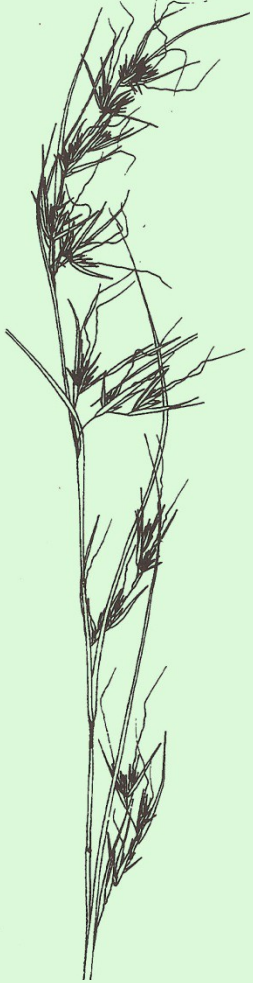


Fire regimes, ecological resilience and weed management

Adrian Hansen



Why care about environmental weeds?

Plant growing in the wrong place?

Much more than that!

Most species in an community are rare – even many singletons! EVNT species in this group.

Hubbell, S. P. (2001). *The unified neutral theory of biodiversity and biogeography*. Princeton University Press.

So rare species do it tough enough – adding weeds just makes it tougher

Don't let people con you it's “novel” ecosystems” or “more biodiversity”



ECOLOGICAL NATURAL AREA MANAGEMENT



SEQ
Fire & Biodiversity
CONSORTIUM



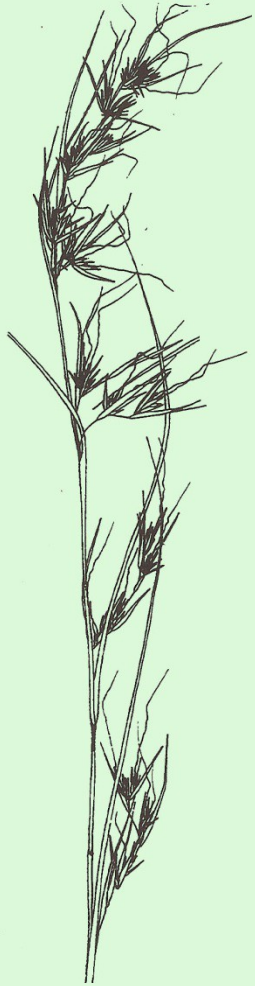
What is ecological resilience?

Ecological resilience the response of individuals, species and ecosystems to ecological **disturbance**

Disturbance!

There's a word with as many definitions as disturbance ecologists

So, a look at that word first!



Disturbance

Two types of ecological disturbance:

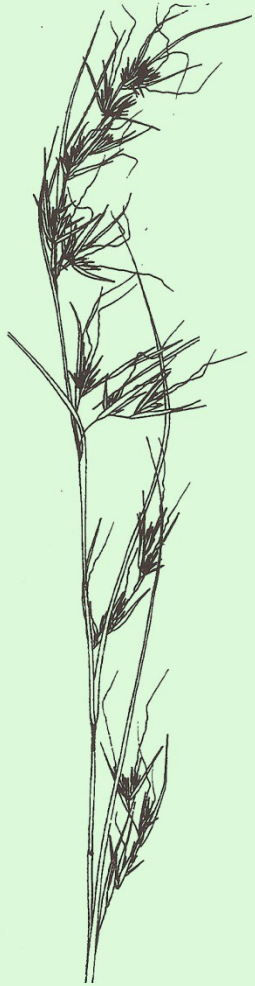
Grime, J.P. (1977). Evidence for the existence of three primary strategies in plants and its relevance to ecological and evolutionary theory. *The American Naturalist*, 111: 1169-1194.

1. Disturbance

Discreet events which destroy or consume biomass

These include:

Fire, flood, storms, frost, herbivory etc



Disturbance

Two types of ecological disturbance:

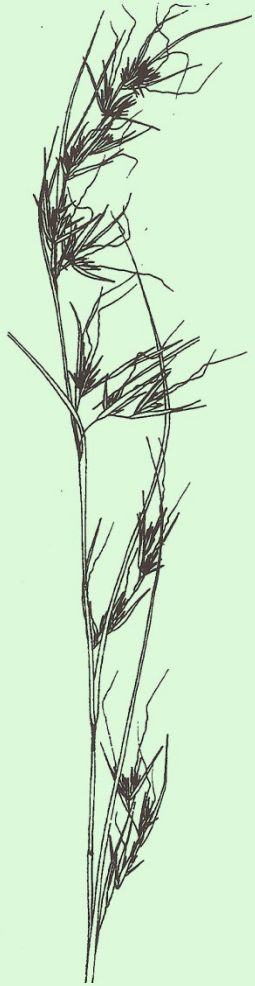
Grime, J.P. (1977). Evidence for the existence of three primary strategies in plants and its relevance to ecological and evolutionary theory. *The American Naturalist*, 111: 1169-1194.

2. Stress

On-going conditions that restrict production

These include:

Shortages of light, water, and sub-optimal temperatures etc



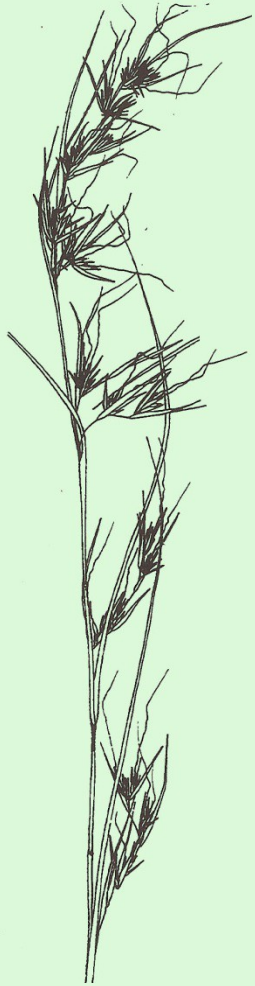
Responses to Disturbance

What can happen when an ecosystem is impacted by a biomass destroying disturbance event?

1. An ecological resilience response

- The biomass that is destroyed by the disturbance event is replaced by growth (from propagules)
- This indicates that resilience **is** propagules

McDonald, C. (1996). Ecosystem resilience and the restoration of damaged plant communities

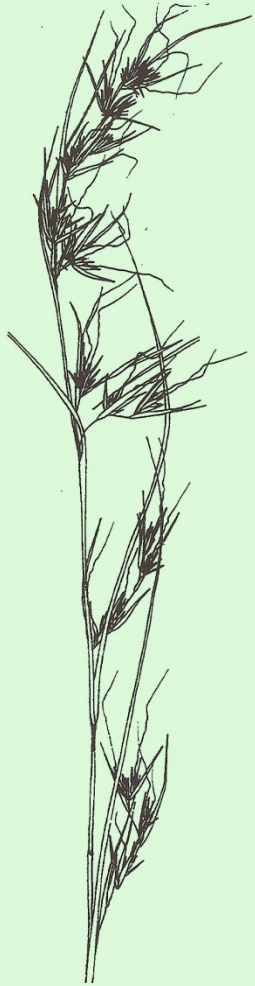


Disturbance regimes

When it comes to disturbance, ecosystems and species are adapted to the fire regime, a history of events, not just individual disturbance events.

Gill & Allan, (2008) Large fires, fire effects and the fire-regime concept

- Frequency
- Variability (Frequency is not just the inverse of time between fires)
- Intensity
- Season
- Severity
- Extent

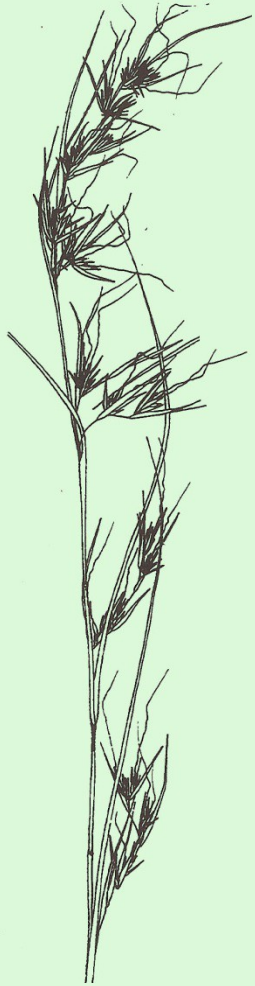


Weeds and resilience

- So, species growing in an ecosystem subject to a certain fire regime, have resilience adaptations to bounce back from the repeat disturbances

This includes the weeds!

- So, how do we manage ecosystems taking into account ecological resilience?



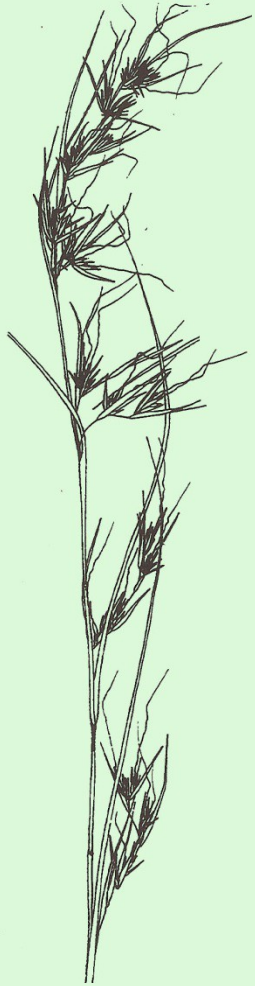
Weeds and resilience

- But weeds can be quite dominant in a native ecosystem

Why is this so?

Weeds come in three main types

- Scattered weeds
- Invasive weeds
- Ecosystem transforming weeds



Scattered weeds

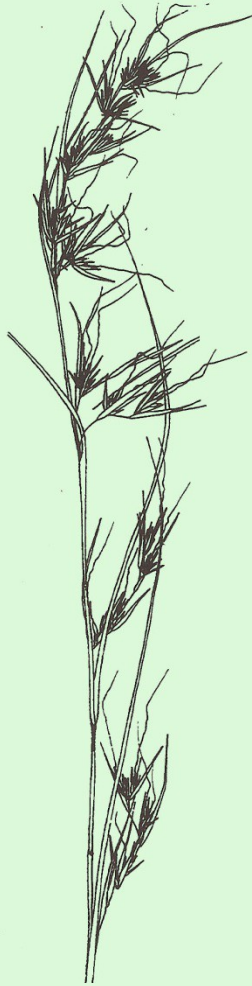
- Scattered weeds are equivalent to Hubbels's uncommon or rare species in an ecosystem

Why is this so?

- Species have niches and a range of species have functional adaptations to a fire regime which allow them to occupy a small space (temporally or spatially) in ecosystems

Bradstock & Kenny, (2003). An application of plant functional types to fire management

- There are plenty of non-native species (weeds) which are relatively rare for the same reason

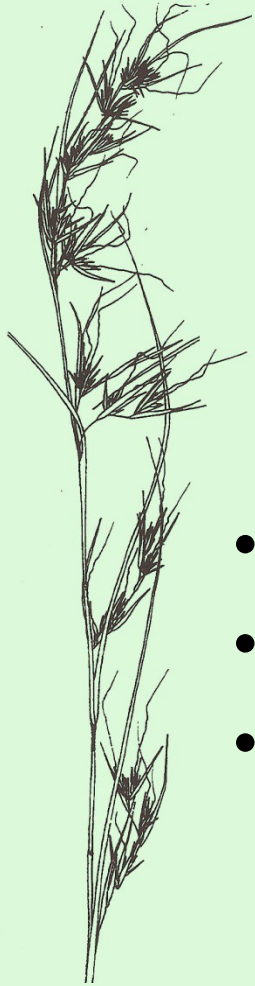


Dominant species

Dominant species have functional adaptations for dominance

Kangaroo Grass (*Themeda triandra*) is a clumping native grass which uses its clumping functional adaptation to:

- Exclude other species
- Rapidly regrow its clumps post fire and
- Come to dominate an ecosystem with its dense swards

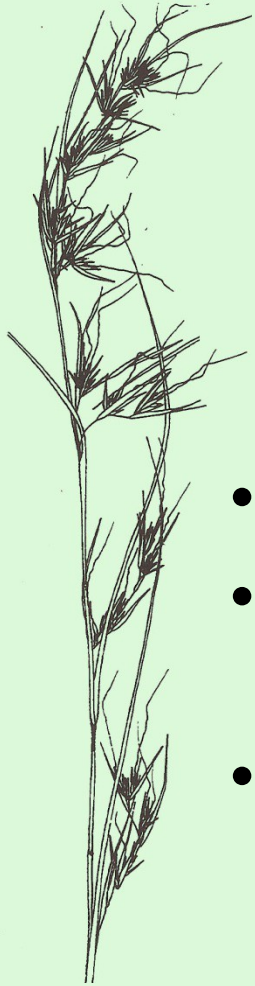


Dominant weeds

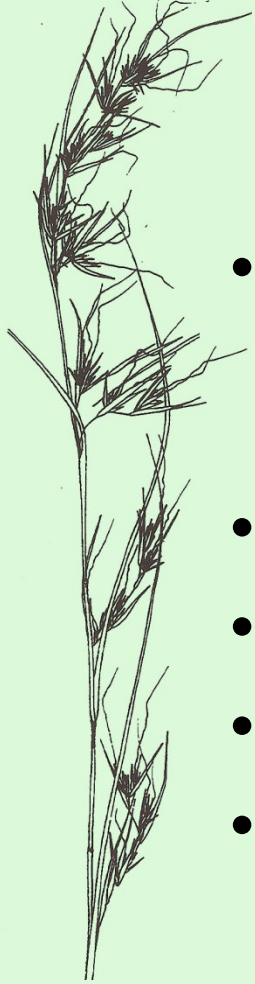
If Kangaroo Grass is so good, how does it lose out to a dominant invasive weed?

A dominant invasive weed that can take on Kangaroo grass and win is *Paspalum dilitatum* - How?

- It grows clumps as fast as Kangaroo grass
- But it has another functional adaptation that Kangaroo grass **doesn't** have in its armory
- The ability to set larger amounts of more viable seed more quickly post fire



Dominant weeds



We also **help** Paspalum!

- We change the disturbance regimes to help by changing the fire regime often setting fires with greater intensity and
- We add other disturbances such as
- Cattle
- Nutrients
- Etc etc



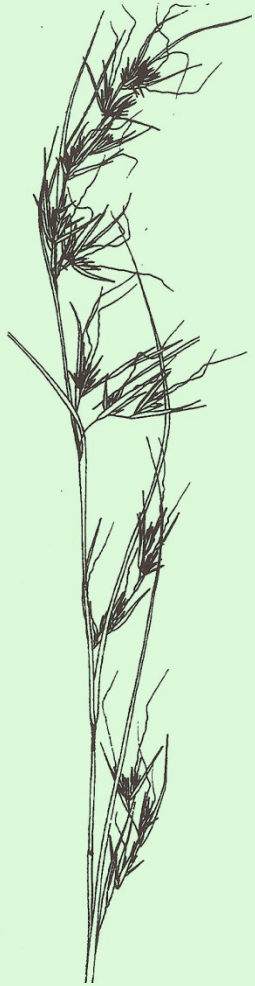
Ecosystem transforming weeds

These weeds transform the ecosystem by transforming the disturbance regime

Para grass (*Urochloa mutica*) and Molasses grass (*Melinis minutiflora*) increase the intensity of a bushfire event

This increases the severity of the bushfire event often killing competitors but generally opening the canopy to more light

This **changes** the ecosystem to favour itself against its indigenous competitors

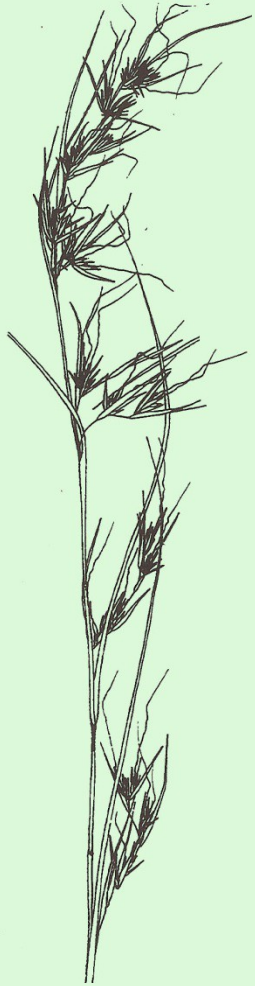


Ecosystem transforming weeds

Asparagus Fern (*Asparagus aethiopicus*) and Singapore daisy (*Sphagneticola trilobata*) do it in the other direction

These weeds form a dense green ground layer doesn't readily burn, the fire doesn't penetrate the ecosystem and species such as Kangaroo grass are disadvantaged by this changed fire regime

This is sometimes been called an ecological resistance response but is more correctly an ecosystem (disturbance regime) transformation

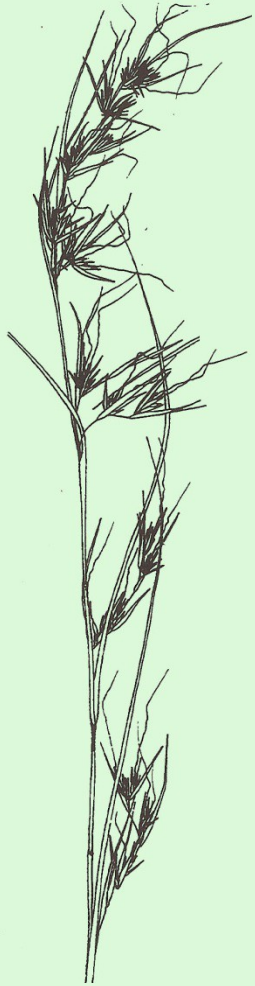


Treatment – Ecological restoration

It is be suggested sometimes that we can use the fire disturbance to treat weeds and examples have been suggested

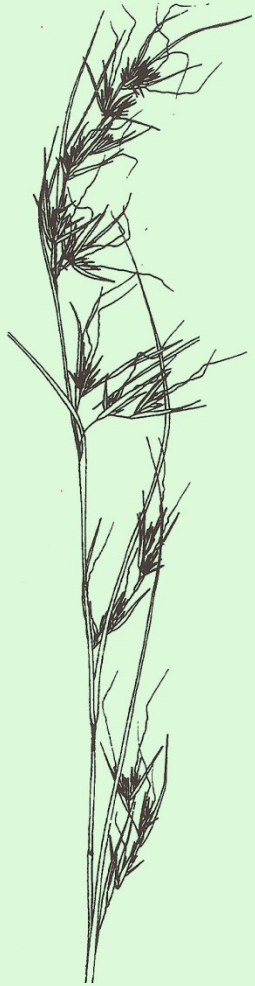
For example, burning Molasses grass swards several times a year kill them or using intense fires to kill Lantana

What can we infer from the science of ecological resilience in the face of the fire disturbance?



Treatment – Ecological restoration

- Use disturbance regime manipulation for weed control as a last resort
- Indigenous species have functional adaptations for the original fire regimes in the original non-weedy ecosystems
- Changing the fire regimes, even with the best intentions to treat weeds would probably have deleterious effects on Hubbel's rare and uncommon species



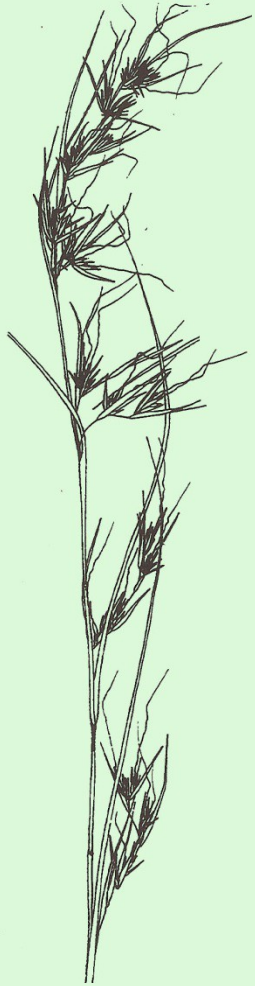
Treatment – Ecological restoration

We should always aim for a disturbance regime which maximises the resilience response of the indigenous species

Because invasive weeds also have a good (sometimes excellent) resilience response to that disturbance regime

We have to find another approach

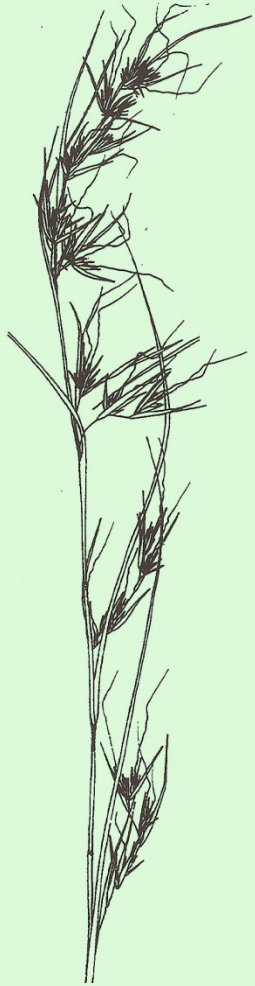
That approach is bush regeneration



Bush regeneration

Bush regeneration aims to degrade the resilience response of the weeds by various methods so that the normal disturbance regime will:

- Favour the resilience response of the natives over the weeds



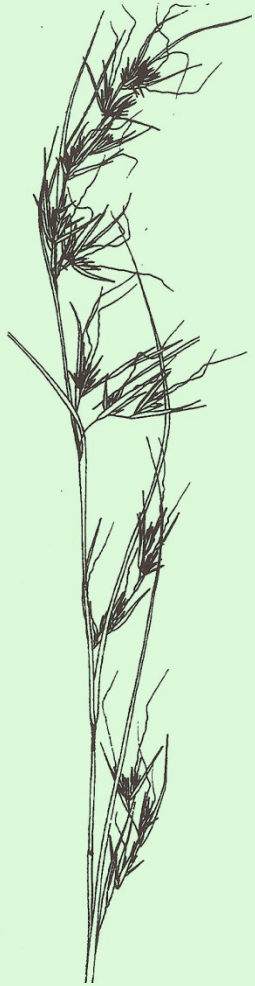
Bush regeneration

For example – *Paspalum dilitatum*

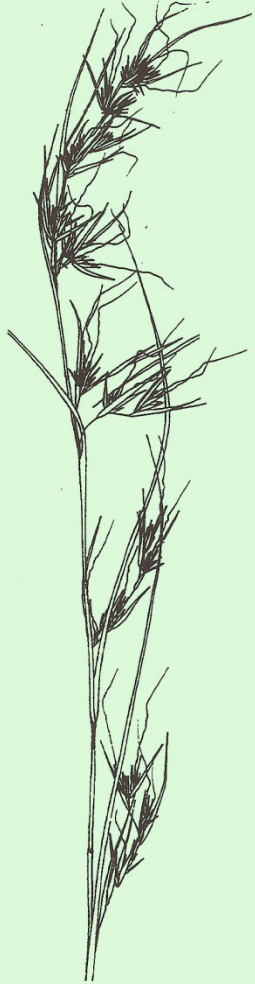
Its advantage is early production of large amounts of high viability seed post fire

Degrade this resilience advantage by:

- Pulse grazing when it is flowering (within phenological constraints)
- Selectively removing the seed of Paspalum
- Setting a prescribed burn and selectively spraying the Paspalum before it can set seed and to kill its clumps



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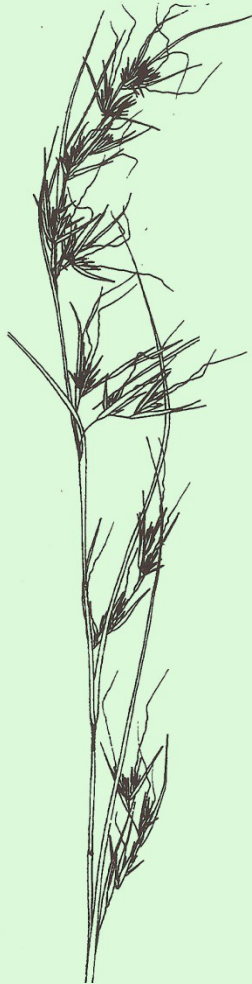
Bush regeneration

Asparagus Fern

It transforms the ecosystem by a reducing flammability of the ecosystem so we want to return to a normal fire regime by:

- Spraying the Asparagus Fern
- Then set a prescribed burn when large amounts of the Asparagus Fern is dead
- Then follow-up spot spraying

Its native competitor is Midgim Berry which re-sprouts strongly post fire



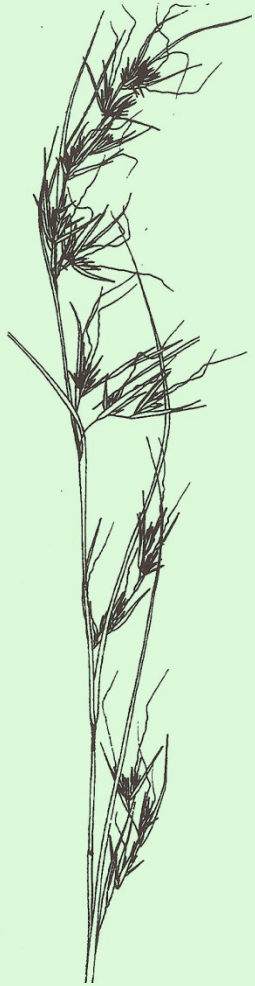
Bush regeneration

Lantana

Use the same trick with Lantana

The fire you get from dead, sprayed lantana is a good one that really encourages native regeneration

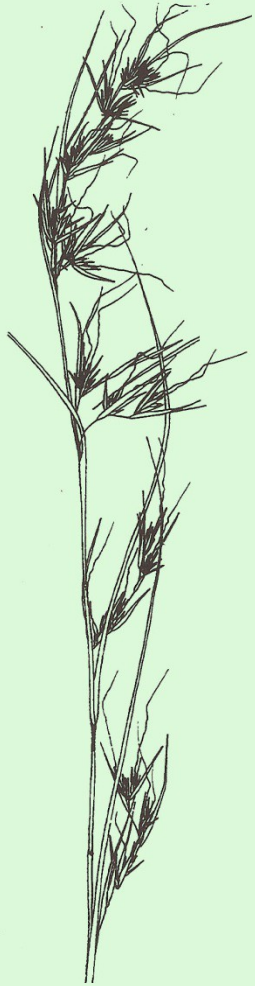
And dead, sprayed lantana doesn't resprout!



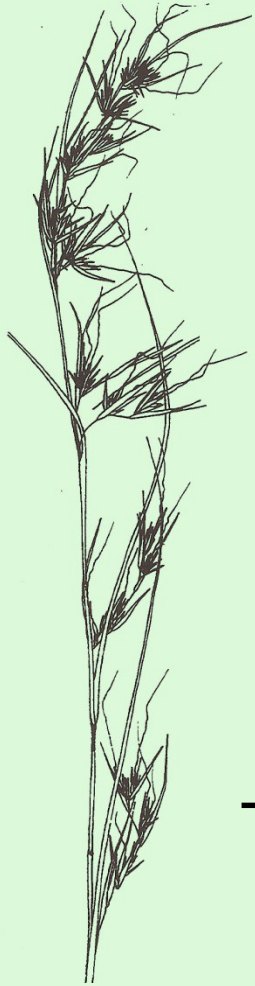
Take home message

We need to:

- Encourage a self-sustaining ecosystem which is functionally integrated into the surrounding landscape and has a strong resilience response to the (pre)-historical fire regime
- Degrade the vigour of the resilience response of the weeds that also have a strong resilience response to that fire regime so that the native ecosystem will “bounce back” after fire and the weeds won't



ECOLOGICAL NATURAL AREA MANAGEMENT



Thank you



Contact

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ECOLOGICAL NATURAL AREA MANAGEMENT

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