Using the state-and-transition framework to explore altered condition in riparian woodlands on the Condamine River, Queensland

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Project outline:

This project will examine:

(i) the role of major landscape change and consequent changes in soil moisture regimes on the health and function of native riparian woodland communities of the Upper Condamine floodplain, currently exhibiting widespread tree decline and invasion by the introduced weed Lippia (*Phyla canescens*); and

(ii) the potential for restoration of community function in these ecosystems central to current national strategies to re-establish environmental flows and control ecologically-significant weed species.

It is contended that altered hydrological and competitive regimes, associated with land use change and intensification on the floodplain, has shifted the dynamics and function of these ecosystems. Restoration of healthy riparian woodland ecosystems may take more than a reversal of adverse pressures if, for example, there has been associated depletion of soil seed banks and/or alteration of soil biological, physical or chemical status.

The study will take a multi-factorial approach, including GIS-based landscape analysis, field assessments of current community composition and condition, experimental investigation of inter-species interactions between Lippia and *E. camaldulensis*, to investigate processes involved in the decline of these ecosystems.

Upper Condamine Floodplain landscapes:

Floodplains of the Upper Condamine are some of the most fertile agricultural lands in Australia.

Landscape change, with the development and intensification of both dryland and irrigated cropping over the past 60+ years, has resulted in significant reduction and fragmentation of *Eucalyptus camaldulensis* / *E.tereticornis* riparian forests and woodlands associated with the Condamine River.

Associated decline in the condition of patches within this vegetation type has also been recorded, including:

- progressive loss of tree cover due largely to dieback processes, evident particularly since a period of prolonged drought in the early 1990s[1,2]
- significant levels of weed invasion[2]

References:

1. Voller, P (1996) Tree decline: issues emerging in riparian forests of the upper Condamine. *Proceedings of the Managing and Growing Trees conference, Kooralbyn 1996*, Queensland Department of Natural Resources
2. McCosker. RO (1996) *An environmental scan of the Condamine-Balonne River system and associated floodplain*. Report prepared for the Qld Department of Natural Resources by LANDMAX Natural Resource Management Services, Armidale NSW.
3. Westoby, M, Walker, B and Noy-Meir. I (1989) Opportunistic management for rangelands not at equilibrium. *Journal of Range Management* 42(4): 266-274
4. Clemens . . .

Fig 1: Map of north-eastern Murray-Darling Basin showing location of study area

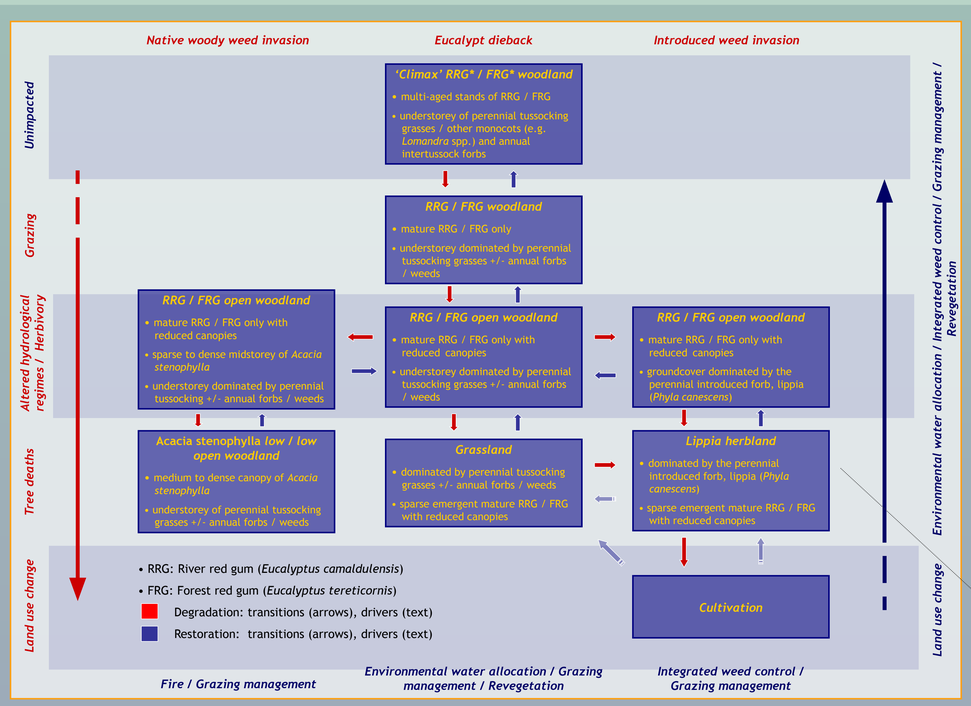

Fig 2: Possible alternate stable states of riparian woodland ecosystems on the upper Condamine floodplain and drivers of transitions between these

State-and-transition frameworks:

- initially proposed as a basis for modeling rangeland ecosystem dynamics[3]
- proposes that ecosystems can have **multiple stable states** - as opposed to the linear succession model describing sequential development towards a predictable 'climax' community[4]
- **transitions** between states may be caused/triggered by natural disturbances (e.g. weather, fire, herbivory) and/or management actions (e.g. grazing, burning, species removal/introduction, alteration of soil physical/chemical status)
- transition from one state to another involves the system crossing a **threshold**, with return to the former state unlikely.

Proposed methodology:

- Survey of floristic, structural and biophysical attributes (light, temperature, microtopography, soil physico-chemical status, mycorrhizal associations) across 40-50 sites in riparian river red gum (*Eucalyptus camaldulensis*) / forest red gum (*E. tereticornis*) remnants associated with the upper Condamine River
- GIS time-series and spatial analysis of landuse development and gross ecosystem change
- Soil seedbank germination trials (glasshouse) to investigate ecosystem potential for restoration
- Experimental manipulations (glasshouse and field) to investigate the competitive role of the invasive weed species Lippia (*Phyla canescens*)
- Survey of landholder attitudes and management responses to landscape change on the Upper Condamine floodplain
- Assessment of the applicability of the state-and-transition paradigm to riparian woodland ecosystems of the upper Condamine floodplain

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