

M. Bristow, J.D. Nichols and J.K. Vanclay, 2006. Improving productivity in mixed-species plantations. *Forest Ecology and Management*, doi:10.1016/j.foreco.2006.05.010

## Improving Productivity in Mixed-Species Plantations

Mixed species plantations are often promoted as being environmentally preferable to monocultures, but are rarely considered operationally viable by commercial forest growers. Despite many publications documenting benefits demonstrated in research studies (e.g., Kelty 2006; Forrester et al. 2006b; Wood and Vanclay 1995), and despite continuing calls from a wide range of advocates for mixed-species plantations, polyculture remains the exception rather than the rule in industrial plantation forestry (Nichols et al 2006).

A workshop held in Ballina (NSW, Australia) during 5-7 August 2005 in association with the XXII IUFRO World Congress, sought to quantify the potential of mixtures to sustain and enhance the growth and productivity, soil fertility, tree and stand health, wood quality, and economics of polyculture plantations. Participants were specifically asked to address whether demonstrable productivity gains in mixed species plantations, compared with monoculture plantations, could make mixtures a commercially attractive option. We specifically sought to attract presentations addressing the operational challenges of making mixed-species plantations practical and successful, and attracted representatives from several industrial plantation agencies.

The workshop attracted 35 participants and 30 presentations, and stimulated an on-going discussion that has continued long after the formal workshop sessions were completed. This special issue includes 17 papers developed from workshop presentations, plus a further four papers that developed from discussions arising from the workshop.

The workshop stimulated presentations and papers, covering a wide range of topics including general overviews (Erskine et al. 2006; Forrester et al. 2006b; Jose et al. 2006; Kelty 2006), bi-cultures with nitrogen-fixing species (Bristow et al. 2006; Hunt et al. 2006; Nichols and Carpenter 2006), economics (Nichols et al. 2006);

experiment design (Vanclay 2006a); management guidelines (Reid 2006); nutrition (Specht and Turner 2006); photosynthesis and carbon dynamics (Medhurst et al. 2006; Forrester et al. 2006a; Unwin et al. 2006), predation (Bosu et al. 2006), spatially-explicit modelling (Bristow et al. 2006; Manson et al. 2006; Vanclay 2006b), trials with several rainforest species (Grant et al. 2006; Petit et al. 2006), and underplanting (McNamara et al. 2006; Simpson and Osborn 2006).

We draw the following important observations following the workshop and the compilation of the special issue:

- several innovative experiment designs (Vanclay 2006a) and analytical techniques (Bristow et al. 2006; Forrester et al. 2006b; Manson et al. 2006; Vanclay 2006b) have been demonstrated, and should provide useful models for others planning and examining mixed-species trials;
- despite the enthusiasm for polycultures, relatively few robust experiments have been established, and even fewer have been maintained long enough to allow rotation-length consequences to be evaluated (Forrester et al. 2006b);
- commercial polyculture plantations are even more scarce than experiments, and rarely offer data to support publication of financial analyses (Nichols et al. 2006);
- small landholders appear to be the main innovators in establishing and demonstrating polyculture plantations (Nichols et al. 2006).

To provide the evidence to encourage industrial uptake of polyculture plantations, we urgently need to establish

- a co-ordinated series of long-term trials, well replicated in time and space, using a standardised design with several treatments (species composition) and comparable species;
- operational-scale demonstration plantings that gather ecological, financial and social data as well as the conventional production data.

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*Mila Bristow, J. Doland Nichols and Jerome K Vanclay*  
Southern Cross University  
PO Box 157, Lismore NSW 2480, Australia  
JVanclay@scu.edu.au