Sustainability of the Armidale fuelwood industry on the Northern Tablelands of New South Wales: resource yield, supply, demand and management options

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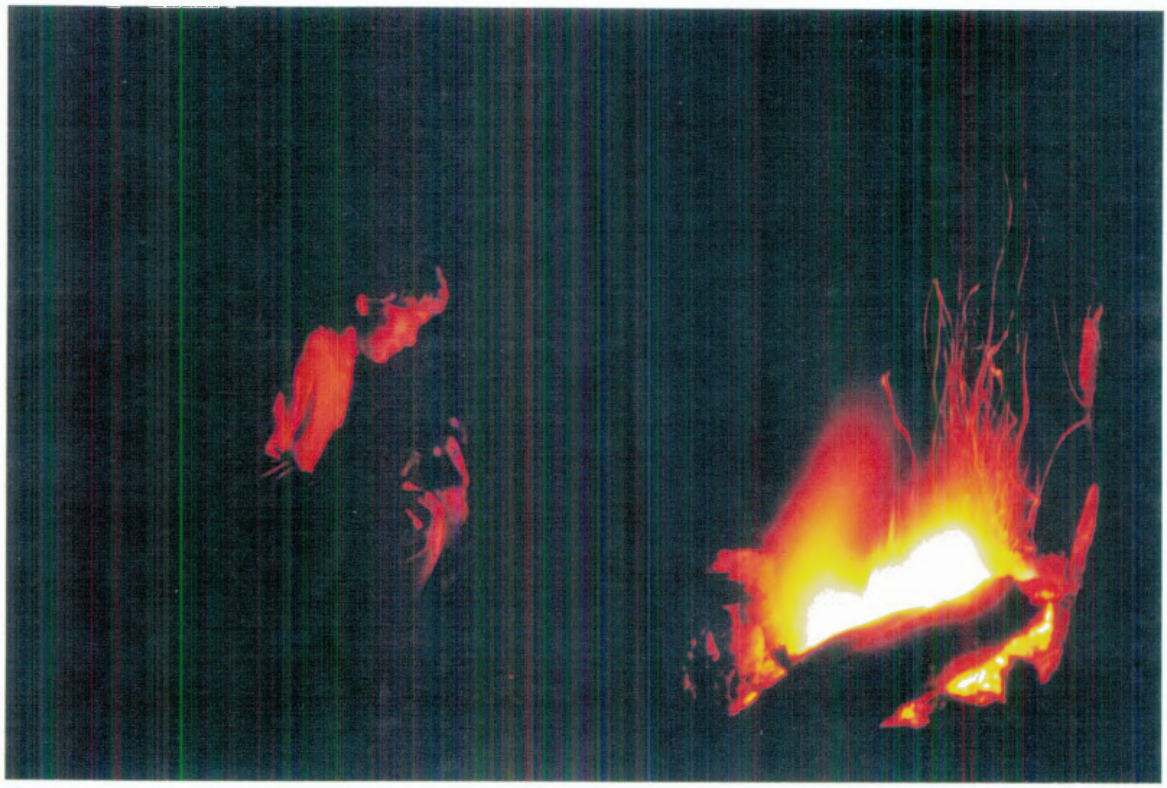

Set the match. Watch how the fire begins
A wince, a flicker, blue,
and full of gold at the core.
Spreading, it grips like teeth,
draws air like breath.
It has work to do,
centuries of deadwood for raging through.
Thats how the fire begins.

from "Bid Me Strike the Match and Blow"

Judith Wright, 1971.

Declaration

I declare that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I declare that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

Julian Wall.

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Abstract

Fuelwood is a significant form of home heating in eastern Australia. Demand is increasing in response to the popularity and efficiency of modern woodheaters, yet supply around some major centres such as Adelaide and Canberra is not sustainable under current management. The industry has often been likened to a mining operation. Cutting tends to target dead timber with little thought for replacement. Extraction is usually *ad hoc*, and many roadside reserves and other public lands are degraded by unregulated cutting.

Fuelwood is the major form of domestic heating in Armidale and surrounding Northern Tablelands. Winters are cold and heating is essential. Regional consumption is 31 000 $t.yr^{-1}$, of which Armidale consumes 18 000 $t.yr^{-1}$. In the late 1970s and 1980s, fuelwood was in plentiful supply due to dieback and broadscale clearing. As dieback intensity and clearing have slowed in recent years, however, supply has become a concern. Over 80% of fuelwood is extracted from dead eucalypts on private land, none of which are actively replaced. Supply may be unsustainable in certain areas, because 60% of wood merchants and urban fuelwood collectors claim that existing supplies are being depleted, and they are forced to travel further from Armidale to harvest dead wood. The average price of delivered fuelwood ($65 t^{-1}) is too low to ensure long-term supply by encouraging landholders and merchants to grow fuelwood commercially, and there is a general community perception that dead trees are expendable. Dead fallen logs and branches are absent from some local stands as a result of repeated visitation by private collectors. Given the structural and functional importance of dead timber in forest ecosystems, and the lack of environmental codes of conduct with respect to its removal, Armidale's fuelwood industry may be ecologically unsustainable in stands where dead wood is regularly depleted.

This thesis investigates the hypothesis that ecological sustainability can be ensured within the fuelwood industry through appropriate forestry practice. The local timber resource is first estimated using a three-stage forest inventory including tree mensuration, stand inventory and regional timber assessment. The yield of eucalypt stands is assessed using tree-stump aging, tree-ring analysis and permanent growth plots, and the yield of native plantings dominated by *Acacia*, *Casuarina* and *Eucalyptus* is determined using volume-age analysis. Silvicultural and institutional practices best suited for managing Armidale's timber resource are reviewed, and preliminary economic analyses are undertaken to determine the financial viability of on-farm fuelwood projects.

The Armidale region contains a total of 31.7 Mt of standing fuelwood biomass, much of which is inaccessible. About 2.4 Mt within 172 km^2 of eucalypt forest is considered suitable for fuelwood extraction, located in relatively large stringybark-dominated stands with a growth increment ranging from 2-3 $t.ha^{-1}.yr^{-1}$. Armidale's entire demand could be drawn from this forest base on a sustained yield

basis. The yield of native trees in shelterbelt plantings is encouraging: up to 10 $t.ha^{-1}.yr^{-1}$ can be achieved after 20 years. It follows that 2500 ha of farmland dedicated to agroforestry could also sustain Armidale's fuelwood demand in the long-term, obviating extraction from native forest and woodland.

Two broad forestry practices for fuelwood production are suggested within a framework of sustainable pastoralism on the Northern Tablelands: group-selection silviculture in native forest with livestock exclusion and retention of dead timber; and agroforestry on pasture land (production shelterbelts and coppice-rotation tree plantations). Given a parallel strategy of industry regulation, including a price increase to encourage farmers to grow trees for fuelwood, these practices could ensure ecological sustainability in the fuelwood industry. On-farm timber volumes would be maintained or increased, biological conservation encouraged, and agricultural income improved.

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