Grasses

The plants that are most like humans

Tim Low


A third of all global vegetation is
grass-dominated, a figure that rises
to one half in Australia.

Super-successful weeds

Coolatai grass (*Hyparrhenia hirta*)

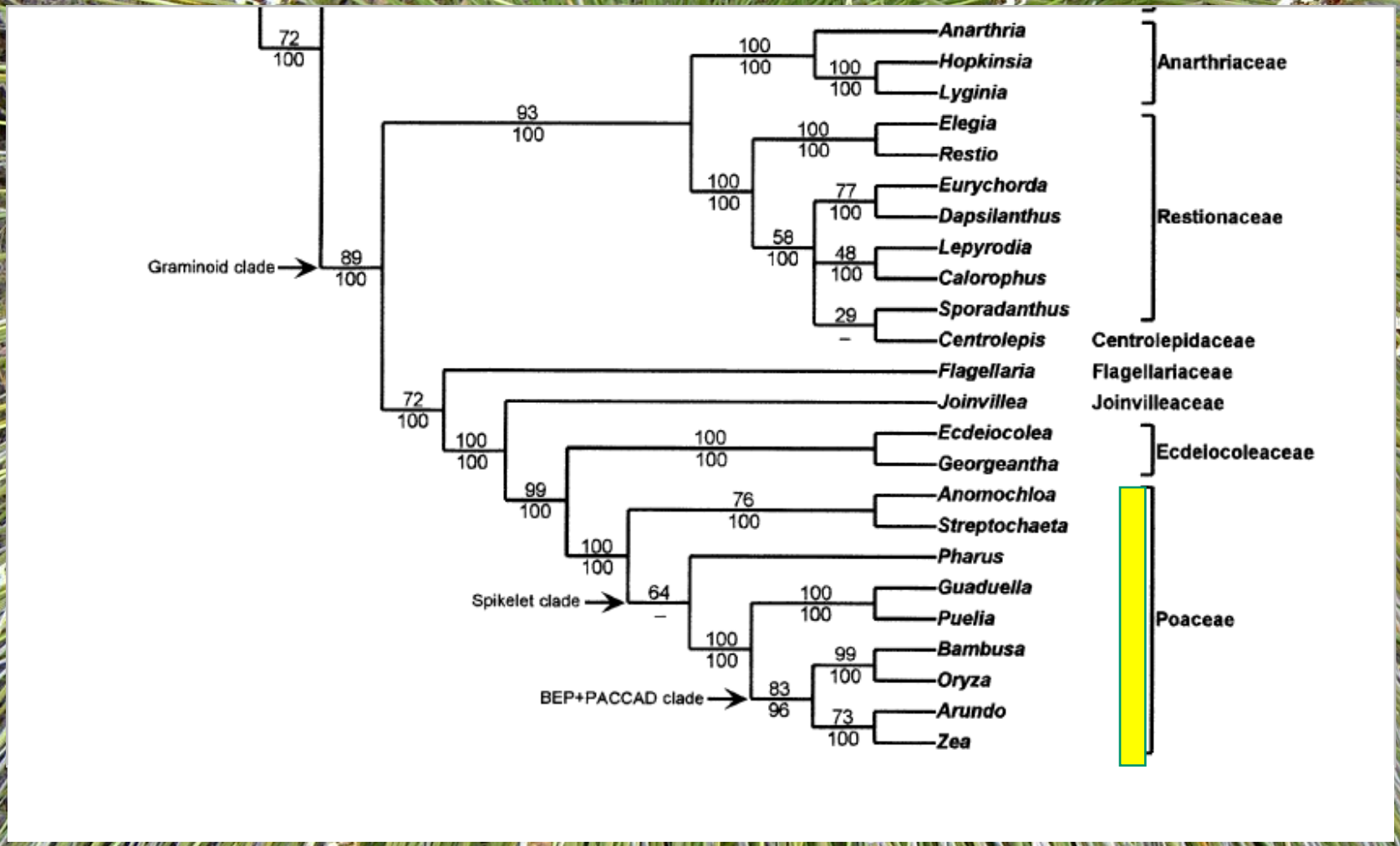
Form A – Interpreting the questions in the Weed Risk Assessment system

Question	WRA GUIDELINES
	may include densely growing grasses.
5	**Plant type**
5.01	**Aquatic** The question includes any plants normally found growing on rivers, lakes and ponds. These species have the potential to choke waterways and starve the system of light, oxygen and nutrients. Consequently, the score is high (5).
5.02	**Grass** A large proportion of the grass family (Poaceae/Gramineae) are weeds in some context. As with congeneric weed species, there is a high probability that a species from this family will be a weed.
5.03	**Nitrogen fixing woody plant** A large proportion of woody legumes (Family Leguminosae/Fabaceae) are weeds, particularly of conservation areas. As with congeneric weed species, there is a high probability that a species from this family will be a weed.
5.04	**Geophyte** Perennial plants with tubers, corms or bulbs. This question is specifically to deal with plants that have specialised organs and should not include plants merely with rhizomes/stolons (see 6.06). Plants from this group can be particularly difficult to eradicate from a site.

Ecdeiocoleaceae


Joinvilleaceae

Flagellariaceae


Anarthria
Hopkinsia
Lyginia
Anarthriaceae
Elegia
Restio
Eurychorda
Dapsilanthus
Lepyrodia
Calorophus
Sporadanthus
Restionaceae
Centrolepis
Centrolepidaceae
Flagellaria
Flagellariaceae
Joinvillea
Joinvilleaceae
Ecdeiocolea
Georgeantha
Ecdeiocoleaceae
Anomochloa
Streptochaeta
Pharus
Guaduella
Puelia
Bambusa
Oryza
Arundo
Zea
Poaceae
Graminoid clade
Spikelet clade
BEP+PACCAD clade
72
100
93
100
89
100
72
100
100
100
100
100
100
100
100
100
77
100
58
100
48
100
29
–
100
100
100
100
99
100
76
100
100
100
64
–
100
100
100
100
99
100
83
96
73
100

Dinosaur Coprolites and the Early Evolution of Grasses and Grazers

Vandana Prasad,[1] Caroline A. E. Strömberg,[2*]
Habib Alimohammadian,[3] Ashok Sahni[3]

Silicified plant tissues (phytoliths) preserved in Late Cretaceous coprolites from India show that at least five taxa from extant grass (Poaceae) subclades were present on the Indian subcontinent during the latest Cretaceous. This taxonomic diversity suggests that crown-group Poaceae had diversified and spread in Gondwana before India became geographically isolated. Other phytoliths extracted from the coprolites (from dicotyledons, conifers, and palms) suggest that the suspected dung producers (titanosaur sauropods) fed indiscriminately on a wide range of plants. These data also make plausible the hypothesis that gondwanatherian mammals with hypsodont cheek teeth were grazers.

Today, grasses (in the family Poaceae) are extant on all continents except Antarctica, and numerous organisms, not least humans, depend on them for food domesticated anin sence of an early


Grasses are plants
that thrive on their
own destruction

WILDLAND FIRES AND ECOSYSTEMS—A HYPOTHESIS[1]

ROBERT W. MUTCH[2]

U. S. Department of Agriculture, Forest Service
Intermountain Forest and Range Experiment Station, Ogden, Utah

Abstract. Plant species which have survived fires for tens of thousands of years may not only have selected survival mechanisms, but also inherent flammable properties that contribute to the perpetuation of fire-dependent plant communities. This concept goes beyond the commonly accepted fire climate–fuel moisture basis of wildland fire occurrence. Plant communities may be ignited accidentally or randomly, but the character of burning is not random. The following hypothesis treats this interaction between fire and the ecosystem: Fire-dependent plant communities burn more readily than non-fire-dependent communities because natural selection has favored development of characteristics that make them more flammable. The hypothesis was experimentally derived following laboratory combustion tests with litter of eucalyptus (*Eucalyptus obliqua* L'Herit), ponderosa pine (*Pinus ponderosa* Laws.), and tropical hardwood leaves.

INTRODUCTION

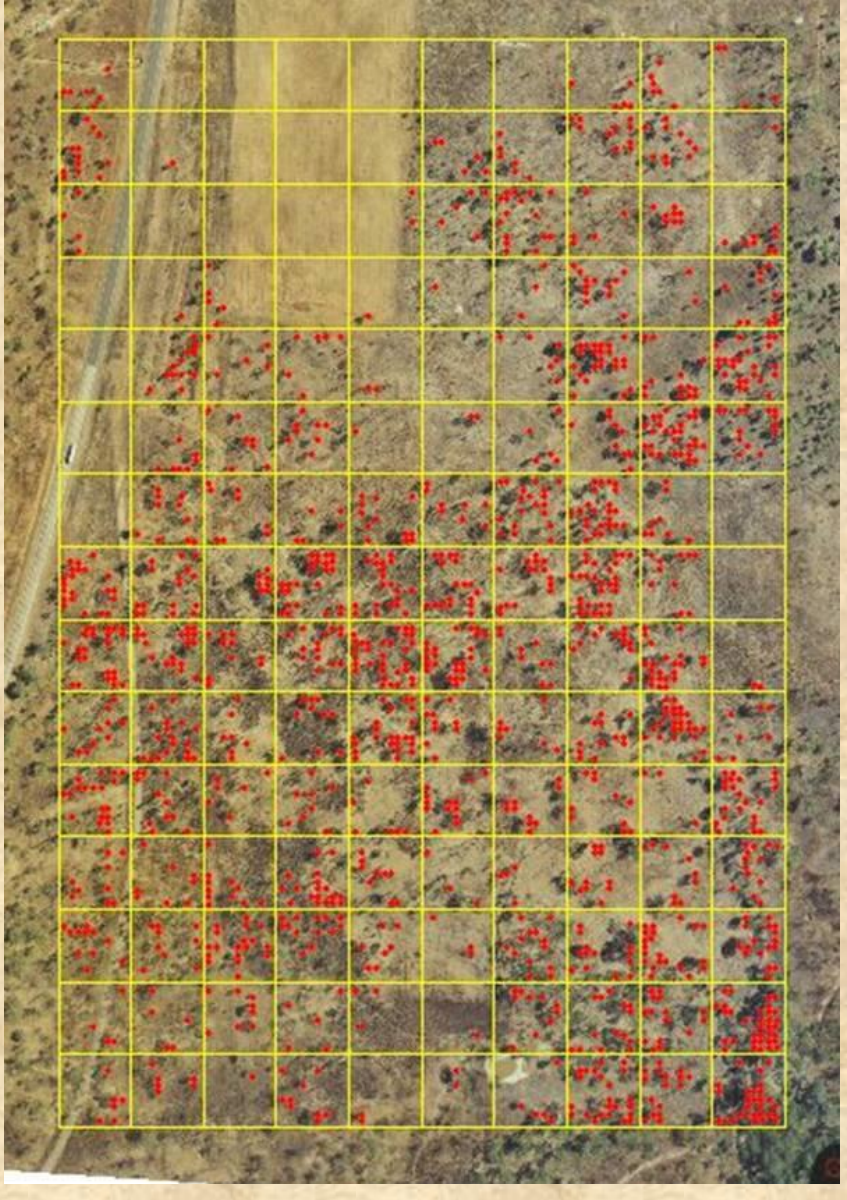
Fire has been described repeatedly as a domi- cluded that fire has been almost as closely related to many communities as other factors of their

"Fire-dependent plant communities burn more readily than non-fire-dependent communities because natural selection has favoured development of characteristics that make them more flammable."

- Mutch (1970) *Ecology* 51: 1046-1051


< Note the man


Thriving on its own destruction



Thriving on its own destruction

Research (and photos) by Michael Douglas

‘If large areas of northern Australia become dominated by gamba grass, the associated fire regime is predicted to transform Australia’s eucalypt-dominated tropical woodlands into tree-free grasslands.’

- Queensland Government weed risk assessment

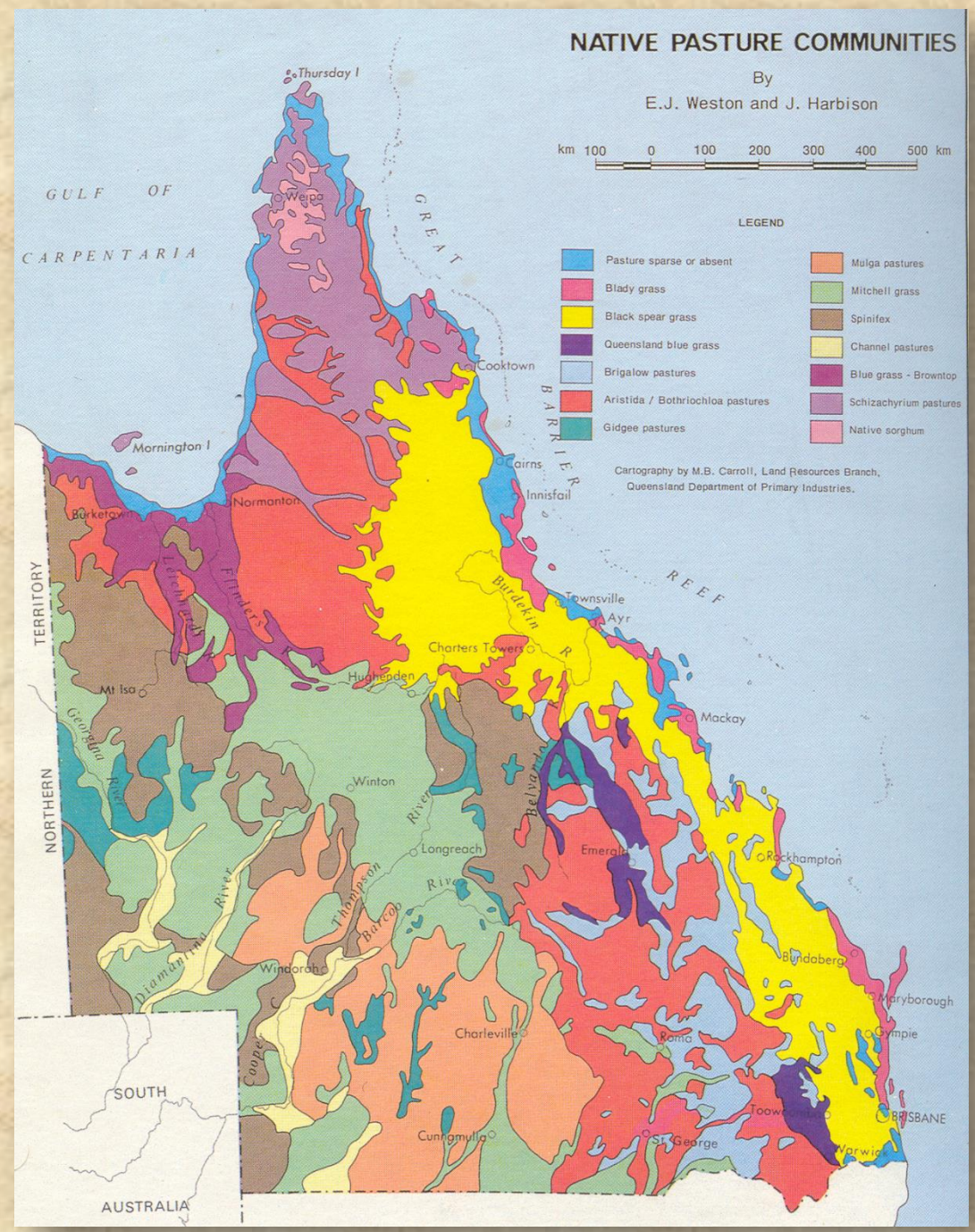
Austral Ecology (2013) **38**, 831–840

Spatial pattern and severity of fire in areas with and without buffel grass (*Cenchrus ciliaris*) and effects on native vegetation in central Australia

CHRISTINE SCHLESINGER,[1]* SARAH WHITE[2] AND SHANE MULDOON[2†]
[1]*Research Institute for Environment and Livelihoods, Charles Darwin University, PO Box 795, Alice*

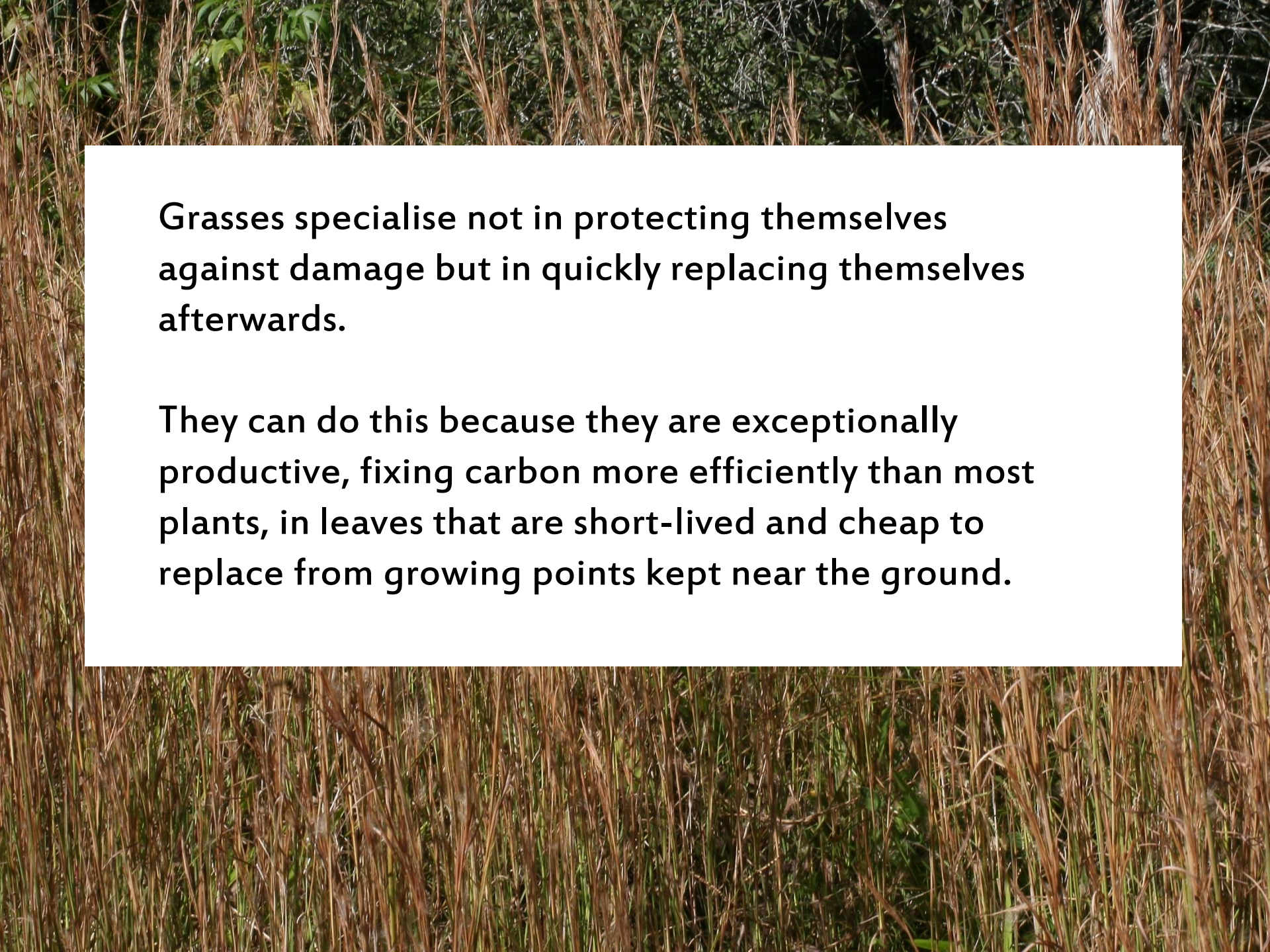
Abstract The spread of buffel grass (*Cenchrus ciliaris*) in semi-arid Australia in recent decades has substantially increased ground cover and fuel loads, particularly in open woodland vegetation communities. The resulting alteration of fire regimes may be the most significant impact of buffel invasion on ecological communities in these

increased pre-existing differences in the number of taxa in the ground level vegetation, an effect that persisted for the duration of our study, suggesting that fire accelerates direct negative competitive effects between buffel grass and native grasses and forbs. *Hakea divaricata* (fork-leafed corkwood) trees in unmanaged buffel grass sites suffered higher burn intensities, and their long-term viability at this location is likely to be threatened if fires fuelled by buffel grass continue. Our results demonstrate clear benefits of removing fire-enhancing invasive plants from areas of high conservation value.



Black Spear Grass

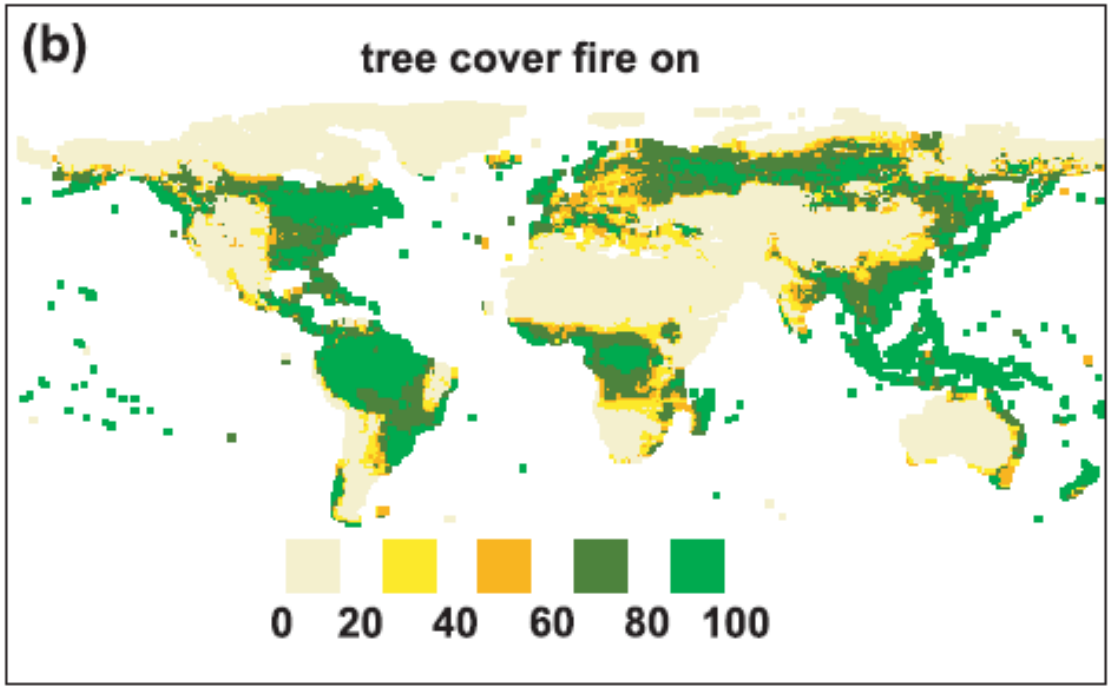
The grass that destroyed the subcoastal sheep industry



Grasses specialise not in protecting themselves against damage but in quickly replacing themselves afterwards.

They can do this because they are exceptionally productive, fixing carbon more efficiently than most plants, in leaves that are short-lived and cheap to replace from growing points kept near the ground.


Acacia jackesiana

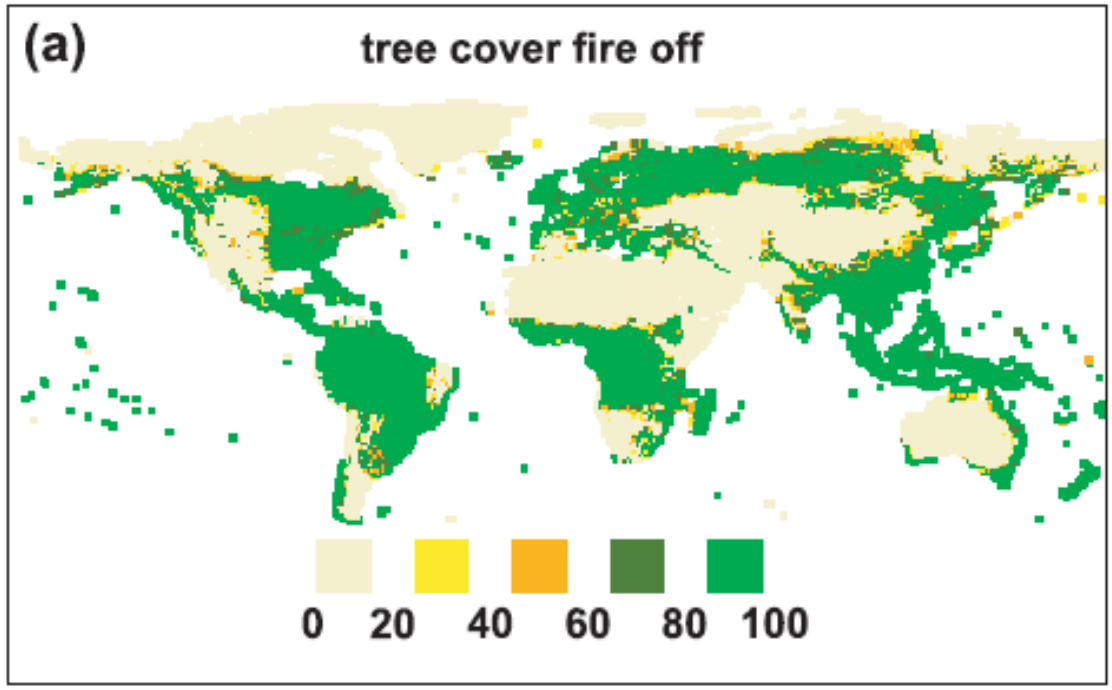


New Phytologist

The global distribution of ecosystems in a world without fire

W. J. Bond[1], F. I. Woodward[2] and G. F. Midgley[3]

Closed forests increase from 27% to 56% of world vegetation



Grasses displacing forests anticipated humans doing so

Calling it a grass is an understandable mistake

PROCEEDINGS OF THE ROYAL SOCIETY B

Proc. R. Soc. B (2011) **278**, 695–701
doi:10.1098/rspb.2010.1145
Published online 8 September 2010

Absence of mammals and the evolution of New Zealand grasses

Alexandre Antonelli[1,*,†], Aelys M. Humphreys[1], William G. Lee[2] and H. Peter Linder[1]

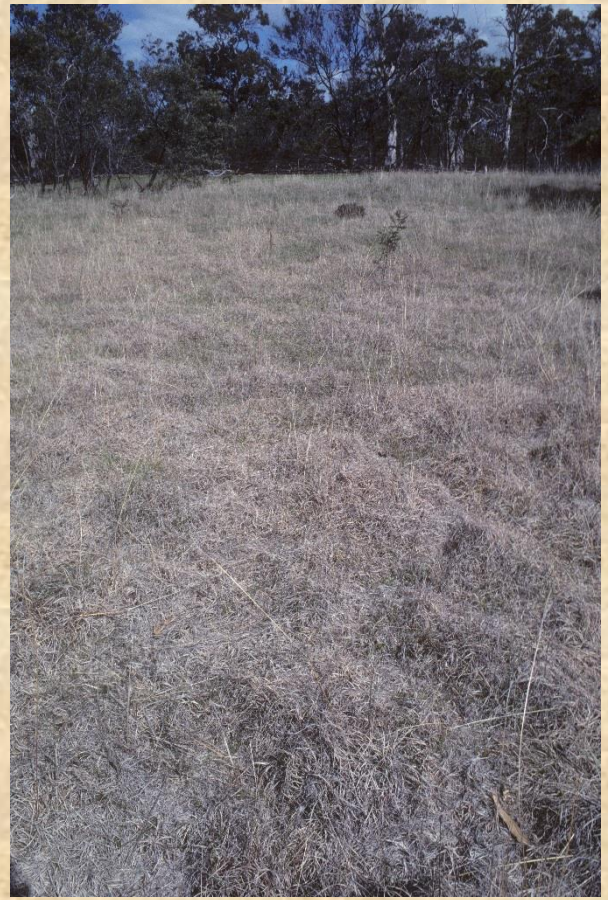
[1] *Institute of Systematic Botany, University of Zurich, Zollikerstrasse 107, 8008 Zurich, Switzerland*
[2] *Landcare Research, Private Bag 1930, Dunedin 9016, New Zealand*

Anthropogenic alteration of biotic distributions and disturbance regimes has dramatically changed the evolutionary context for the differentiation of species traits. Some of the most striking examples in recent centuries have been on islands where flightless birds, which evolved in the absence of mammalian carnivores, have been decimated following the widespread introduction of exotic predators. Until now, no equivalent case has been reported for plants. Here, we make use of robust analytical tools and an exceptionally well-sampled molecular phylogeny to show that a majority of New Zealand danthonioid grasses (Poaceae) may have adapted to the relaxed vertebrate herbivore pressure during the late Cenozoic through the development of a distinctive and unusual habit: abscission of old leaves. This feature occurs in only about 3 per cent of the world's roughly 11 000 grass species and has been empirically shown to increase plant productivity but to reduce protection against mammal grazing. This result suggests that release from a selective pressure can lead to species radiations. This seemingly anachronistic adaptation may represent an overlooked factor contributing to the severe decline in the geographical extent and species diversity of New Zealand's indigenous grasslands following the introduction of herbivorous terrestrial mammals in the 19th century.

Keywords: evolution; plant–animal interactions; species radiations

1. INTRODUCTION

Plant species show many adaptations caused by specific interactions with past and present herbivorous animals, including leaf toughness and spines. However, dis- teeth; birds graze tussock grasses by pulling and cutting foliage, and several (notably rails) use clamping and tugging to remove tillers and access basal meristematic tissue [9]. The historical absence of mammals could thus have



The block is leased to carry up to 300 head of sheep and a requirement of the lease is to maintain existing grazing regimes. Monitoring plots have been set up around the property to determine what future management practices are required to maintain the high plant diversity and survival of the many rare plants.

Tom Gibson Nature Reserve, Epping Forest, Tasmania. Up to 300 head of sheep run for plant conservation

Review

TRENDS in Ecology and Evolution Vol.20 No.7 July 2005

Fire as a global 'herbivore': the ecology and evolution of flammable ecosystems

William J. Bond[1] and Jon E. Keeley[2,3]

[1]Department of Botany, Univ...

BIOLOGICAL INVASIONS BY EXOTIC GRASSES, THE GRASS/FIRE CYCLE, AND GLOBAL CHANGE

OIKOS 73: 79–85. Copenhagen 1995

Kill thy neighbour: an individualistic argument for the evolution of flammability

William J. Bond and Jeremy J. Midgley

...W. J. and Midgley, J. J. 1995. Kill thy neighbour: an individualistic argument for ... Oikos 73: 79–85.

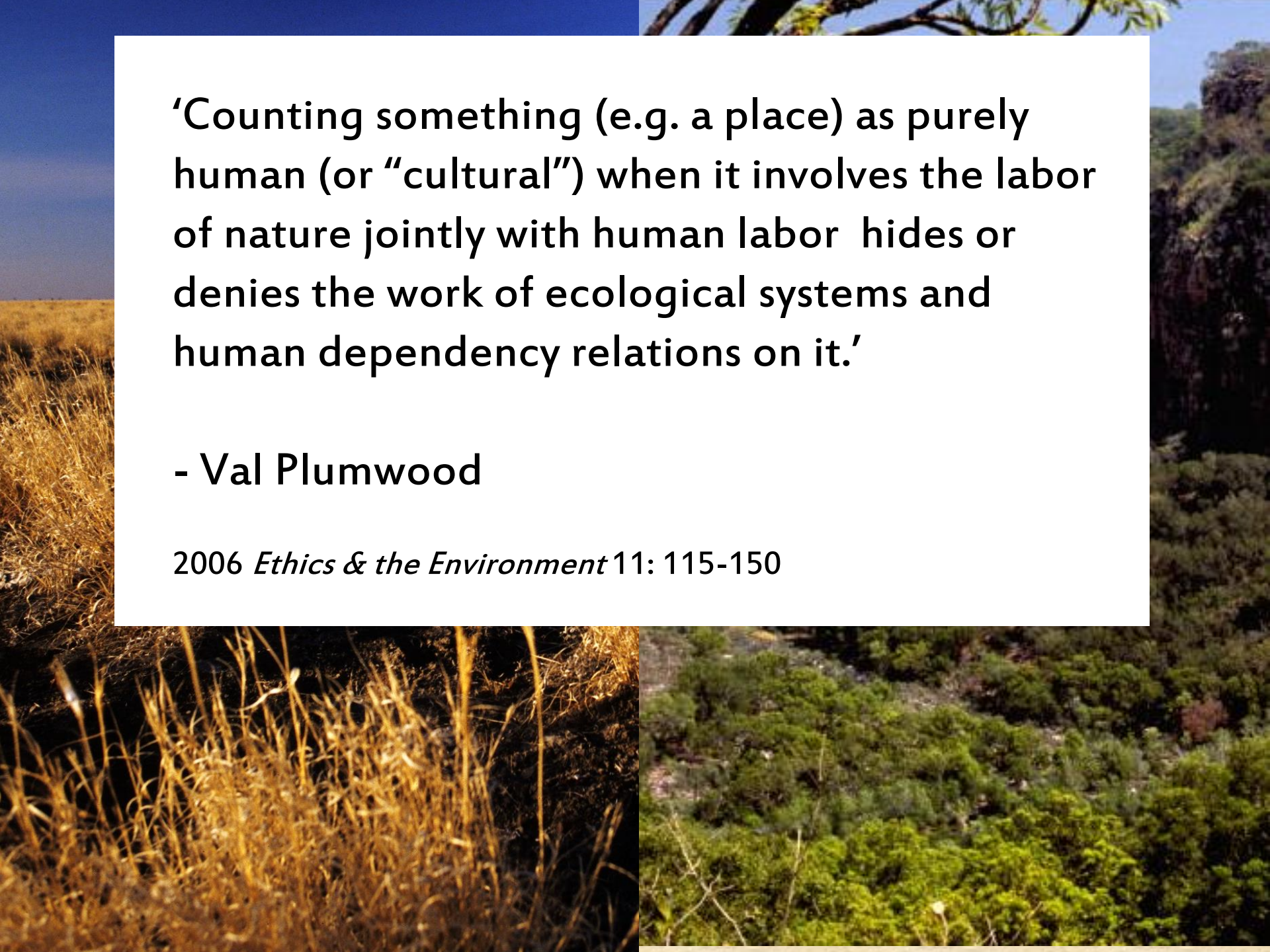
Ecosystem Engineer

Photos by Toby Hudson
Marcin Klapczynski

Super-successful weeds

‘Australia in 1788 was made, not natural.’

– Bill Gammage, *The Biggest Estate on Earth*



‘Counting something (e.g. a place) as purely human (or “cultural”) when it involves the labor of nature jointly with human labor hides or denies the work of ecological systems and human dependency relations on it.’

- Val Plumwood

2006 *Ethics & the Environment* 11: 115-150

CLIMATE CHANGE

Is Global Warming Causing More, Larger Wildfires?

Steven W. Running

On 3 April 2006, the U.S. weekly news magazine *Time* ran a report on global warming with the cover title "Be worried, be very worried." Similar coverage of global warming has emerged in other general-interest magazines in recent months, triggered by scientific studies that are finding evidence for adverse impacts of global warming occurring today, not merely projected for future decades. These adverse impacts—from higher probabilities of category 4 and 5 hurricanes (*1*, *2*) to higher rates of sea-level rise (*3*)—are found not in some distant unpopulated region, but rather right in our own back yards.

On page 940 of this issue, Westerling *et al.* (*4*) come to a similarly discomforting conclusion for wildfires. They show that warmer temperatures appear to be increasing the duration and intensity of the wildfire season in the western United States. Since 1986, longer, warmer summers have resulted in a fourfold increase of major wildfires and a sixfold increase in the area of forest burned, compared to the period from 1970 to 1986. A simfire danger low in these arid forests until the spring melt period ends. Once snowmelt is complete, the forests can become combustible within 1 month because of low humidities and sparse summer rainfall. Most wildfires in the western United States are caused by lightning and human carelessness, and therefore forest dryness and hot, dry, windy weather are the necessary and increasingly common ingredients for wildfire activity for most of the summer. Snowpacks are now melting 1 to 4 weeks earlier than they did 50 years ago, and stream flows thus also peak earlier (*6*, *7*).

Westerling *et al.* found that, in the 34 years studied, years with early snowmelt (and hence a longer dry summer period) had five times as many wildfires as years with late snowmelt. High-elevation forests between 1680 and 2690 m that previously were protected from wildfire by late snowpacks are becoming increasingly vulnerable. Thus, four critical factors—earlier snowmelt, higher summer temperatures, longer fire season, and expanded vulnerable area of high-elevation forests—are combining to pro-

the investment of $120 million and deployment of 25,000 firefighters—were only extinguished when snow began to fall in mid-September (*8*).

The Yellowstone fires exemplify a common statistic of wildfires: Less than 5% of all wildfires account for more than 95% of the area burned. A small fraction of fires get very

Giant Reed (*Arundo donax*)

A target for biocontrol in California, and a major biofuel in Florida

Photos by Valerie Vartanian

West Canning Advanced Energy Project

Company Name	ENEnergy - West Canning Project
Sector	Energy and Transport Fuels
Year Established	2006 - Norway & 2009 - Australia
Business Stage	Commercialisation
Location	West Canning Basin, WA
Seeking	Investor/Strategic Partner
Total Investment	$50M (staged against milestones)

Executive Summary — A "New Ballgame" in Oil Production

ENEnergy of Norway (ENE) has developed a breakthrough process for refining plant matter (biomass) into usable energy in the form of ethanol, lignin (or "green" coal) and biogas. This technology has been validated by some of the world's leading engineering firms and described as "game changing" as it:

- Can quickly process any plant matter into usable energy;
- Is ready to be deployed at industrial scale;
- Can produce ethanol in West Canning for **under $30 per barrel**.

This project represents a unique opportunity to invest in the future of global energy. Major technology and project milestones have been reached and we are now ready to roll out a project at scale that has the potential to significantly impact the global energy market at a time when major oil companies are reporting exploration costs at $80 per barrel.

Management

Hans Olav Bjornenak - Chairman ENEnergy. Over 30 years experience (inc. Statoil, Scanoil, Petroder) in oil/energy industry and former owner of leading energy trader/broker (HOB) — world's largest broker of transport fuels.

ENERGY MARKET

Changing the World of Energy

Our Breakthrough Technology

Our Biofuels and the Energy Market

Our Projects »

CHANGING THE WORLD OF ENERGY

ENEnergy aim to totally transform the way energy is produced and to be competitive in the

OUR PROJECTS

The ENEnergy team has done a global search for the best locations and biomass to roll out large scale projects based on this technology.

We believe that there are many locations around the world that would be suitable for large scale bioenergy projects. We have already identified interesting opportunities in Asia, Africa and Latin America.

However as a starting point we believe that **Northern Australia** displays the best combination of growing conditions (i.e. solar resource, water availability, soil temperature etc.), political stability, access to global markets and availability of vast areas of land that does not compete with standard agriculture.

Our analysis indicates that there are potentially millions of hectares of available land in Northern Australia (in WA, NT and QLD) that could be converted to the growing of high-density biomass crops.

Pilbara Project

We are currently planning our first project to be located in the Pilbara region of Western Australia. The region has a great growing climate, vast areas of affordable land and access to a massive subterranean reservoir of low quality water. The area is also close to port facilities from which we can export to the world.

Our first project is planned as a 10,000 Ha plantation for either sorghum or Arundo Donax (or a combination of both) that will produce approximately 1,000,000 dry tonnes of biomass per annum, and produce approximately 400ML of ethanol, plus 100,000 tonnes of lignin.

The project has undergone an initial feasibility study and we are now in the process of attempting to raise funding to complete a detailed feasibility study and full pre-engineering plan. The project will be led by ENEnergy and our preferred EPC partner, KBR.

Immigrant Birds

Grass finches
Grassbirds
Songlarks
Cisticolas
Richard's pipit
Spinifexbird
Welcome swallow
Barn swallow
Horsfield's bushlark
Pied chat

Quail
Grass owl
Barn owl

Grass seeds are the easiest to husk

Molecular Phylogenetics and Evolution xxx (2013) xxx–xxx

Contents lists available at SciVerse ScienceDirect

Molecular Phylogenetics and Evolution

journal homepage: www.elsevier.com/locate/ympev

Multilocus phylogeny of the avian family Alaudidae (larks) reveals complex morphological evolution, non-monophyletic genera and hidden species diversity

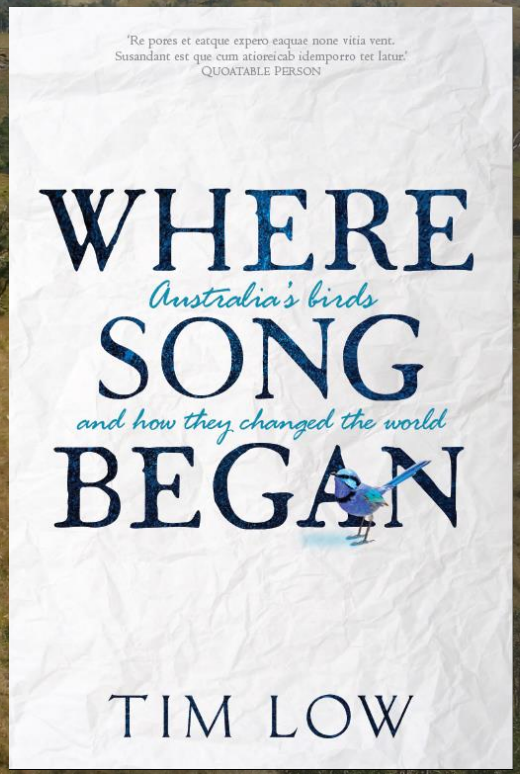
Per Alström [a,b,c,*], Keith N. Barnes [c], Urban Olsson [d], F. Keith Barker [e], Paulette Bloomer [f], Aleem Ahmed Khan [g], Masood Ahmed Qureshi [g], Alban Guillaumet [h], Pierre-André Crochet [i], Peter G. Ryan [c]

[a] Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, Chaoyang District, Beijing 100101, PR China
[b] Swedish Species Information Centre, Swedish University of Agricultural Sciences, Box 7007, SE-750 07 Uppsala, Sweden
[c] Percy FitzPatrick Institute of African Ornithology, DST/NRF Centre of Excellence, University of Cape Town, Rondebosch 7700, South Africa
[d] Systematics and Biodiversity, Gothenburg University, Department of Zoology, Box 463, SE-405 30 Göteborg, Sweden

Kangaroo Grass

Themeda triandra

Timlow.com


'Re pores et eatque expero eaquae none vitia vent.
Susandant est que cum atioreicab idemporro ter latur.'
QUOATABLE PERSON
WHERE
Australia's birds
SONG
and how they changed the world
BEGAN
TIM LOW