NEFA BACKGROUND PAPER Prepared by: Dailan Pugh, 2014

Logging Dieback is the dominant form of Bell Miner Associated Dieback affecting forests in north-east NSW.

Bell Miner Associated Dieback (BMAD) is spreading through our forests as a consequence of logging opening the canopy and promoting understorey dominance by lantana. It is principally a problem of wet forests and gullies, though is increasingly affecting surrounding forests subject to lantana invasion. For over two decades the Forestry Corporation have intentionally procrastinated over the causes and management of BMAD so that they can go on logging affected and susceptible stands (see **The Battle to Redress Logging Dieback**).

The “moist hardwood” forests have long been recognised as a management problem due to difficulty in achieving regeneration of the eucalypt component following logging as a result of competition from rainforest elements or weeds (e.g. van Loon 1966, Forestry Commission 1982, King 1985). The NSW Forestry Commission (1982) notes *“The Moist Coastal Hardwood types can be among the most difficult in the state to regenerate successfully. The dense rainforest understorey precludes hardwood regeneration without major disturbance; some of the most important species are relatively slow growing in their younger stages; weed growth after disturbance can be prolific and vigorous.”* The more developed the rainforest component, the harder it is to achieve eucalypt regeneration (i.e. Forestry Commission 1982).

State Forests (1995) identified moist hardwood forests as 'Potentially High Yielding, Difficult to Manage Forest', one of three categories (along with 'Low Wood-Yield Forest' and 'Geographically Remote Forest') for consideration for exclusion from the core productive forest estate on the basis that:

> *"Under the current restrictions that apply to logging intensity, many past and current areas of potentially high wood productivity such as moist hardwood and rainforest ecotone forest cannot be satisfactorily regenerated back to the same stand level of sclerophyll species following logging. Generally, the light logging practised in these forests has the effect of promoting either the mesophyll (rainforest) component or a viney, weedy component. Either way, the effect is one of reducing the sclerophyll component and lowering commercial productivity."*

Bell Miner Associated Dieback (BMAD) is an additional constraint to the successful management of these forest types. Serious consideration needs to be given to the wisdom of trying to continue to manage these forests for industrial logging.

The direct causes of BMAD are a variety of species of psyllids. Psyllids are small (usually <5 mm) aphid-like invertebrates, the nymphs of which suck sap directly out of leaves and cause defoliation. Continued feeding on the replacement foliage results in a continuing demand on the tree's carbohydrate reserves, weakening the trees and making them more susceptible to secondary stresses such as wood borers and fungal decay (Stone 1999). The reduced vigour of the root system increases the tree's susceptibility to soil fungal pathogens and moisture stress (Stone 1999).

For protection the psyllid nymphs secrete waxy or sugary coatings called lerps (e.g. Campbell and Moore 1943), which are important food sources for a range of other invertebrates, birds and arboreal mammals. Predation usually controls populations of psyllids. Though it has long been recognised that outbreaks of psyllids can occur in the presence of Bell Miners (i.e. Campbell and Moore 1943, Clarke and Schedvin 1999, Stone 1996; Stone 2005), and that the removal (Loyn et. al. 1983, Clarke and Schedvin 1999) or control (Stone 1996) of Bell Miners allows other predators to control the psyllids.

Bell Miners are thought to feed on other insect predators (i.e. Campbell and Moore 1943) and are known to aggressively exclude most other avian predators (i.e. Loyn et. al. 1983). Bell Miners exhibit aggressive interspecific territoriality, meaning that they co-operate in attacking or mobbing both potential competitors and nest predators to drive them from their colonies (i.e. Poiani 1991), resulting in *"almost total exclusion of all other avian species from the colony's territory"* (Clarke and Fitz-Gerald 1994). Bell Miners also exhibit selective foraging behaviour when feeding on psyllids, frequently removing their lerp casings and leaving the nymphs behind intact, and are thus likely to have a reduced impact on psyllids relative to other predators (Loyn et. al. 1983, Haythorpe and McDonald 2010).

Bell Miners appear to have a preference for a disrupted eucalypt canopy and low dense understories for nesting sites (Stone et. al. 1995, Stone 1999, Stone 2005, Haywood and Stone 2011), and a permanent source of water (Stone 1999). They like to build their nests about two metres above the ground (i.e. Clarke 1988). It is likely that an open midstorey better enables Bell Miners to control the site (Stone et. al. 1995). Bell miner colonies can occur in a range of eucalypt forest types but typically in mesic eucalypt forests and often on relatively fertile sites (Stone 2005).

On the north coast Bell Miners are strongly correlated with lantana (i.e. NSW Scientific Committee 2008, St.Clair 2009) though also occur where watervines smother regrowth. Lantana itself is a weed of national significance and a key threatening process. The NSW Scientific Committee note *"There is a strong correlation between Lantana establishment and disturbance ..., with critical factors being disturbance-mediated increases in light and available soil nutrients".* Lantana invasion is enhanced by the opening of the canopy by logging and by burning (i.e. Gentle and Duggin, 1997, Raizada and Raghubanshi 2010). As noted by Wardell-Johnson *et. al*. (2006) "*the proliferation*

of dominant understorey weeds, such as Lantana (Lantana camara), in the north-eastern region of NSW has largely been attributed to the disturbance caused by logging and associated activities".

Raizada and Raghubanshi (2010) found that germination of the numerous lantana seeds that survive is enhanced along with seedling vigour by fires, commenting *"that the use of fire as a management option to control L.camara should be discouraged, because fire may result in encouraging, rather than in checking its spread".*

Jurskis and Walmsley (2012) consider that dieback primarily affects older trees (i.e. >30 years old), stating *"Species and site combinations that are predisposed to decline may remain healthy, despite inappropriate management, until stands reach the pole stage".*

The NSW Scientific Committee's (2008) final determination for listing 'Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners' as a Key Threatening Process notes that:

> *Broad-scale canopy dieback associated with psyllids and Bell Miners usually occurs in disturbed landscapes, and involves interactions between habitat fragmentation, logging, nutrient enrichment, altered fire regimes and weed-invasion (Wardell-Johnson et al. 2006). ... Over-abundant psyllid populations and Bell Miner colonies tend to be initiated in sites with high soil moisture and suitable tree species where tree canopy cover has been reduced by 35 – 65 % and which contain a dense understorey, often of Lantana camara.*

Stone et. al. (1995) found that *"The vast majority of plots (97%) had been exposed to some degree of logging and were on their second or third rotations ... A possible long-term explanation of why the dieback problem may be increasing, is that the proportion of moist sclerophyll forest being exposed to selective logging is increasing throughout the State."*

Wardell-Johnson *et. al*. (2006) identify that many authors who have studied BMAD have identified logging as a cause, noting:

> *Hence, logging operations may be both implicated in the development of BMAD, and affected by changes in yield induced by BMAD. Nevertheless, the literature remains very limited concerning the impacts of logging and associated disturbance on the initiation or development of BMAD.*

Bell Miner

Based on her research for the Forestry Corporation and review of the literature, Stone (1999) put forward a conceptual model for BMAD:

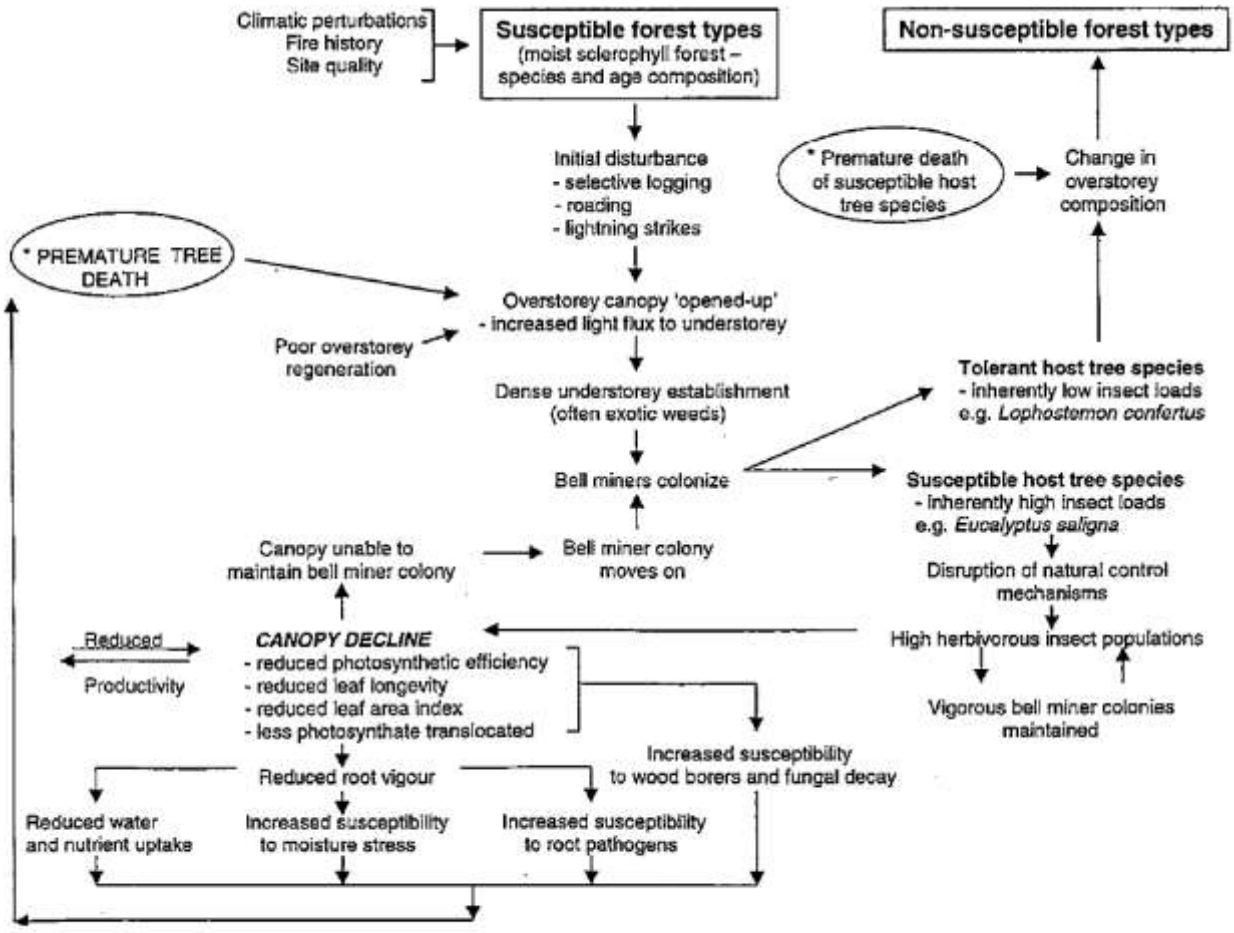

Figure 1. A conceptual model illustrating possible relationships and several feedback loops between processes which may contribute to canopy dieback associated with bell miners in moist eucalypt forests.

Kavanagh and Stanton (2003) in their assessment of logged and unlogged coupes over 22 years near Eden, considered that the increase in Bell Miners in moist forest types at the heads of two gullies in logged coupes *"provides support for the hypothesis (Stone 1999) that logging disturbance can be a contributing factor in creating the habitat conditions required by the Bell Miner"*.

Others in the Forestry Corporation have been attempting to discredit Stone's work and confuse the issue. This has been led by Vick Jurskis who asserts that the BMAD problem is the result of reduced frequency of burning causing eucalypt decline (Jurskis and Turner 2002, Jurskis 2004, Florence 2005, Jurskis and Walmsley 2012). Despite limited evidence this approach has been effective in confusing the issue and stopping needed action.

This theory of rainforest invasion due to reduced burning (i.e. Florence 2005) has driven the Forestry Corporation's failed silvicultural approach to the management of "wet sclerophyll" forest for the past century. Their simplistic approach of blaming natural processes rather than their own miss-management is part of the problem. On the north coast of NSW lantana is invading the logged "wet sclerophyll" forests, the more intensive and frequent the disturbance the more lantana is favoured. As a management tool fire is of limited use in "wet sclerophyll" forest. In stands with a naturally grassy understorey occasional fires can control lantana, though as the past 100 years prove it is not

a successful means of managing sites that naturally have a low fire frequency and rainforest understory. Logging and burning simply promote lantana in these forests.

Jurskis' (Jurskis and Turner 2002) wanting to restore natural fire regimes may have some effect in controlling lantana in drier open forests, though he, and his co-author John Turner, ignore the fact that the evidence is that pre-European fires were relatively infrequent in wet forests on the north coast. Carbon dating of charcoal and wood in the catchment at the head of Terania Creek established that the frequency of fire (with sufficient severity to result in the production of charcoal) was estimated to be 300 years in the blackbutt forest, 300–400 years in the brushbox forest and in excess of 1000 years in the rainforest (Turner 1984). Under Forestry Corporation management logging and fire frequency is measured in decades (or less) not centuries.

The basis of Jurskis' hypothesis is that a reduced fire frequency causes changes in soil chemistry that affects the eucalypts, with Psyllids and Bell Miners simply being symptoms rather than causes. Investigations into this have basically found that BMAD occurrence is related to increasing soil fertility and moisture (Stone 2006, Mews 2008) which also corresponds to the wet sclerophyll forests Bell Miners prefer. The limited and equivocal evidence of leaf litter and some nutrient increases on affected sites may be due to feedback loops associated with the changes in understorey and crown foliage associated with BMAD (i.e. Mews 2008). Jurskis' theory is unsubstantiated conjecture, which has been shown to fail in practice.

To make the facts fit the theory Jurskis and Walmsley (2012) seem to imply that BMAD is not a problem in wet sclerophyll forests, stating *"The wet sclerophyll forests are naturally adapted to high intensity fires at intervals of several centuries and remain healthy over this period whereas the naturally grassy forests are predisposed to decline in the absence of frequent low intensity fire"*.

Florence (2005) also emphasised the "struggle" between eucalypt and rainforest as a fundamental factor in BMAD, basically concluding, as has been apparent for many decades, that such forests are not suitable for the management they are being subject to:

> *Where destabilised by post-settlement fire and logging, changes in ecosystem processes may have exposed the limits of the eucalypts' capacity to cope with soils with consistently high levels of available nutrients.*

It is recognised that stress may be a factor involved in the proliferation of BMAD and that BMAD becomes worse during periods of low rainfall (i.e. Stone 2005, Jurskis and Walmsley 2012). This suggests that global warming, with its increasing temperatures, skyrocketing evaporation and intensifying droughts is likely to be a major contributor to increasing BMAD.

Many factors contribute to Bell Miner Associated Dieback. We do know that BMAD is related to prolonged outbreaks of abundant psyllids, that high densities of Bell Miners facilitate high populations of psyllids, and that Bell Miners are advantaged by logging operations that create low dense understories of lantana, open midstories and sparse overstories.

NEFA's extensive experience with BMAD leaves us in no doubt that logging and associated disturbances are the principal factor responsible for the alarming spread of BMAD through our forests. The solution to BMAD is to stop logging affected and susceptible forests and to rehabilitate affected areas to reduce their suitability for Bell Miners.

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