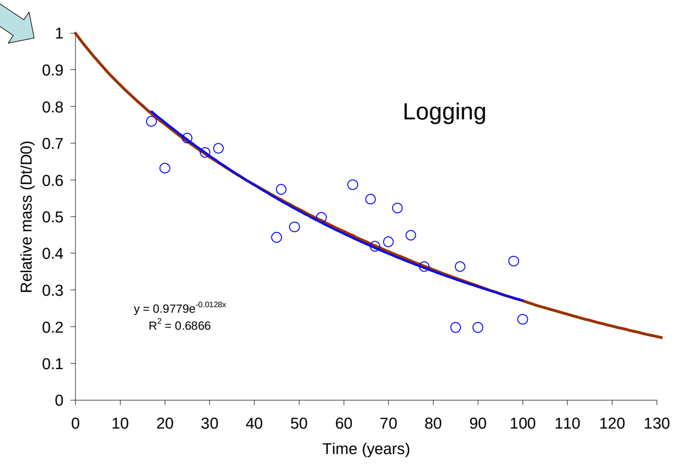
Mean decay-class values were calculated for every year post-disturbance represented by one or more log-sections in the data-set (left). In doing this, it was found that there was no statistical justification in stratifying the data by diameter-class. These mean decay-class values were then converted into relative mass values, employing the relationship between decay class and wood density derived from related studies (right).



3. Curve-fitting

Negative exponential curves (shown in blue on the charts to below left and right) were found to be the best fit for the converted data. CWD arising from logging operations (below right) was found to decay at a slightly faster rate than CWD arising from wildfire (below left).





4. Model tweaking

The CWD dynamics model developed for *E. obliqua* was 'seeded' with undecayed CWD, and the decay-class residence times used in the model were tweaked until the model's outputs (shown in red on the charts to left and right) most closely matched the exponential functions describing the decay curves calculated from this study. Further exponential functions were then derived through fitting curves to these model outputs.

5. The end result

Decay of *Eucalyptus obliqua* CWD in Tasmanian lowland wet eucalypt forest can be modelled as a negative exponential function (see table to right), implying that rates of mass loss are proportional to remaining mass. CWD derived from logging appears to decay faster than CWD derived from wildfire, necessitating multiple decay functions. The decay rates for *E. obliqua* CWD are slower than have been found for most other CWD studies, meaning that the time taken for CWD to decay is proportionately longer. These data can now be used in models of CWD dynamics that can predict changes in CWD volume or mass under a range of disturbance scenarios.

	Wildfire		Logging	
	Study data	Model	Study data	Model
Decay rate constant *k*	0.0108	0.0106	0.0131	0.0151
Strength of fit of curve to data (R^2)	0.7715	0.9973	0.6861	0.988
$T_{0.50}$ (years)	67	68	56	49
$T_{0.95}$ (years)	280	286	232	201
$T_{0.99}$ (years)	429	437	355	308
Res. time DC 1 (years)	-	8	-	8
Res. time DC 2 (years)	-	30	-	30
Res. time DC 3 (years)	-	75	-	45
Res. time DC 4 (years)	-	42	-	32
Res. time DC 5 (years)	-	35	-	30

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