Maintaining landscape resilience in production landscapes with overland flow control.

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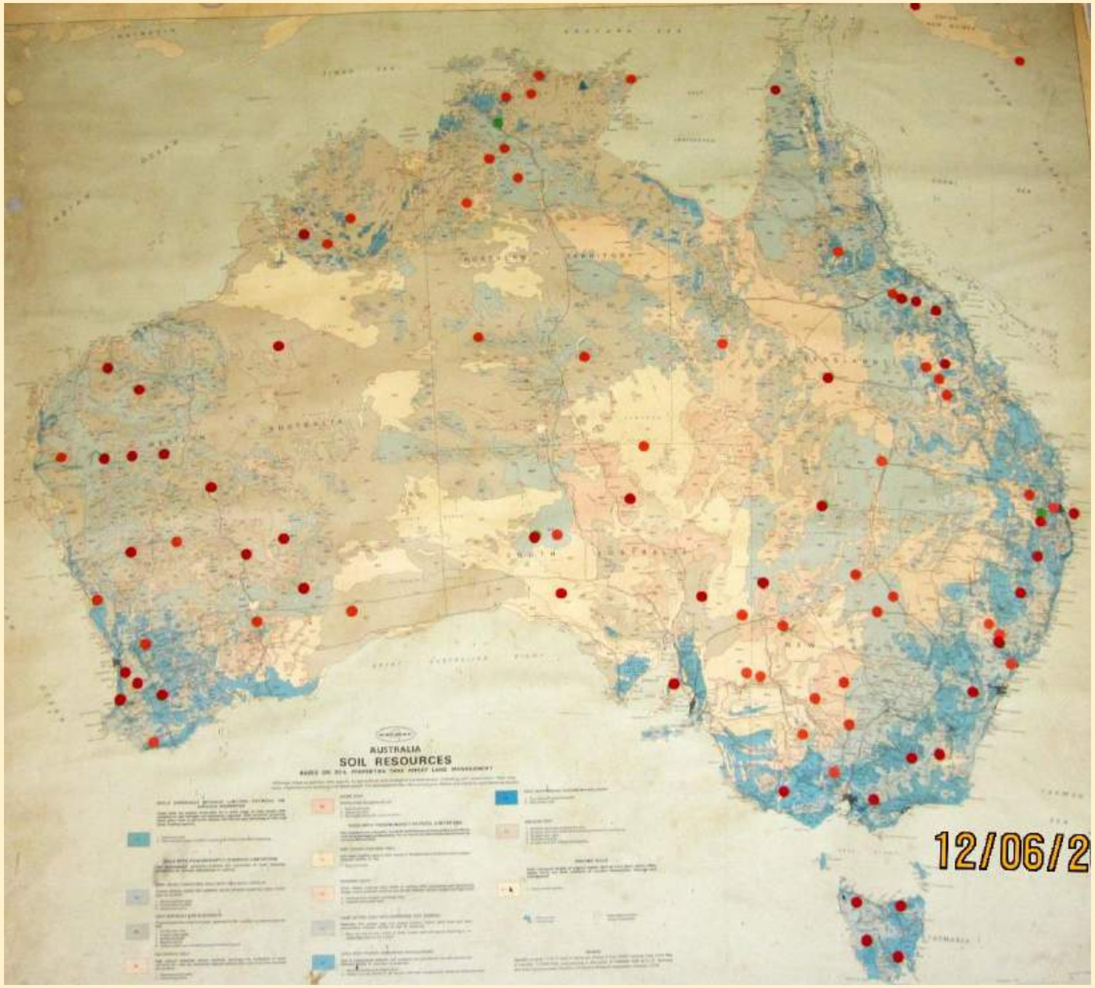


- Managing production landscapes to enable them to persist in the face of climate change predictions means that they must have high resilience

- Landscape resilience is the capacity of a landscape to **recover rapidly** from stress and/or disturbance (S/D)

- In my view, this is best achieved by managing landscapes to be **highly functional**.

- Landscape function → **"How does this landscape work as a biophysical system?"**

High functionality means:

- Absorbing a high proportion of incident rainfall
- Losing a low proportion of rainfall, topsoil and organic matter off the paddock
- Maximising "rainfall use efficiency" – kg of biomass per hectare per mm of rainfall

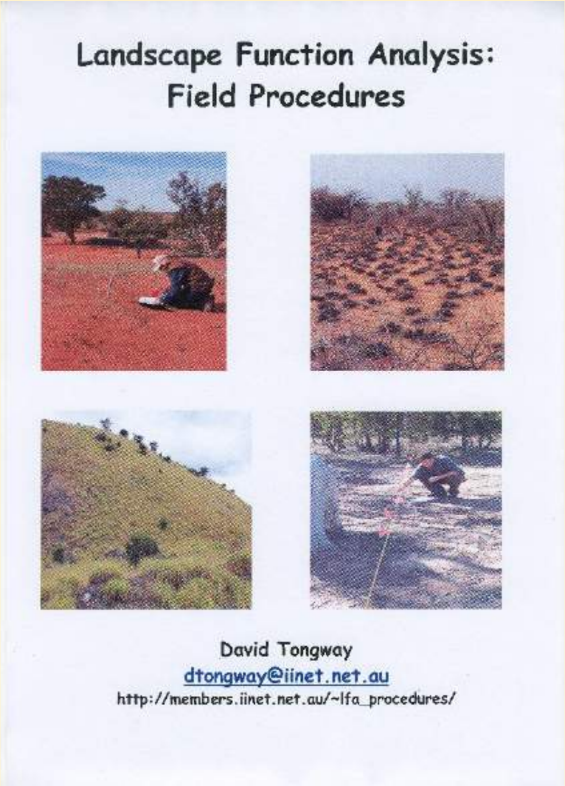
	Bare Soil	Grassland	Woodland
Soil Water	15.7 mm	33.7 mm	51.6 mm
% of rainfall	42	90	138

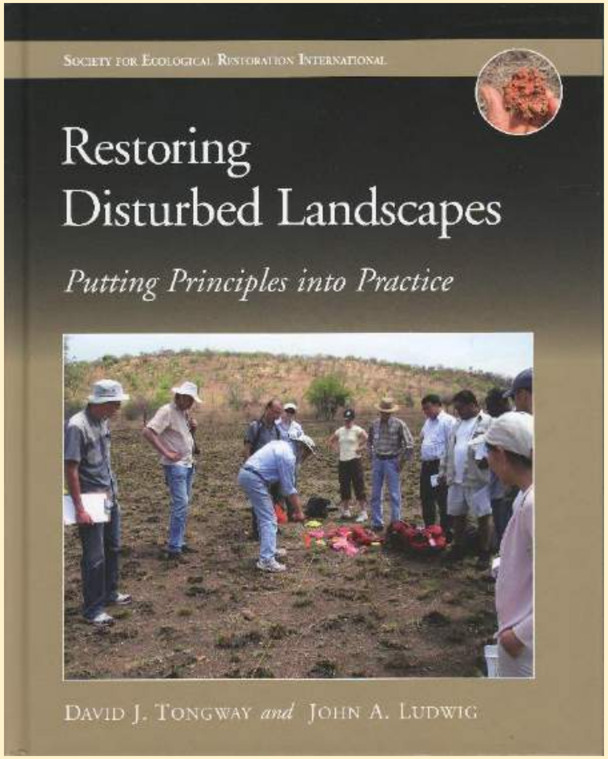
Rainfall infiltration from a 37.5 mm event over 2 days

With my colleagues Norman Hindley and John Ludwig, I have devised a simple field procedure that assesses how well a landscape is working:

"Landscape Function Analysis" or

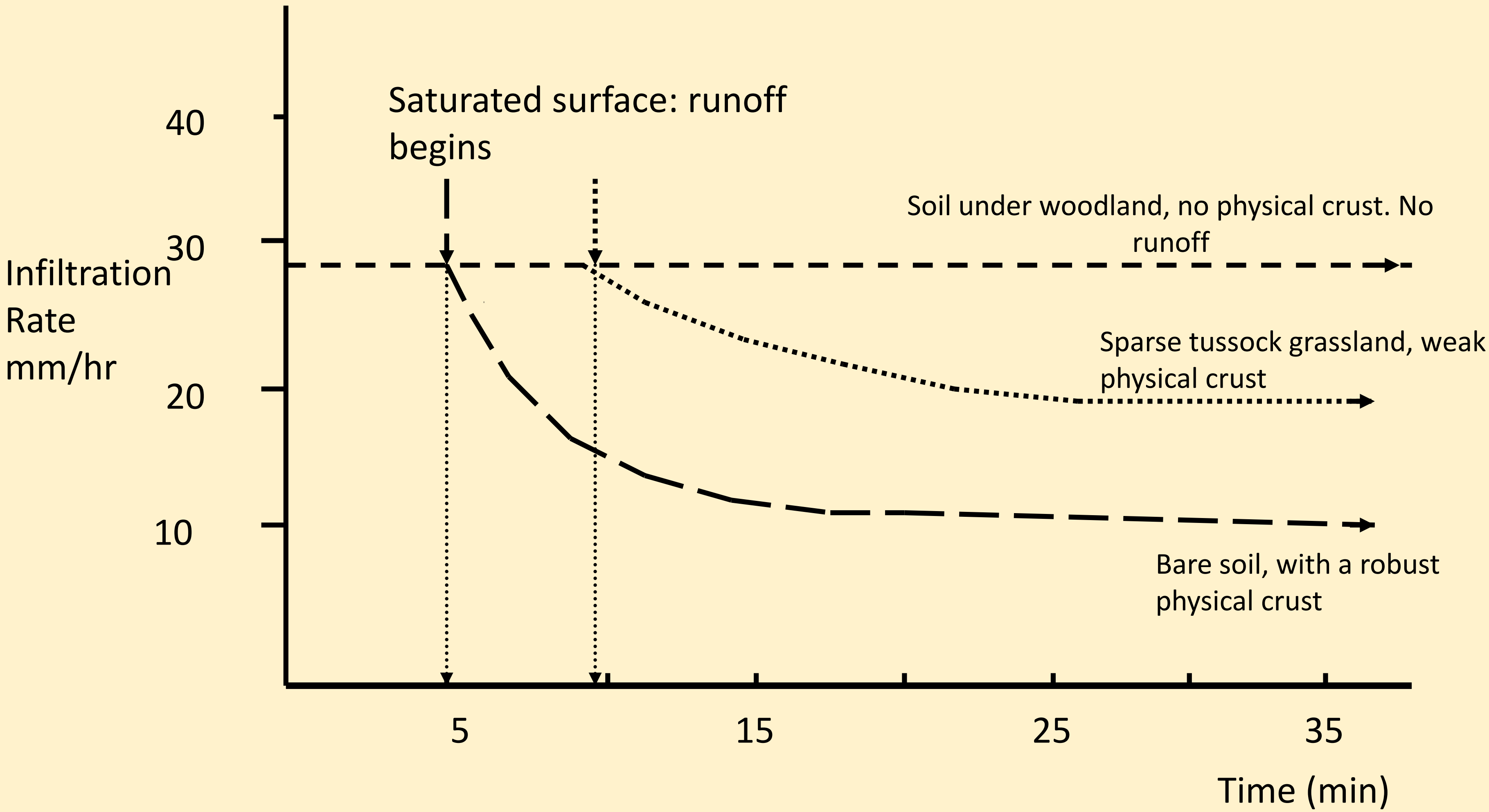
"Reading the Landscape"

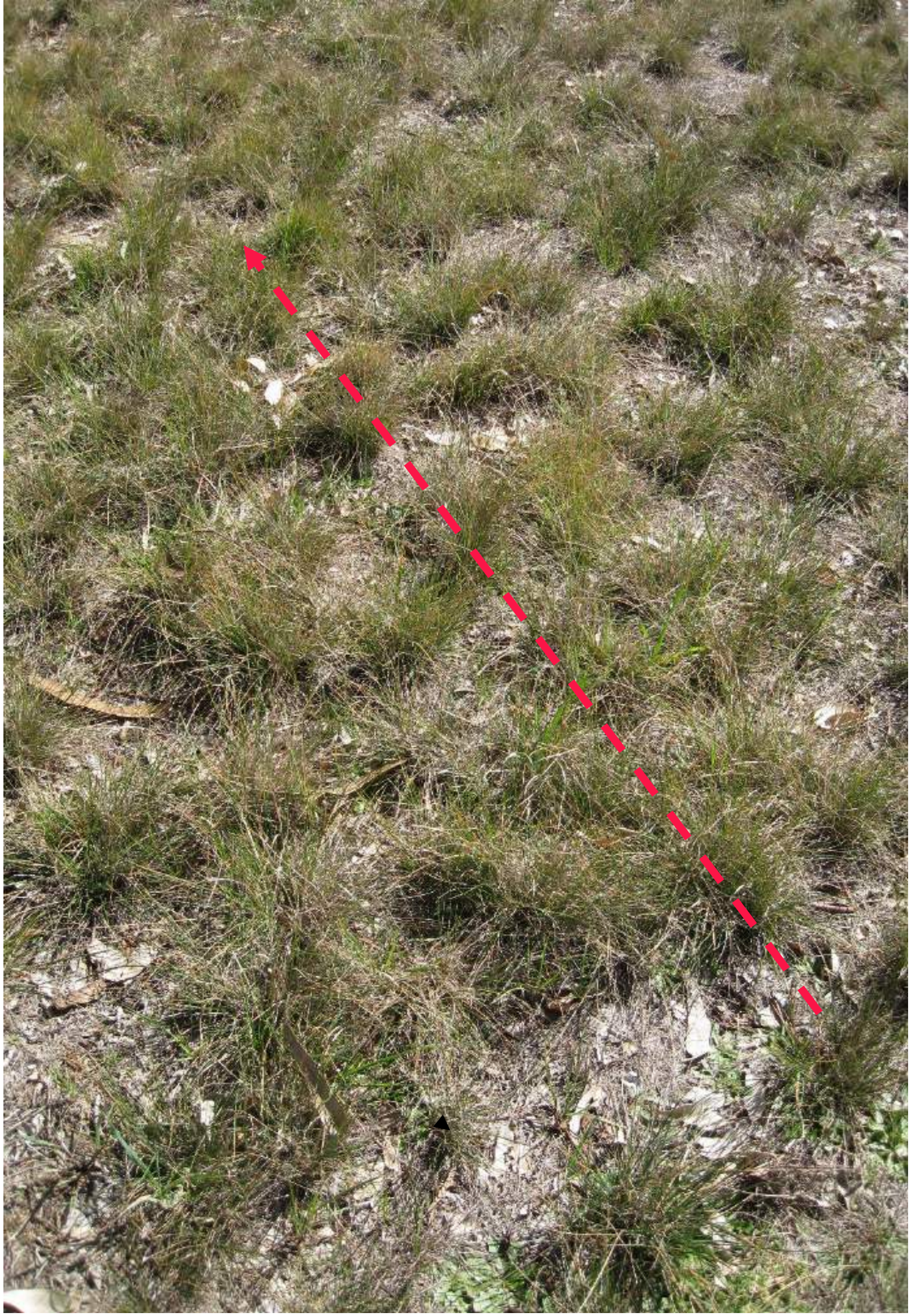




Functioning semi-arid grasslands were converted to dysfunctional shrublands by overgrazing and lack of fire.

Simulated Rainfall infiltration/runoff character in re physical soil crusts

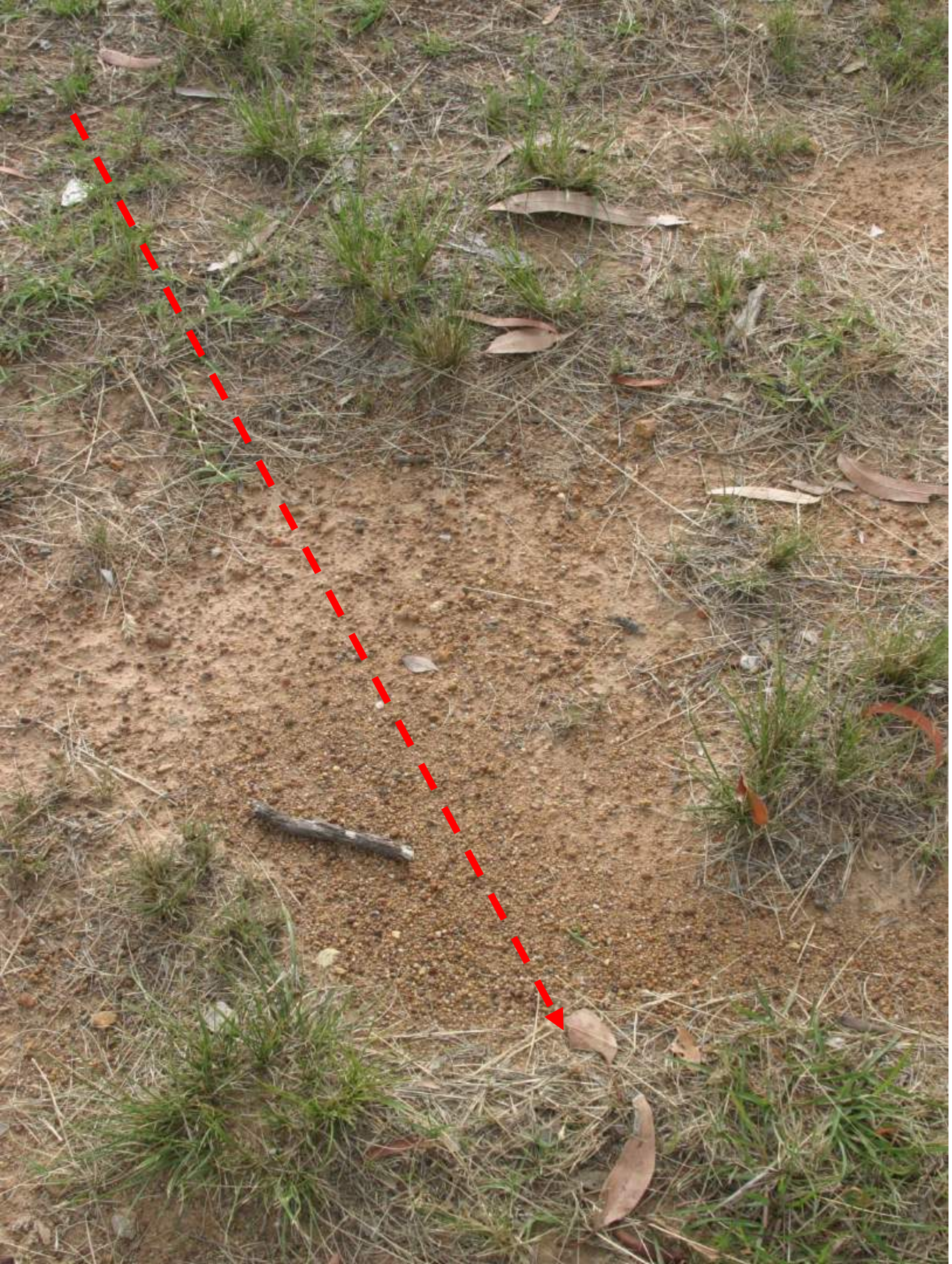




This is a “grassy sward” patch.

The grass plants are close enough together that the water run-off is unable to generate enough energy to redistribute the grassy litter, which is evenly distributed.

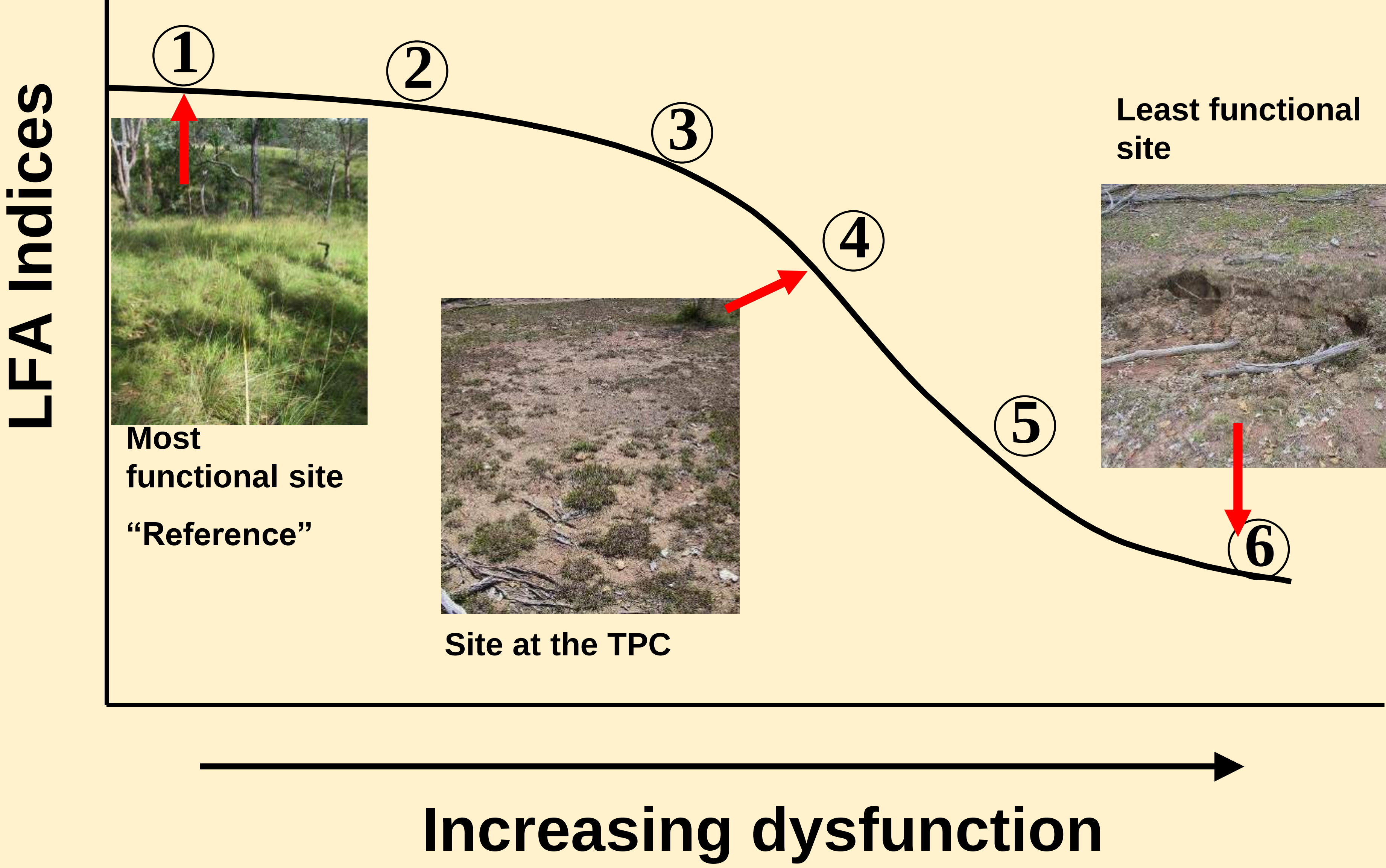
In regions of > 450 mm rainfall, swards or continuous patches would be “normal” and a management objective.



A “slightly dysfunctional” grass sward, due to pedestrian trampling

Litter and sediment have both been washed off the interpatch and have been arrested by a down-slope grass patch. Note the orientation of the grassy litter strands.

The shape of a land dysfunction curve; note non-linearity



Soil physical crusts are formed when rain directly impacts an unprotected soil surface.
These may be quite thin, but reduce the infiltration rate greatly

Evidence for Strategic management success (New England plateau).

Strategic grazing on "Lana", involving extensive rest between periods of grazing

"Typical" for the district: even low continuous stocking results in landscape dysfunction and loss of function and resilience.

Typical vertical view of pasture on "Lana": rain never impacts directly on the soil surface

Strategic resting not only reduces biomass loss from grazing, but permits recovery from trampling.

Strategic resting also results in improvements in topsoil structure and properties:

- Bulk density,   water holding capacity,
- water infiltration rate,
- root length,
- aggregate stability,
- soil respiration,
- soil biota complement (esp macro-biota for bioturbation)

Summary

- Increase resilience with strategic resting → improved functionality

- This will be accompanied by improved “rainfall use efficiency”

- The simplest indicator is “soil cover as high as possible” – litter as well as plants.

Sequence of observations in "reading the landscape"

1. How is rainfall partitioned into infiltration and runoff?
2. Is there sediment and litter movement and loss?
3 What sort of pulse growth is there after a rainfall trigger?
4. What are the "consumptive processes" depleting the plant growth pulse?
5. How effective is the cycling of organic matter back into the soil?
6. How does the physical arrangement of plants after a growth pulse affect future run-off and infiltration processes?