Proc. Ecol. Soc. Aust. (1983) **12**, 174-75.

Effects of prescribed burning on forest-floor microclimate and on subsequent rates of litter decomposition in a *Eucalyptus pauciflora* forest

Abstract

A prescribed burn in Eucalyptus pauciflora forest increased the amount of solar radiation absorbed by the forest floor, which in turn increased surface soil temperatures and the rate of drying of the litter layer after rain. The rate of decomposition of leaf litter was significantly reduced on burnt sites. The practical and ecological implications of the rapid re-accumulation of litter which occurs after prescribed burning in snowgum forests are briefly discussed.

Prescribed burns applied at intervals of about 6 years are used to reduce fuel weights and hence the risk of wildfire in sub-alpine forests of E. pauciflora (snowgum) in S.E. Australia. The influence of such fire regimes on soil conditions and subsequent rates of litter decomposition are important with respect to: (1) the cycling of plant nutrients via litter, and the loss (particularly in smoke) of nutrients accumulated in understoreys, litter and surface soil; (2) the rate of re-accumulation of fuel for subsequent fires.

This report describes changes in temperature and moisture conditions of the forest-floor, and alterations to the pattern of litter decomposition induced by a prescribed burn in a stand of E. pauciflora in the Brindabella Range, A.C.T. The autumn (April) burn was of low intensity (350-450 kWm^{-1}) in dry 7-year-old fuels and consumed 10.5 of the 16.1 t ha^{-1} of fine (<8 mm diameter) litter present. Virtually all the understorey vegetation (mostly Daviesia mimosoides and Poa caespitosa) was either burnt or defoliated during the fire.

Combustion of litter and understorey resulted in increased absorption of solar radiation by the forest-floor, thus increasing temperatures (Table 1) and the rate of drying of litter after rain (Table 2). These effects of fire are most pronounced on exposed sites (Table 2) and decline over the subsequent 1-2 years as a cover of litter and understorey redevelops.

Table 1. Maximum daily temperatures (°C) under (initially comparable) adjacent unburnt and burnt snowgum forest. Measurements taken during the initial month after burning in autumn (April). SE of mean (n = 4) in parentheses.

	Clear day		Overcast day	
	unburnt	burnt	unburnt	burnt
Ambient (screen)	20.3		15.3	
Litter, surface	33.2 (4.2)	36.4 (4.0)	19.6 (0.8)	21.0 (0.9)
Soil, 2 cm	21.0 (2.1)	33.2 (4.0)	17.4 (0.7)	21.4 (1.0)
Soil, 5 cm	18.1 (1.1)	22.2 (1.6)	16.3 (0.7)	17.6 (0.6)

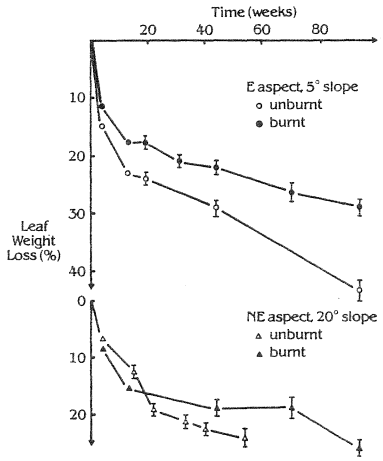
After burning both the rate of decay of freshly fallen leaves (Fig. 1, vertical bars are SE of the mean, n = 10) and the total amount of litter decomposing (rate multiplied by the weight of accumulated litter) were reduced. The effect of fire

on litter decomposition appeared to be greater on sheltered (easterly) aspects (Fig 1) where litter moisture contents remained higher and thus decomposition was more rapid under unburnt conditions.

Table 2. Typical moisture contents (% O.D.W.) of surface leaf litter at different stages of drying on burnt and unburnt snowgum sites. SE of mean (n = 10) in parentheses

	Sheltered Aspect		Exposed Aspect
	unburnt	burnt	burnt
Moist	161(16)	128(8)	54(5)
Drying	66(11)	35(7)	20(1)
Dry	19(1)	13(1)	9(1)

Fig. 1. Effect of prescribed burning on decomposition of snowgum leaves.



The slow rate, and small total amount of litter decomposing in the initial 2-3 years after prescribed burning in these forests, leads to rapid re-accumulation of fine fuels to near-equilibrium weights (16-20 t ha^{-1}) within 6-8 years (authors, unpubl.). This rapid re-accumulation of litter has important practical and ecological implications. Firing at about 6-yearly intervals is required to maintain litter weights at < 16 t ha^{-1}, the weight considered 'safe' from a fire control point of view. Such a fire regime would, however, result in the loss from the forest of about 50% of the organic matter and nitrogen transferred in litterfall (1).

References

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