

A recent 'advance' in landscape ecology: humans are part of the landscape!

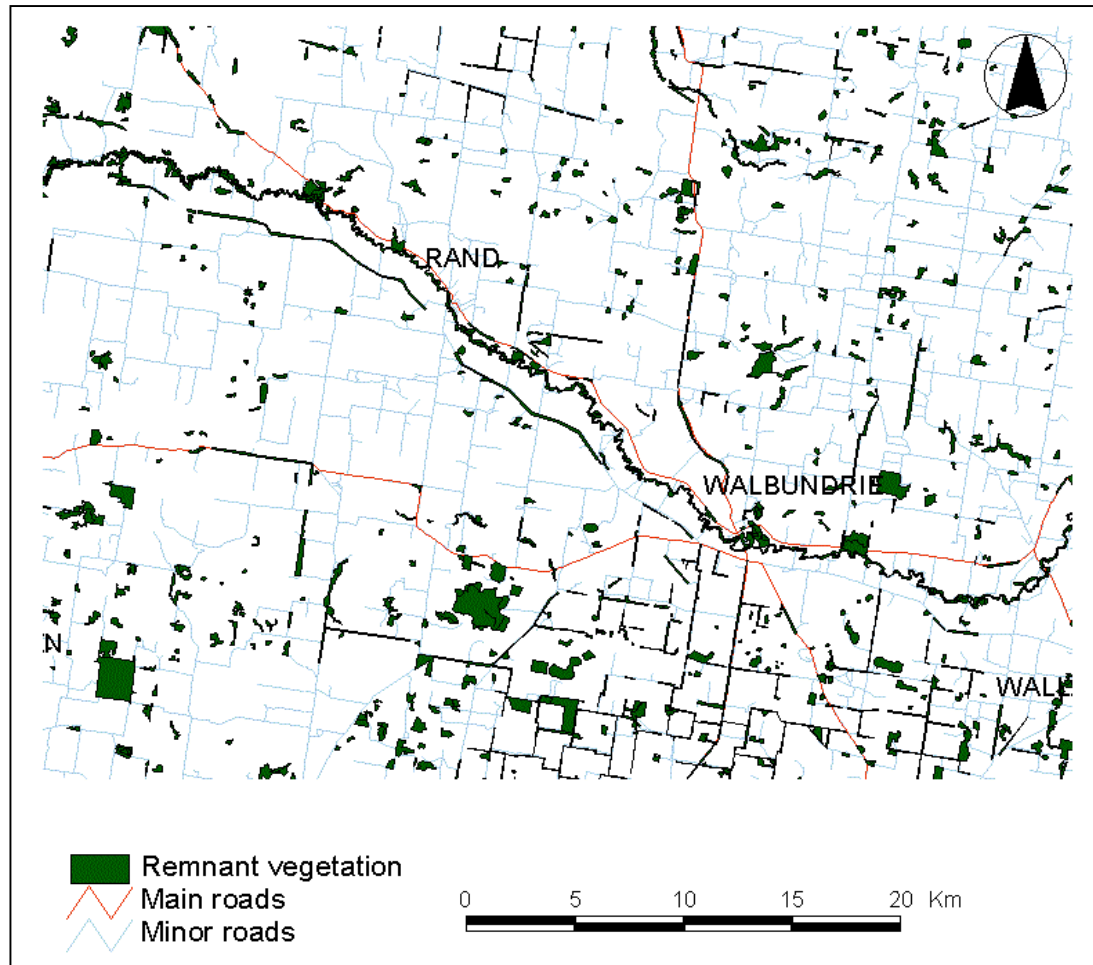


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Background: the fragmentation paradigm



‘Traditional studies’ based primarily on island biogeography theory (Mac Arthur & Wilson, 1967)

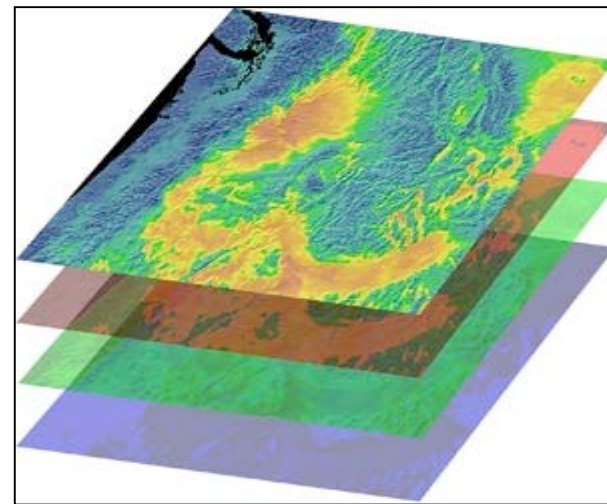


Background: the fragmentation paradigm (up to early 2000s)

- Many fragmentation studies have exhibited species richness patterns contrary to predictions based on M&W (Debinski & Holt, 2000)
- As Usher (1987, p. 118) stated many years ago, *'there are a bewildering series of contradictions in the literature...almost always when one has found a few studies that indicate that there may be some 'rule', one then finds a study that points in exactly the opposite direction'*
- Ongoing questions on the utility of existing paradigms

What is landscape ecology?

- The discipline emerged from attempts to develop an all-encompassing fragmentation paradigm (Turner, 1989; Wiens, 1997)
- Landscape ecology is the study of the interactions between spatial heterogeneity (ie fragstat metrics) and ecological processes



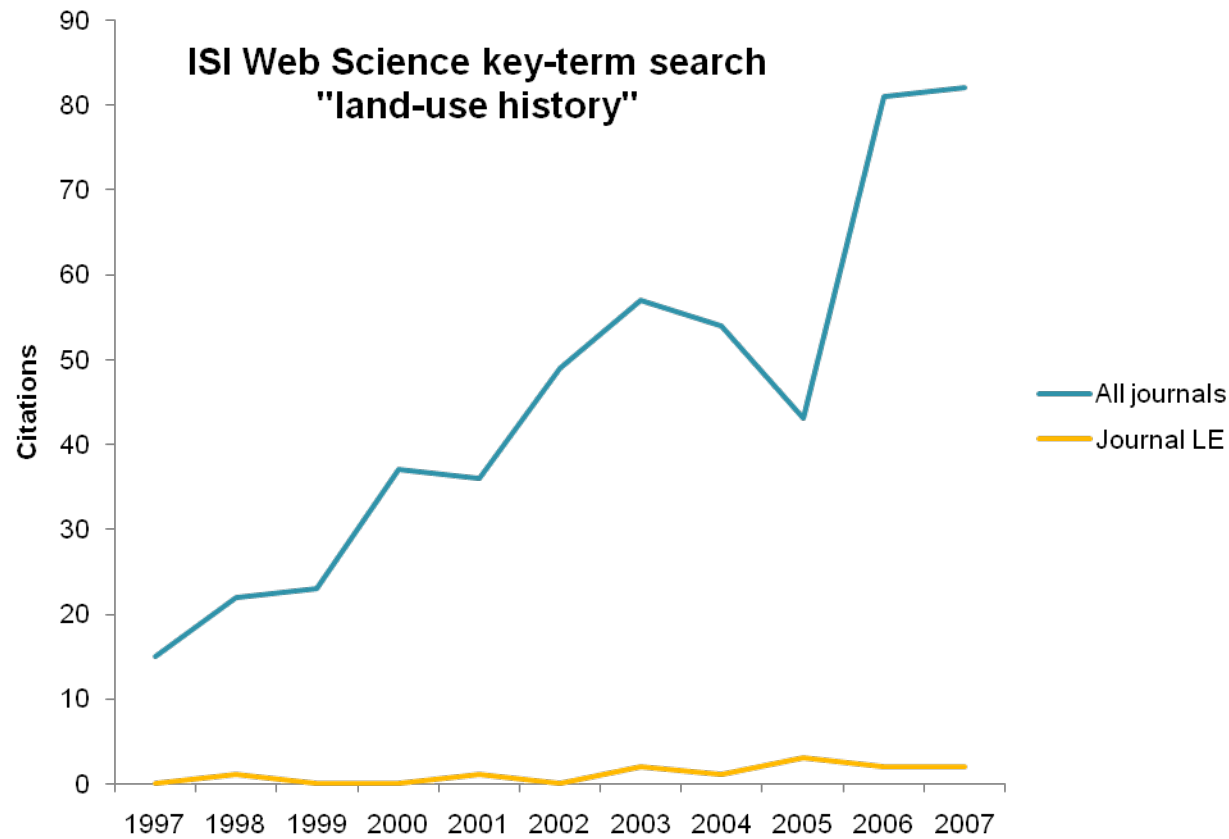
What is landscape ecology?

- Although landscape ecology does consider variation in patch quality, connectivity and the surrounding environment, **this approach has been criticised for:**
 - *tending to exclude people from the landscape,*
 - *concentrating mainly on spatial scale and ignoring temporal issues* (Turner, Garner & O'Neill 2001),
and
 - *resulting in a high proportion of non-quantitative descriptive studies* (Hobbs 1999).

This isn't news to the Europeans...

- Have a more anthropocentric view of landscapes!
- Past land-use legacies recognized in many European landscape studies
- ...and from Australia, a greater emphasis on the causes of patterns (e.g. work of Hobbs, Saunders)
- *Greater recognition that present day patterns are a legacy of **past disturbances**, which continue to drive processes*
- *(LESSON HERE: BEWARE of BIASES in the LITERATURE)*

Recognition of the importance of land-use history



Why history matters – the temporal component of landscapes

Over the next century, land-use history will continue to control ecological processes and influence future changes in many fragmented agricultural landscapes

(Motzkin et al. 1996; Swetnam & Christensen 1999; Foster et al. 2003).

(top) Up to the 1950s, rabbit plagues denude much vegetation in Australia
(bottom) Callitris pine regen. following past clearing and grazing



Historical ecology

- Where ecologists view ecosystems as **historically and spatially** influenced non-equilibrium systems, that are complex and open to human inputs
- In other words, this approach highlights that **humans are an integral component of landscape dynamics**



What does this all mean?

A shameless plug on the topic...

Journal of Biogeography (J. Biogeogr.) (2005) **32**, 1859–1873



Using historical ecology to understand patterns of biodiversity in fragmented agricultural landscapes

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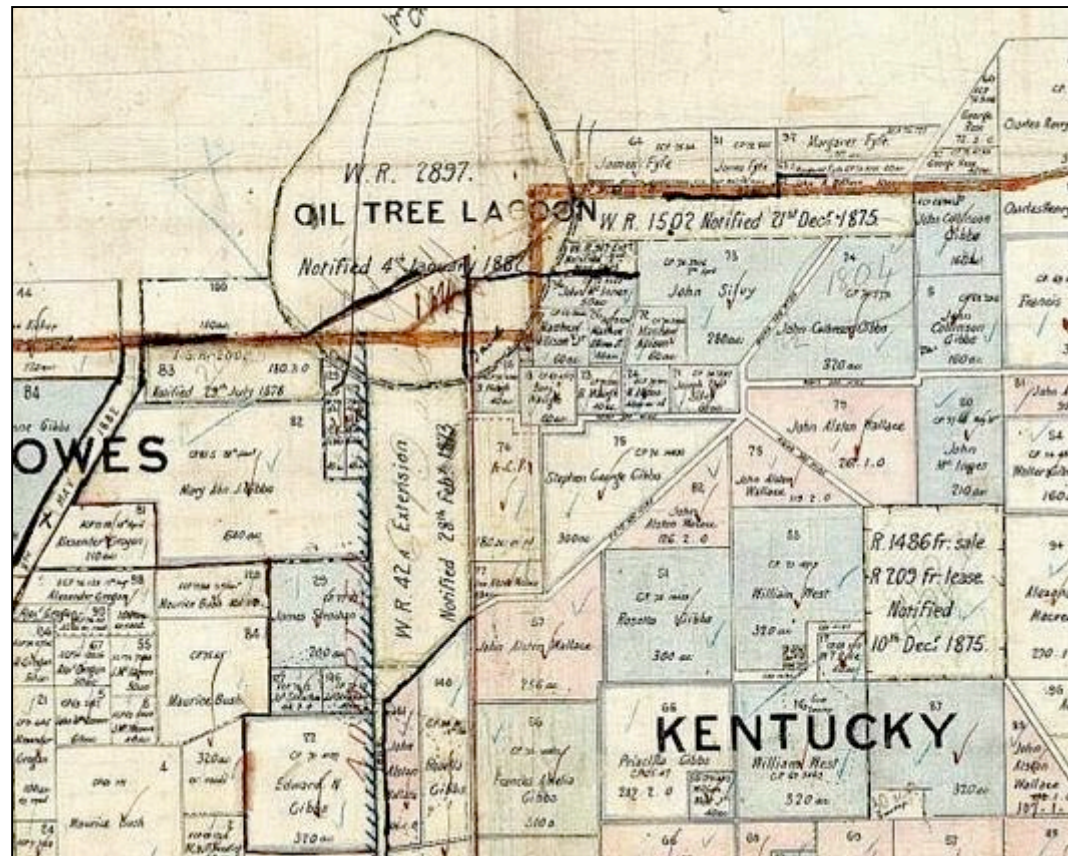
ABSTRACT

Aim To enhance current attempts to understand biodiversity patterns by using an historical ecology approach to highlight the over-riding influence of land-use history in creating past, current and future patterns of biodiversity in fragmented agricultural landscapes.

...to explain some important points to consider in your own work - from a vegetation perspective

Point 1

Spatial patterns of remnants are the result of previous human land-use decisions, and interactions with the biophysical environment. Consequently, spatial patterns are not random, but often arrayed in logical ways.



1870s pastoral
map:

'Quat Quatta'

Point 1:

Spatial patterns of remnants are the result of previous human land-use decisions, and interactions with the biophysical environment. Consequently, spatial patterns are not random, but often arrayed in logical ways.



1870s pastoral
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Point 2:

Historical land tenure is a strong predictor of disturbance history, and consequently, of current ecosystem conditions



Point 3:

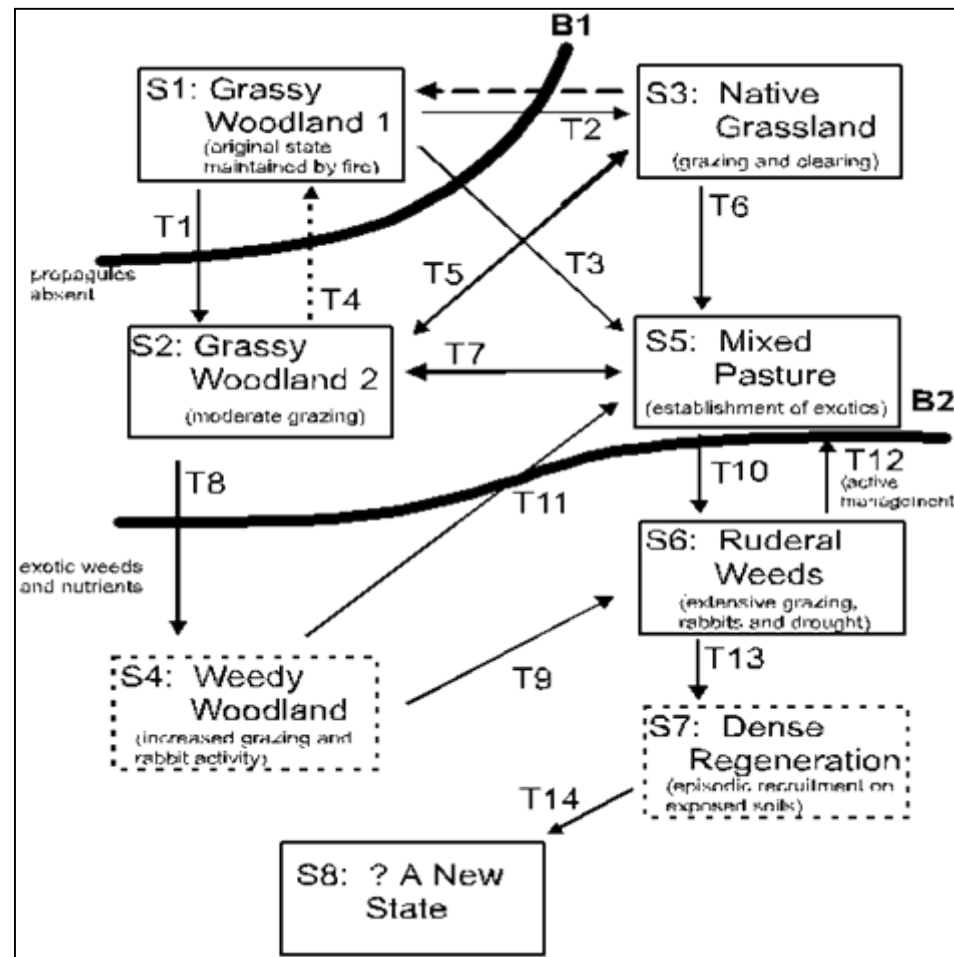
Some functionally important species or remnant ecosystems may now depend on current or future anthropogenic disturbances for their persistence.



*Even age stand of Acacia pycnantha
along roadside*

Point 4:

A history of anthropogenic disturbances has created a range of distinct and sometimes **novel ecosystem states**, which differ in structure, composition and function from past “pre European” conditions.



Spoooner & Allcock 2006



Conclusions

- Traditionally, landscape ecology has focussed on **space** (patch area –isolation concepts)
- Historic ecology integrates spatial patterns, **temporal changes**, and human disturbance history
- To fully understand biotic patterns in fragmented landscapes, landscape ecology is rapidly evolving to embrace these concepts
- **Into the future:** ecosystem services analyses; integration of socio-economic factors; landscape scenario modeling

Want to know more?

Turner MG (2005) Landscape ecology: What is the state of the science? ANNUAL REVIEW OF ECOLOGY EVOLUTION AND SYSTEMATICS 36, pp 319-344

Much of the reference list contained in this MS is essential reading (eg Wiens, Foster, Wu, Pickett)

Also check out papers from Europe! (eg Cousins, Lindborg, Eriksson,

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LANDSCAPE ECOLOGY: What Is the State of the Science?

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Key Words disturbance, fragmentation, spatial heterogeneity, spatial pattern, succession

■ **Abstract** Landscape ecology focuses on the reciprocal interactions between spatial pattern and ecological processes, and it is well integrated with ecology. The field has grown rapidly over the past 15 years. The persistent influence of land-use history and natural disturbance on contemporary ecosystems has become apparent. Development of pattern metrics has largely stabilized, and they are widely used to relate landscape pattern to ecological responses. Analyses conducted at multiple scales have demonstrated the importance of landscape pattern for many taxa, and spatially mediated interspecific interactions are receiving increased attention. Disturbance remains prominent in landscape studies, and current research is addressing disturbance interactions. Integration of ecosystem and landscape ecology remains challenging but should enhance understanding of landscape function. Landscape ecology should continue to refine knowledge of when spatial heterogeneity is fundamentally important, rigorously test the generality of its concepts, and develop a more mechanistic understanding of the relationships between pattern and process.

INTRODUCTION

Scientists have observed and described heterogeneity (complexity or variability in a system property of interest in space and time) (Li & Reynolds 1995) in ecological systems for a very long time. However, an explicit focus on understanding spatial heterogeneity—revealing its myriad abiotic and biotic causes and its ecological consequences—emerged in the 1980s as landscape ecology developed and spatial data and analysis methods became more widely available. Since then, progress in landscape ecology has been substantial and rapid, and its concepts and methods are now widely used in many branches of ecology. Landscape ecological approaches are not limited to land, but are also applied in aquatic and marine ecosystems (e.g., Bell et al. 1999, Ward et al. 2002). Research in landscape ecology has enhanced understanding of the causes and consequences of spatial heterogeneity and how they vary with scale and has influenced management of both natural and human-dominated landscapes.