

The use of exotic species in dry tropics forestry: assessments, potential conflicts of interests and the application of The Precautionary Principle.

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'Weeds are amongst the most serious threats to Australia's primary productivity and natural environment. They reduce farm and forest productivity, displace native species and contribute significantly to land degradation. The cost of weeds to agricultural industries alone has been estimated at over \$3.3 billion per annum'

This opening paragraph in the Executive Summary of the 1999 Revised Edition of the National Weeds Strategy produced by the Agriculture and Resource Management Council of Australia and New Zealand, the Australia and New Zealand Environment and Conservation Council and Forestry Ministers of these two countries unambiguously states the impact of weed species on our economy and environment. A more recent study undertaken by researchers with the CRC for Australian Weed Management (Sinden *et al.* 2004) suggests that the actual cost of weeds to Australian agriculture is closer to 4 billion dollars *per annum*.

In this paper we consider alien species as potential weeds in the context of forestry in the 'dry' tropics of northern Australia, give some examples of previous and current problems with introduced tree species, and suggest how similar problems might be minimized in future activities.

We raise this issue because at this stage of development the dry tropics forest industry has the opportunity to:

- Be proactive in regard to the cultivation of commercially important trees with weed potential,
- Save money in the control of invasive woody weed species in the future by the judicious choice of species now, and
- Take note of the wealth of experience both here and abroad of the dangers and costs of ill-advised choices of species.

¹ It is with great regret and sadness that shortly after this paper was presented, Gary Werren passed away.

In addition, we raise the topic because-

- Forestry, particularly that involving hardwood species, is a long term commitment and we wish to emphasise the need for ongoing and successful management to prevent some plantation species from becoming invasive in the wider environment,
- In part, the reason for the success of exotic species is that they escape the constraints of the ecological envelope of their place of origin, and control of them as weeds is often made more difficult due to this, and
- Some concerns are held by some about the weed potential of some of the species, e.g. Indian mahogany *Chukrasia velutina* Roem. (MELIACEAE) and African mahogany *Khaya senegalensis* (Desr.) A. Juss. (MELIACEAE), being discussed at this workshop.

It should be noted in making the above and following observations that we are not 'picking' on Australian timbers growers but are taking a broader ecological approach to the situation. Similar concerns are held or have been realised about Australian species in other countries, e.g. *Acacia mearnsii* De Wild. (MIMOSACEAE) Black Wattle, in South Africa (Rouget et al. 2002) and in California, the Tasmanian blue gum, *Eucalyptus globulus* Labill. (MYRTACEAE).

In this paper we discuss tree species that we, or others, for example Csurhes and Edwards (1998), recognise as potential or already known weed species and it is appropriate to define what we mean by 'weed' species. The term 'weed' generally refers to a species, native or otherwise, growing outside its normal habitat and/or in an unwanted location. The general public often thinks of weeds primarily as ground layer and shrub species, although there are notable exceptions, e.g. Olives, *Olea europaea* L. (OLEACEAE) in South Australia and camphor laurel *Cinnamomum camphora* T. Nees & C. Eberm (LAURACEAE) on the Atherton Tableland, southeast Queensland and northern NSW.

This may be due to the fact that trees usually have a longer lifespan and their potential to spread and cause damage is less immediately obvious, that many tree species that become weeds do so only after an extended period or the species may have commercial value as well as weed potential, e.g. pine species in the section *Pinus* of the genus *Pinus* (Rejmánek and Richardson 1996).

The impact of environmental weeds on ecosystem function include:

- Competition for resources
- Prevention of recruitment
- Alteration of geomorphological processes
- Alteration of hydrological cycles
- Alteration of soil nutrient content
- Alteration of fire regimes, and
- Changes in abundance of indigenous fauna.

(Csurhes and Edwards 1998).

Hughes (1994, 1995) and Richardson (1998) (cited in Ewel et al. (1999)) both noted the recent development of 'multipurpose' tree species for agroforestry has resulted in a new wave of purposeful introductions across the tropics. It should also be noted that Ewel et al (1999) consider 'most proponents of purposeful introductions understand the risks, and most conservation biologists recognize the potential benefits to be derived from careful controlled introductions'.

In Australia, the control of the importation of exotic species comes under the purview of a plethora of agencies, both state and federal. However the review of applications to import plant germplasm is rigorous and a sequence of protocols is enacted. If the species being

applied for is not listed an AQIS New Plant Application must be completed and all species in this category are subject to a Weed Assessment by BioSecurity Australia. If it is considered to have weed potential the application will be rejected and the species added to the PROHIBITED list.

Hnatiuk (1990) listed ca. 2,200 of naturalised plant species in Australia, Randall (2002) gives a figure of 3020 and Lawrence (2004) a figure of >2500 species; most were deliberately introduced, this particularly the case in respect of pasture species and escaped garden ornamentals. Swarbrick and Skarratt (1994) listed 1,059 of these species as environmental weeds. Data from the Queensland Herbarium indicate >1100 species alien species are naturalised in this state; whilst many of them are woody shrub species, e.g. *Prosopis* spp. and *Acacia* spp. (MIMOSACEAE), surprisingly few of them are tree species.

Csurhes and Edwards (1998) produced the report Potential Environmental Weeds in Australia, which contained a list of species nominated as potential environmental weeds and listed those species that:

- Have histories as weeds overseas and are vulnerable to eradication in Australia
- Do not have histories as weeds outside Australia, and
- Have histories as weeds overseas but are too widespread to be eradicated in Australia.

Their report was based on research, survey of state and federal lists and responses from 63 respondents across all states and territories. The report lists 294 potential environmental weeds, only 15 of them native species, and they note that 47% of them are woody trees or shrubs. 50% of the non-native species listed had histories of being weeds elsewhere in the World.

In respect to exotic species introduced into northern Australia for the production of timber, several, e.g. White Teak, *Gmelina arborea* Roxb. ex Sm. (VERBENACEAE) and Indian mahogany *Chukrasia velutina* Roem. have escaped cultivation and established as weeds (Figure 1). In addition, Neem, *Azadirachta indica* A. Juss. (MELIACEAE) (syn. *Melia azadirachta* L.), until recently promoted by the QDPI and planted as an amenity species at several locations in the dry tropics of Queensland, has established as a weed species on the Gilbert River system and about Normanton in the Gulf Plains bioregion. Of these species *C. velutina* and *A. indica* are listed by Csurhes and Edwards (1998) and noted as having a weed history overseas. In addition, they list *K. senegalensis* as a potential environmental weed but note that it has no record of being so overseas.

Whilst the above described review and control mechanisms may prevent the introduction of new tree species that are likely to become weeds we contend that those involved in or considering being involved in forestry in the dry tropics need to be cognisant of the potential problems with those species already in use or being considered.

This can be done by

1. Reviewing the available literature on these species and in particular, taking note of experience with them in other locations with similar environmental conditions.

Particularly useful sources of information on this topic are the Pacific Island Ecosystems (<http://hear.org/pier/>), Global Compendium of weeds websites (<http://hear.org/gcw/>) and A Global Compendium of weeds (Randall 2002b). The WWF Australia Position Paper 03/01 provides a particularly useful overview of the subject.

2. Implementing management protocols to prevent escape and to deal with escapees that should be devised in tandem with the industry.

An example of such a protocol is that of the South Australian Olive Policy.

3. The application of the Precautionary Principle in respect to the introduction and cultivation of alien species in dryland tropical forestry.

The Precautionary Principle is a much discussed but little understood concept, despite often being cited. The underlying principle is that a proactive approach should be taken on actions that may be deleterious to the environment and priority given to preventive management to avert possible, but not certain, damage. Deville and Harding (1997) developed a four-step approach to the application of the principle, they are:

1. Are precautionary measures needed?
2. How precautionous should we be?
3. What precautionary measures can be applied? and
4. What precautionary measures should be applied?

The application of the principle is likely to be a contentious issue but two recent examples show its use. Calver, Bradley and Wright (1999) describe how it was used in consideration of a proposed injunction on timber harvesting by the Department of Conservation and Lands (CALM) in jarrah forest in Western Australia due to the possible effects of the logging on the fauna in the forests. A decision handed down by Justice Wheeler of the Supreme Court of Western Australia found that CALM had applied due consideration and that their procedures could continue. In the second example, one that was proactive on the part of the department involved, a review of the weed potential of African blackwood *Dalbergia melanoxylon* Guill. & Perr. (FABACEAE) being trialed in Western Australia as a timber species resulted in the abandoning of the trial. In Queensland, trials of exotic *Calliandra* spp. Benth. (MIMOSACEAE) and *Acacia angustissima* (Mill.) Kuntze (MIMOSACEAE) have been abandoned for the same reason.

The evidence is that species from particular families, e.g. Meliaceae, and with particular methods of seed dispersal, e.g. wind, water and bird dispersal, give most cause for concern as to their ability in establishing as weed species. Examples of this in Queensland have been the spread in salt water of seeds of *Leucaena leucocephala* in the area about Weipa and the spread of seeds by water and birds of Neem, *Azadirachta indica*, along the Gilbert River. These data indicate particular attention should be given to the safe cultivation of species with these characteristics.

Our desire is that:

- The best possible practice be applied to the selection and cultivation of hard wood timber species for use in the dry tropics, and where species are recognised as having potential as environmental weeds that particular attention is paid to the control of propagules and the prevention of spread of 'wildlings'.
- A Risk Assessment System (RAS), including the Precautionary Principle, is applied to proposed activities and the species involved, particularly where they are non-native, before the commencement of projects, and
- Preference is given to the cultivation of native species.

We are particularly keen that management plans include proposed actions in the case of the financial failure and abandonment of plantations and the establishing of wildlings outside the plantation area.

It is our opinion that the best outcomes in dry tropics forestry can be achieved by well-managed plantations of species of known provenance and ecological attributes and the rigorous application of the measures described in this paper. We believe the discussions in and resulting from this workshop will substantially contribute to this goal.

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Figure 1. *Gmelina arborea* escapee from cultivation established in Emerald Creek, Atherton Tableland, north Queensland.