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Agricultural Information & Monitoring Services
3 August 2024

Wallabadah Water Forum

AIMS

2020 - Common practices

- Continuous grazing
- Low stock numbers grazing large areas at any time
- Forage crops, for feed and hay production
- Subtropical pasture species
- Urea, single superphosphate, DAP, gypsum fertiliser
- Herbicides for weed control

Comments

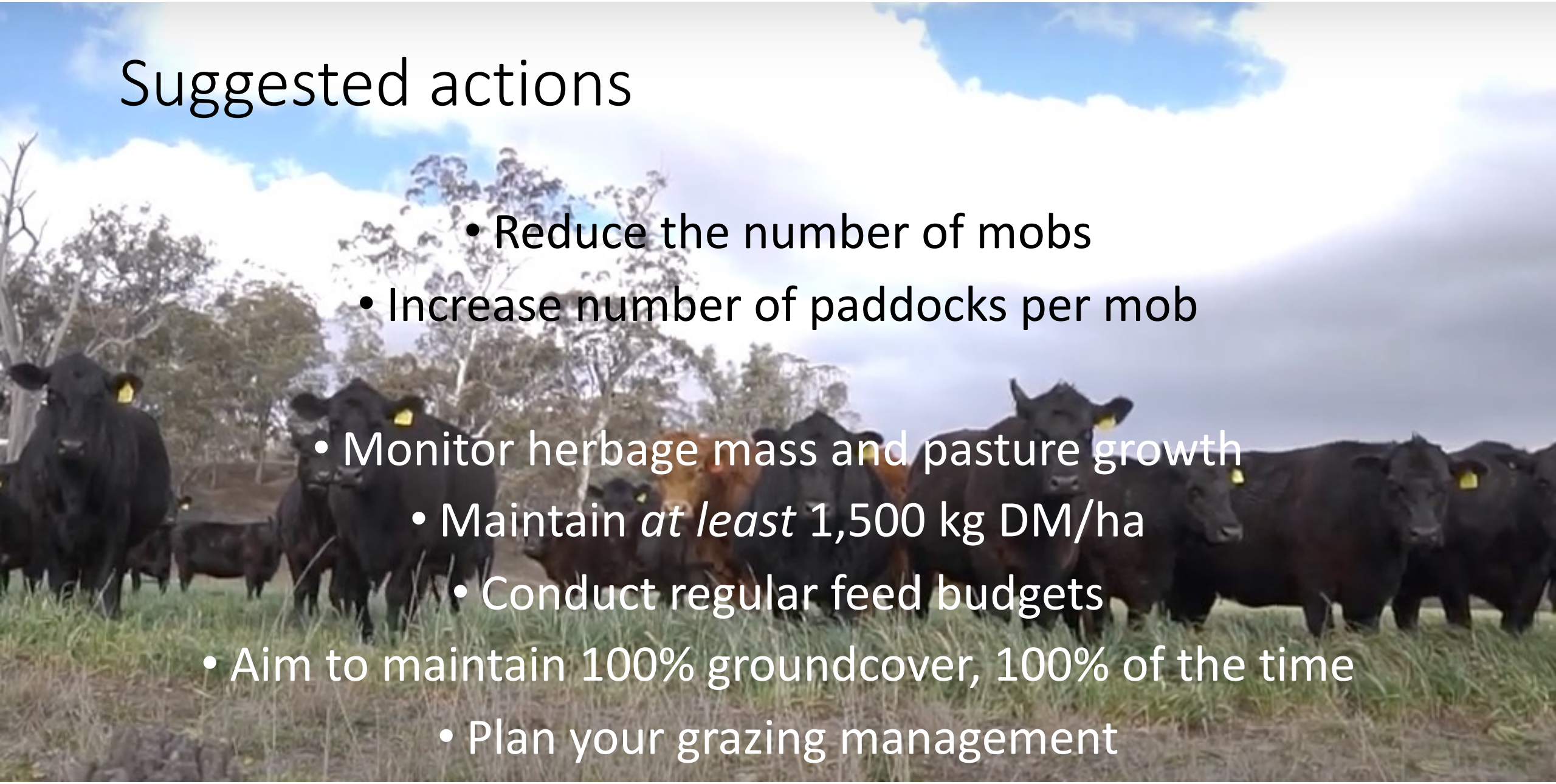
- ‘Pre 1980’s we ran 9 dse/ha, after 1984 it was 6 dse/ha’- currently 3 dse/ha
- ‘The creek has never stopped flowing before’
- ‘The creek rarely flows now’
- ‘During the drought even the holes dried up’
- ‘The creek is now narrower and the bed lower’
- ‘50 years ago it took 9 hours for floodwater to reach Quirindi, now its 4 hours’

So what’s changed?

Issues identified

- Increasing costs
- Cost of feeding livestock
- Cost of restocking
- Increasing weeds – e.g. speargrass, Bathurst burr, heliotrope
- Low soil sulphur levels
- Climate variability
- Feral animals
- Declining condition of waterways

Suggested actions



- Reduce the number of mobs
- Increase number of paddocks per mob

- Monitor herbage mass and pasture growth
- Maintain *at least* 1,500 kg DM/ha
- Conduct regular feed budgets

- Aim to maintain 100% groundcover, 100% of the time

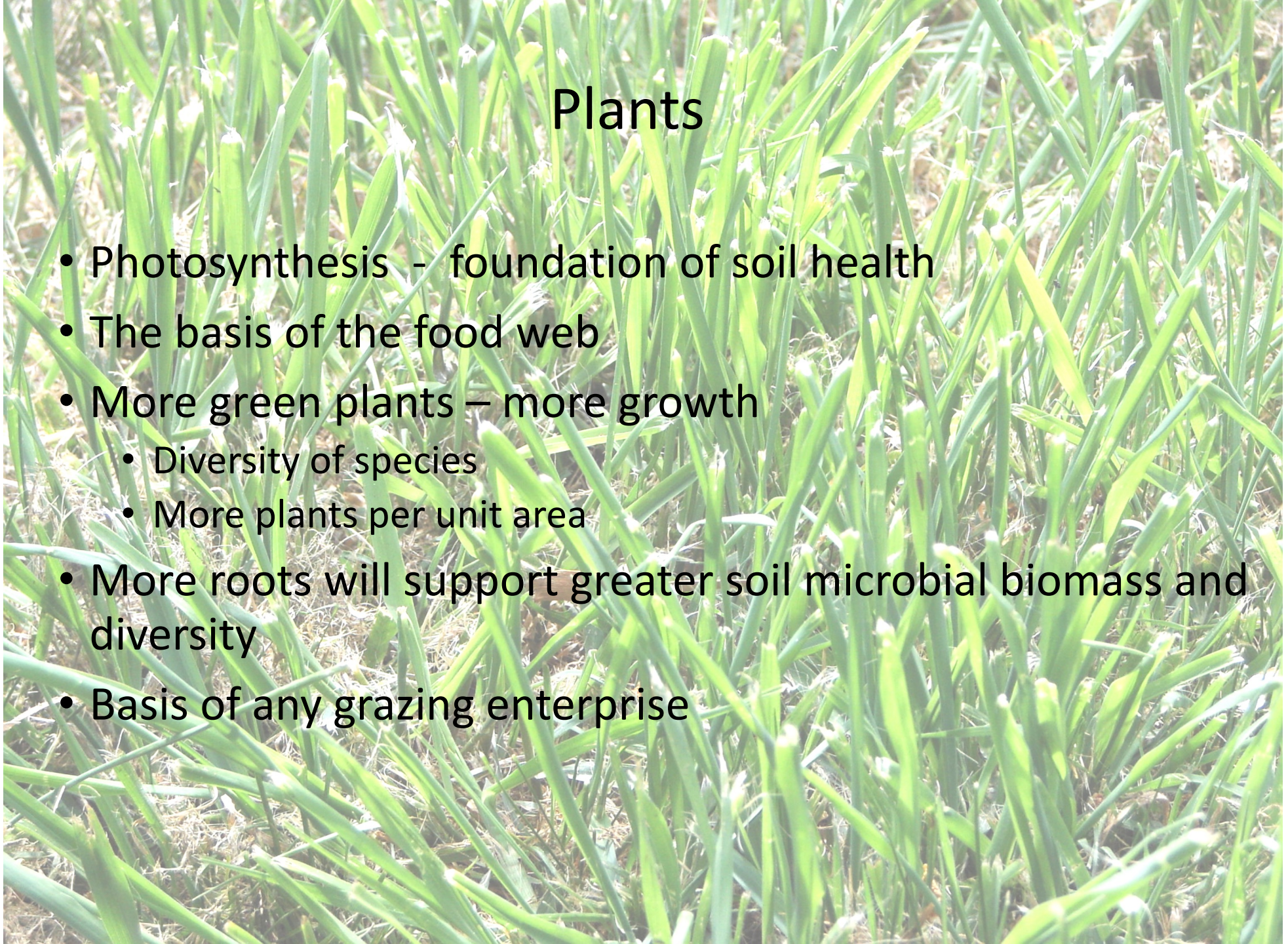
- Plan your grazing management

Suggested actions

- Encourage species diversity
- Encourage deep rooted perennial plants
- Encourage soil biology
- Reduce use of herbicides
- Reduce use of urea and inorganic fertilisers - appropriate use
- Consider biologically friendly soil amendments
- Reduce soil disturbance
- Let nature work with you and for you

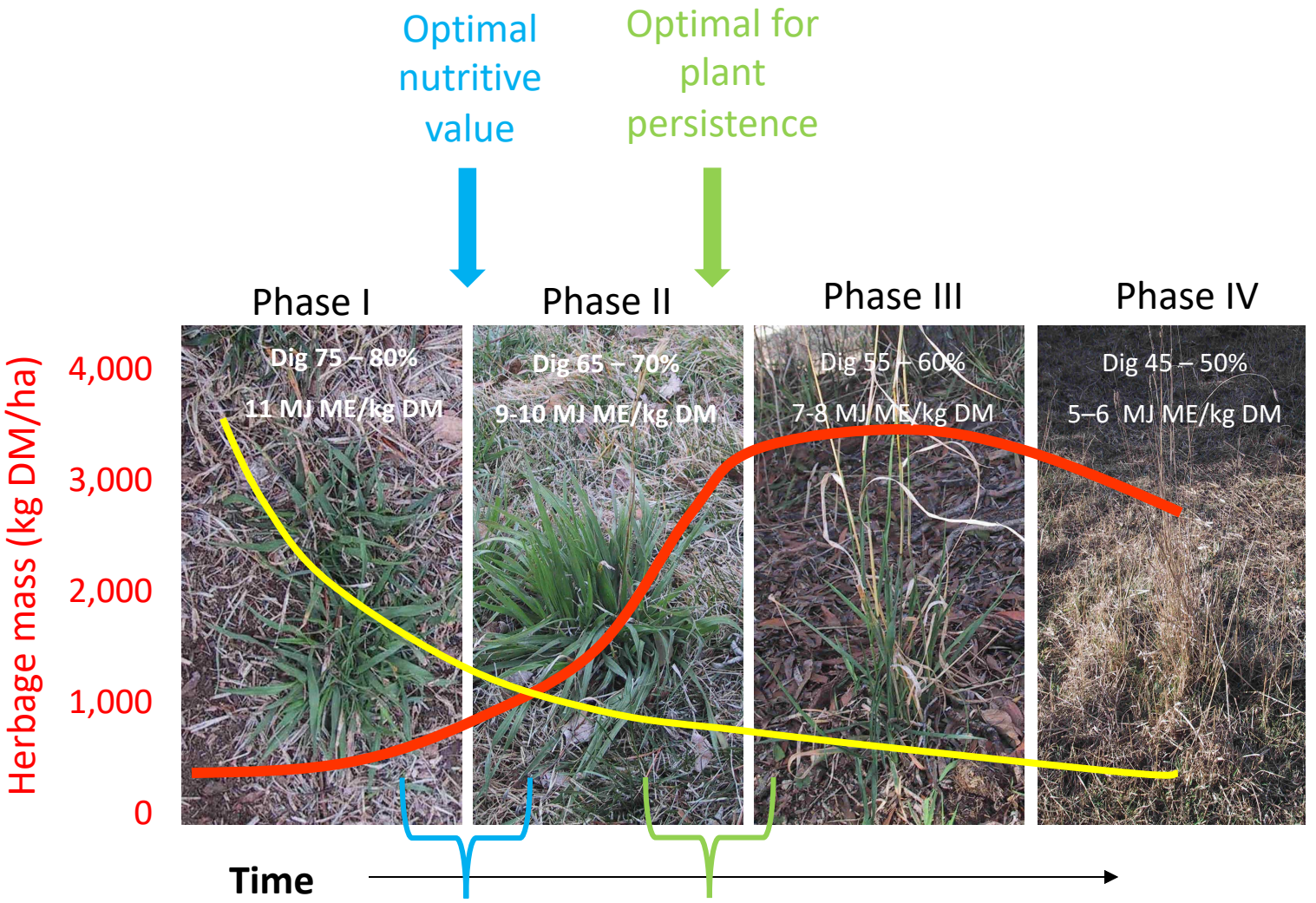
Key issues

- Importance of plants to soil health
- Managing pastures to enhance soil health
- Groundcover



Plants

- Photosynthesis - foundation of soil health
- The basis of the food web
- More green plants – more growth
  - Diversity of species
  - More plants per unit area
- More roots will support greater soil microbial biomass and diversity
- Basis of any grazing enterprise


Optimal nutritive value
Optimal for plant persistence
Phase I
Phase II
Phase III
Phase IV
Dig 75 – 80%
11 MJ ME/kg DM
Dig 65 – 70%
9-10 MJ ME/kg DM
Dig 55 – 60%
7-8 MJ ME/kg DM
Dig 45 – 50%
5–6 MJ ME/kg DM
Herbage mass (kg DM/ha)
4,000
3,000
2,000
1,000
0
Time

Plant material above the ground is a reflection of root material present below the ground

Photo: Christine Jones

Factors that influence plant growth

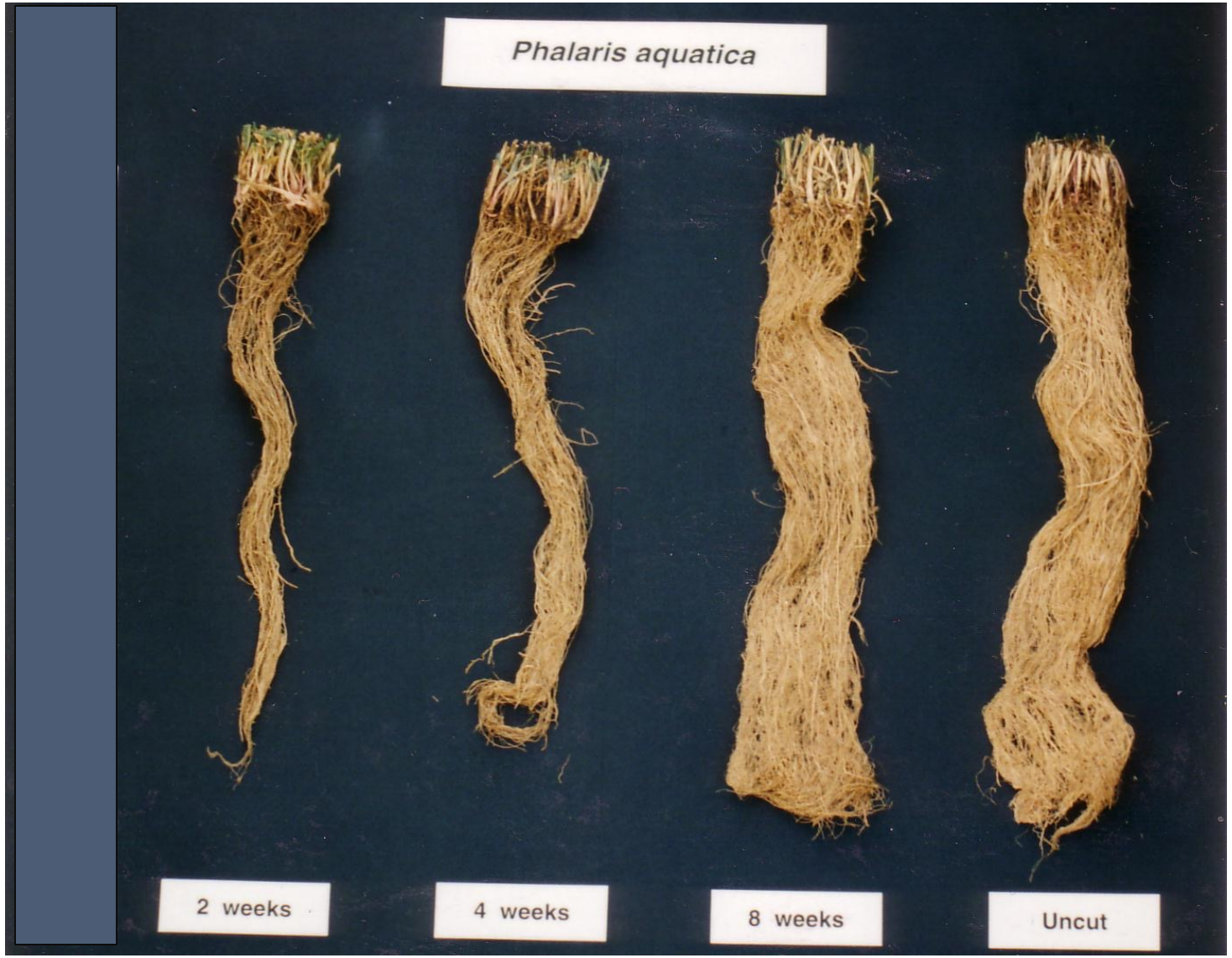
Environmental factors	Plant factors	Soil factors
Rainfall: amount & distribution	Species	Cation exchange capacity
Temperature	Stage of growth	Fertility and pH
Sunlight: duration & intensity	Height or leaf area	Water holding capacity
Season	Time since grazed	Water infiltration rate
Soil type	Residual herbage mass	Compaction
Slope	Groundcover	Organic matter and soil C
Aspect	Presence of weeds	Biological activity
Proximity to water	Tree cover	Depth of topsoil

Senesced leaf

Axillary Bud

New tillers

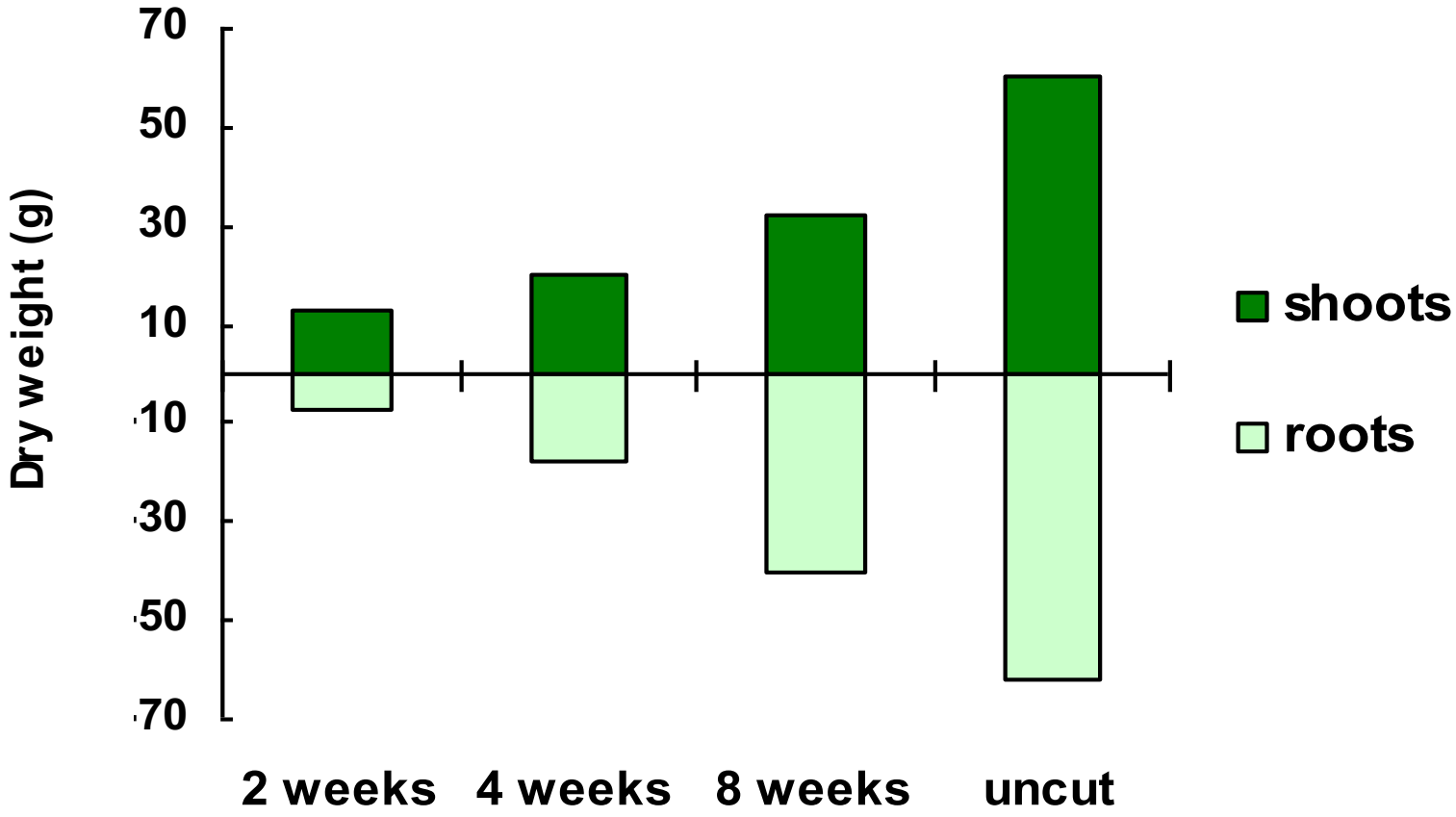
New roots



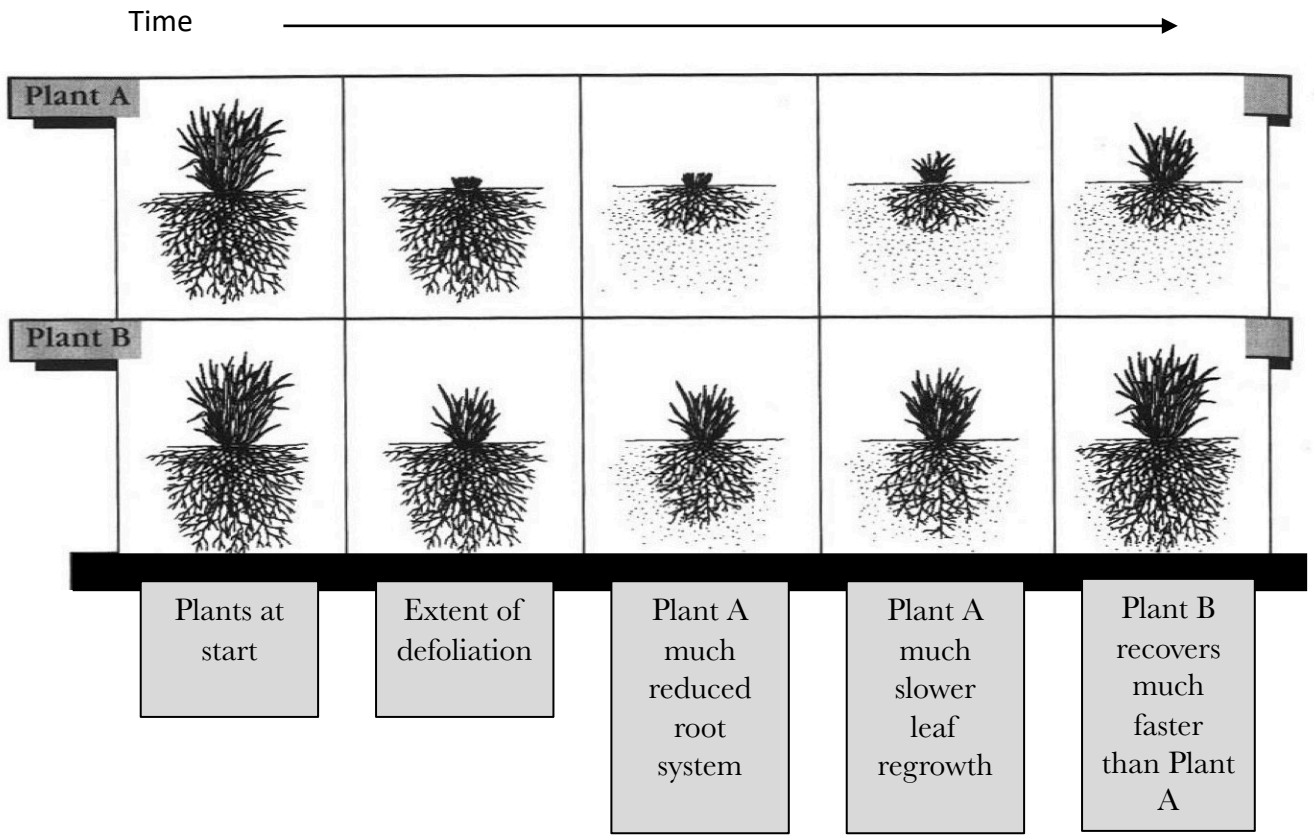
Effect of frequency of cutting on roots over 1 year

Shoot to root ratios

Controlled pot experiment where plants were cut to 3cm at 2, 4 or 8 week intervals or uncut over 12 months



Leaf removal and growth rates



Adapted from Savory 1999

Defoliation

- Intensity
  - The amount of herbage mass removed
  - The amount of residual herbage remaining
- Frequency
  - How often plants are defoliated
  - Time required for leaf and shoots to regenerate
  - Time required for roots to regenerate.


Grow more – Use more – Leave more
The more you leave behind the faster it grows

Healthy perennial grasses

Increased root biomass

=> Increase soil organic matter

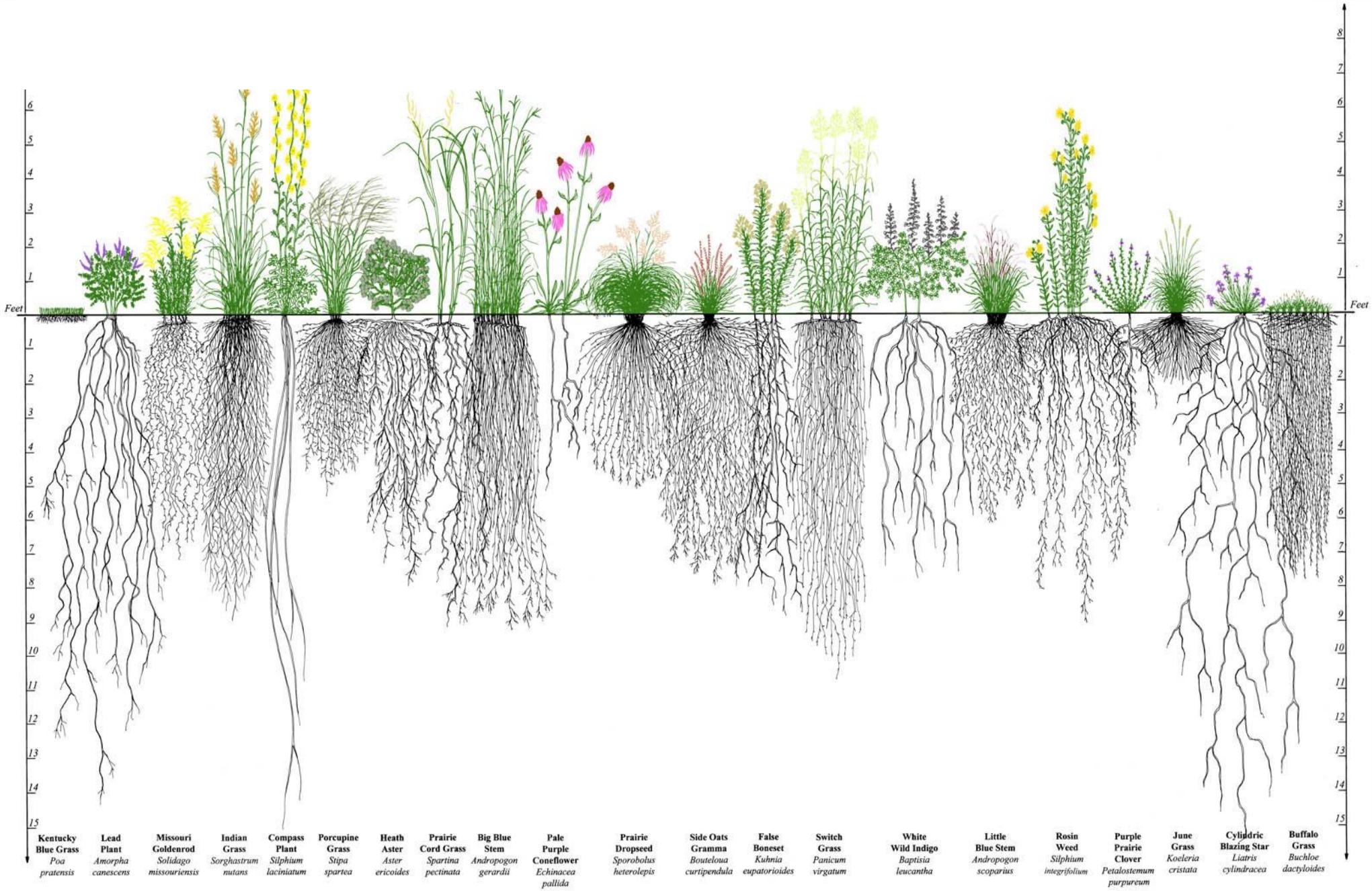
=> Increase biological activity

=> Increase nutrient cycling

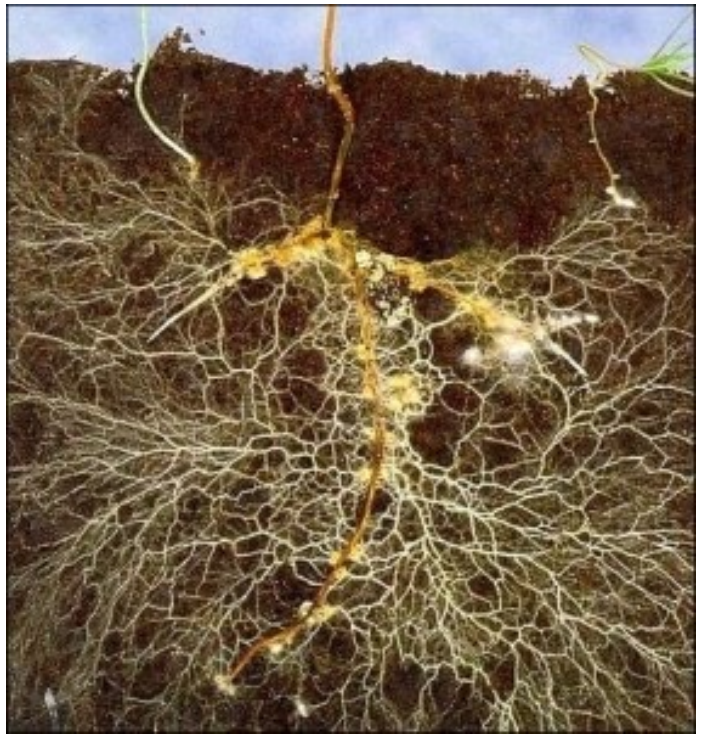
=> Increase humus

=> Increase plant growth rate

=> Increase livestock carrying capacity


Feet
Feet
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Kentucky Blue Grass Poa pratensis
Lead Plant Amorpha canescens
Missouri Goldenrod Solidago missouriensis
Indian Grass Sorghastrum nutans
Compass Plant Silphium laciniatum
Porcupine Grass Stipa spartea
Heath Aster Aster ericoides
Prairie Cord Grass Spartina pectinata
Big Blue Stem Andropogon gerardii
Pale Purple Coneflower Echinacea pallida
Prairie Dropseed Sporobolus heterolepis
Side Oats Gramma Bouteloua curtipendula
False Boneset Kuhnia eupatorioides
Switch Grass Panicum virgatum
White Wild Indigo Baptisia leucantha
Little Blue Stem Andropogon scoparius
Rosin Weed Silphium integrifolium
Purple Prairie Clover Petalostemum purpureum
June Grass Koeleria cristata
Cylindric Blazing Star Liatris cylindracea
Buffalo Grass Buchloe dactyloides

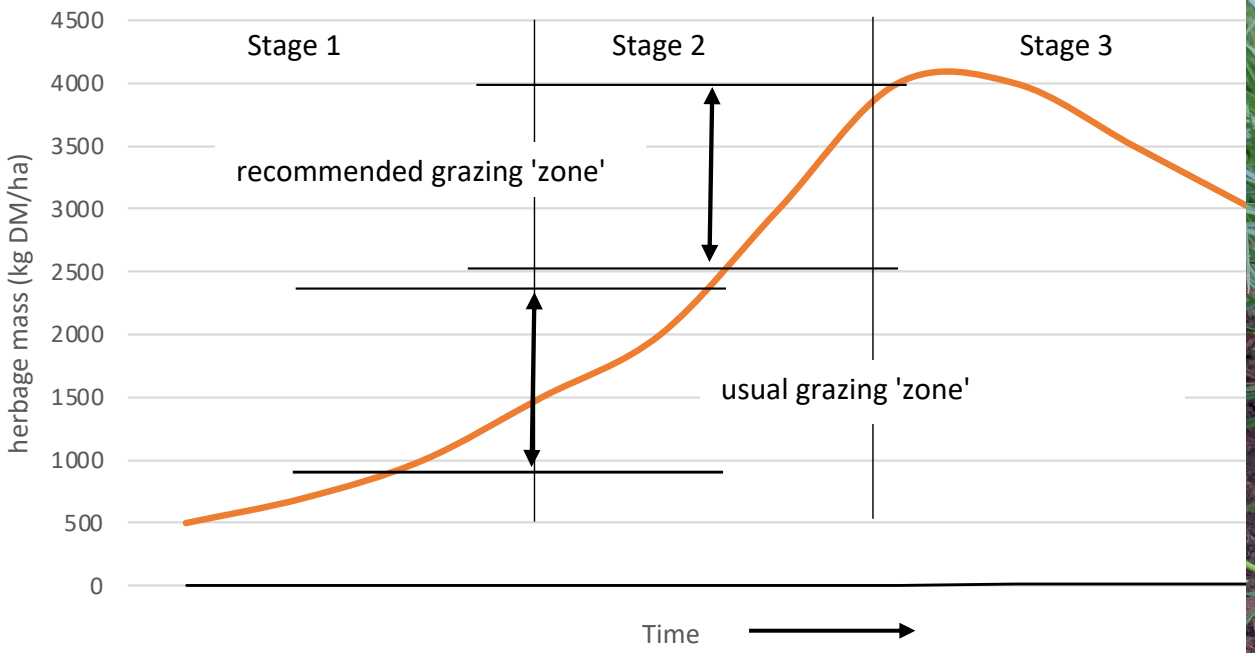


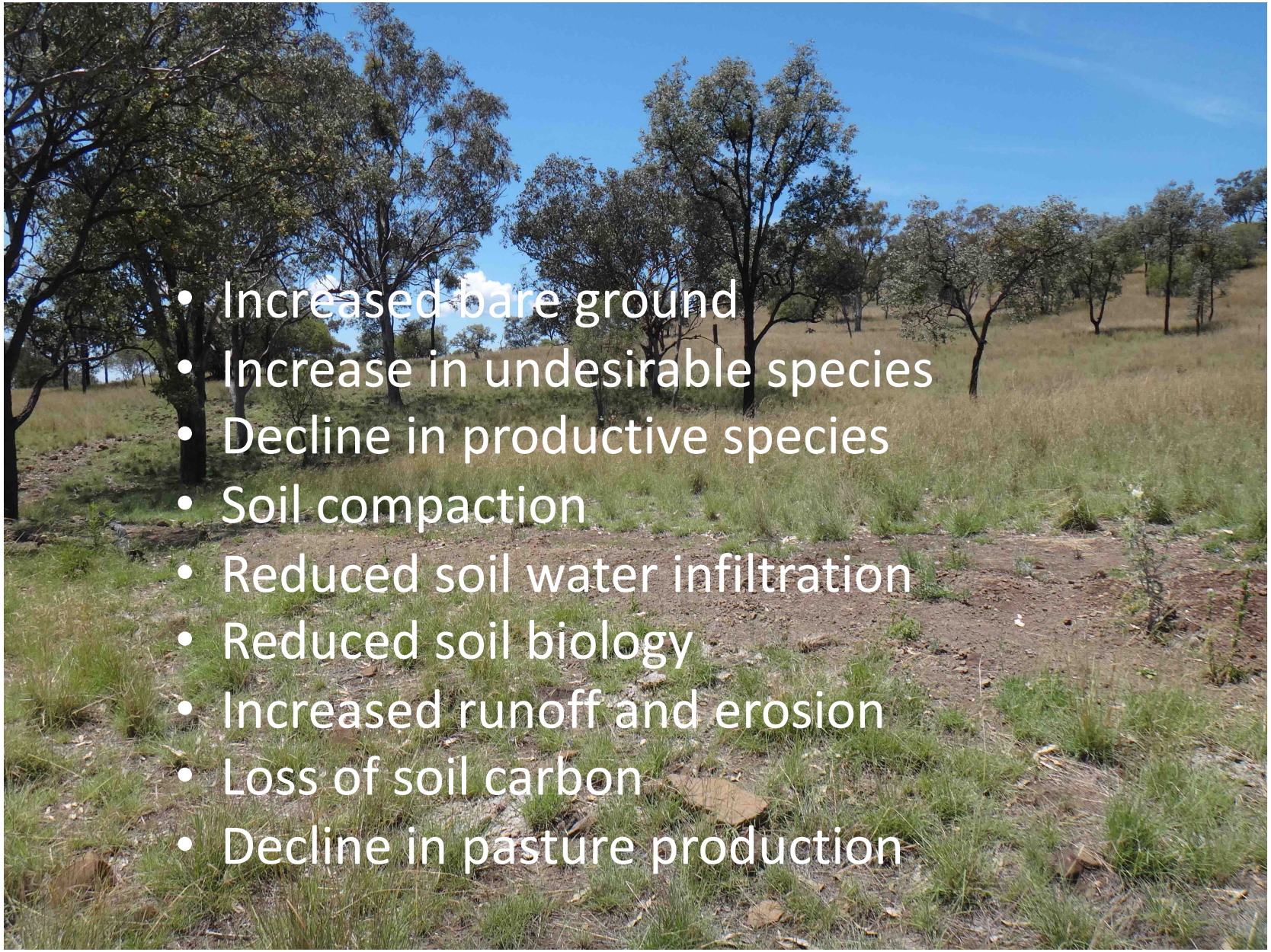


Soil livestock


Grazing zone



Degraded pastures - symptoms

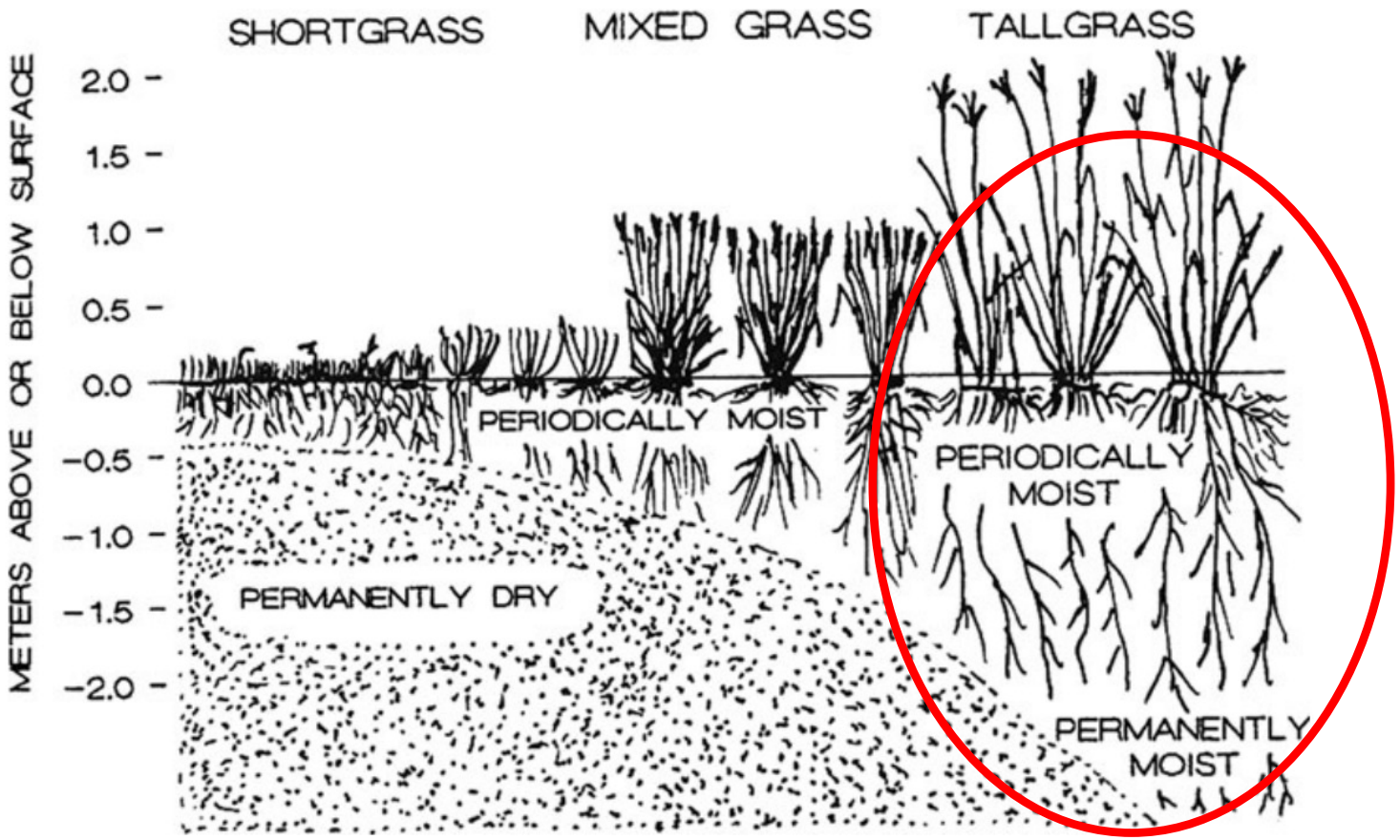


Threats to stability

- Loss of diversity
  - Reduces potential of ecosystems to provide ecological services
  - Reduces production – plant biomass
  - Reduces biological activity and microbial biomass

- Loss of perenniality
  - Overgrazing of plants
  - Increasing bare ground
  - Increasing ‘undesirables’
  - Increasing woody plants
  - Loss of production
  - Loss of carbon
  - Loss of soil

Grassland soils

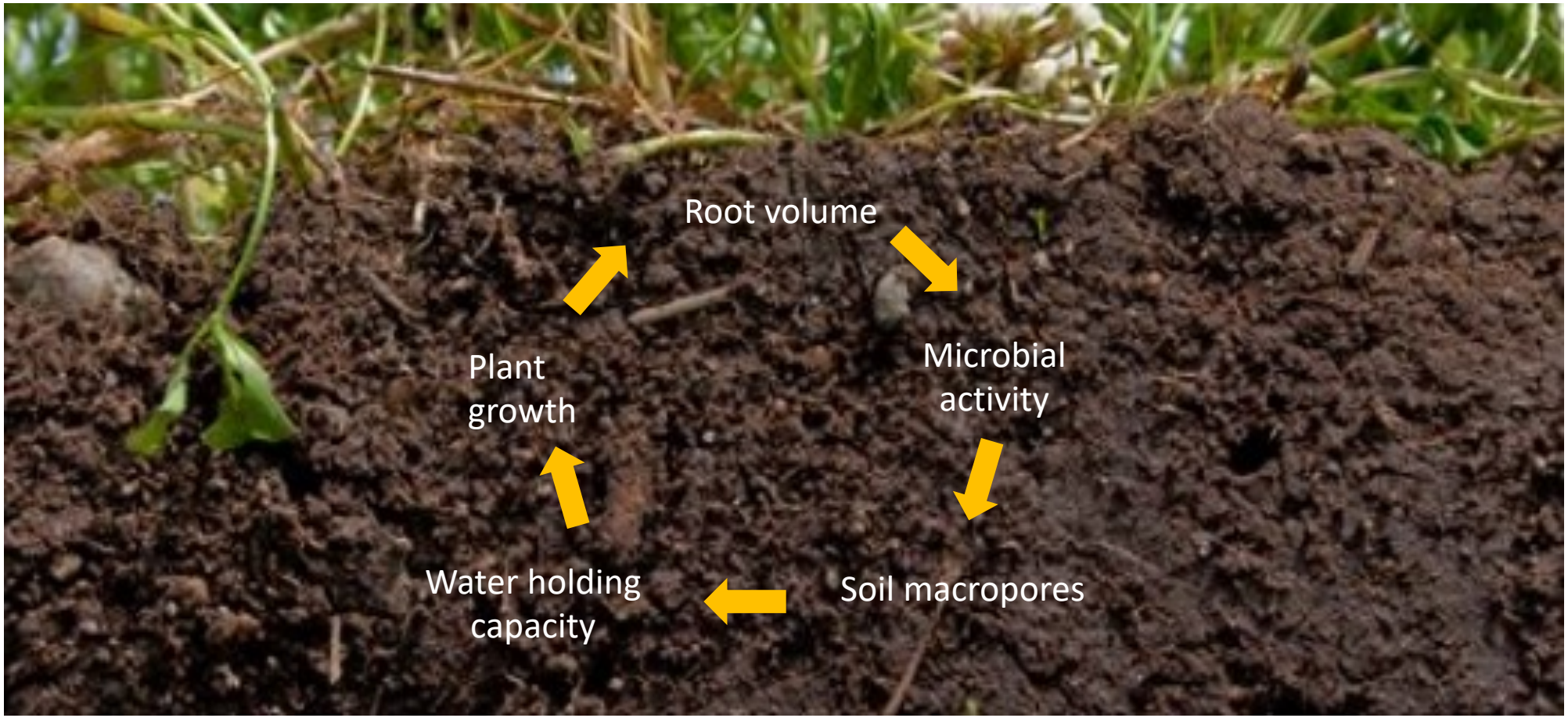


Source: Blair *et al* 2014

Increasing soil carbon

- Increase plant density
- Increase biodiversity
- Maintain optimal herbage mass residual
- Improve plant growth and vigour
- Increase water use efficiency

Soil & water


Root volume
Microbial activity
Soil macropores
Water holding capacity
Plant growth

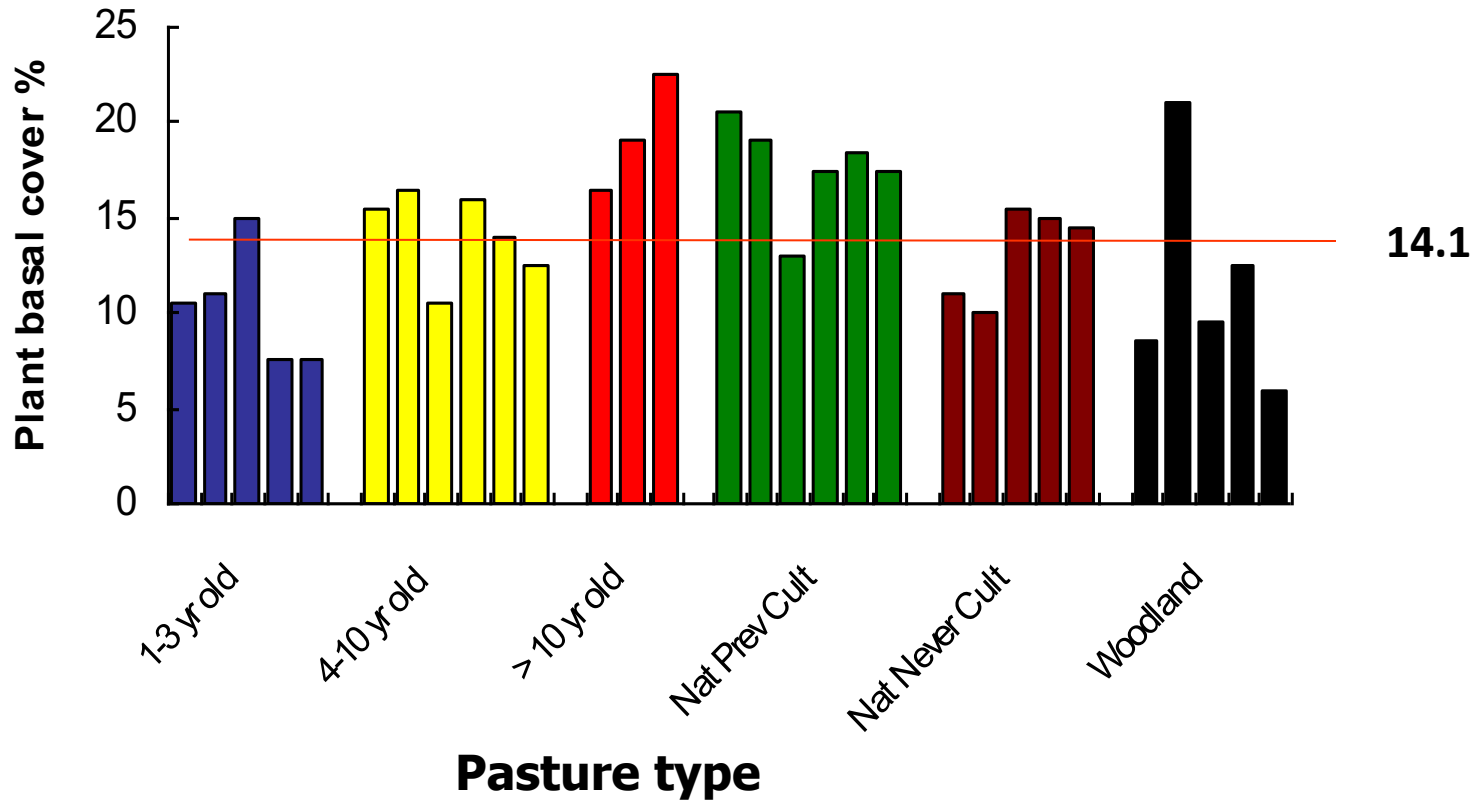
16 mm rainfall event
How much infiltrated into the soil?
Need to plan to maintain cover !!!

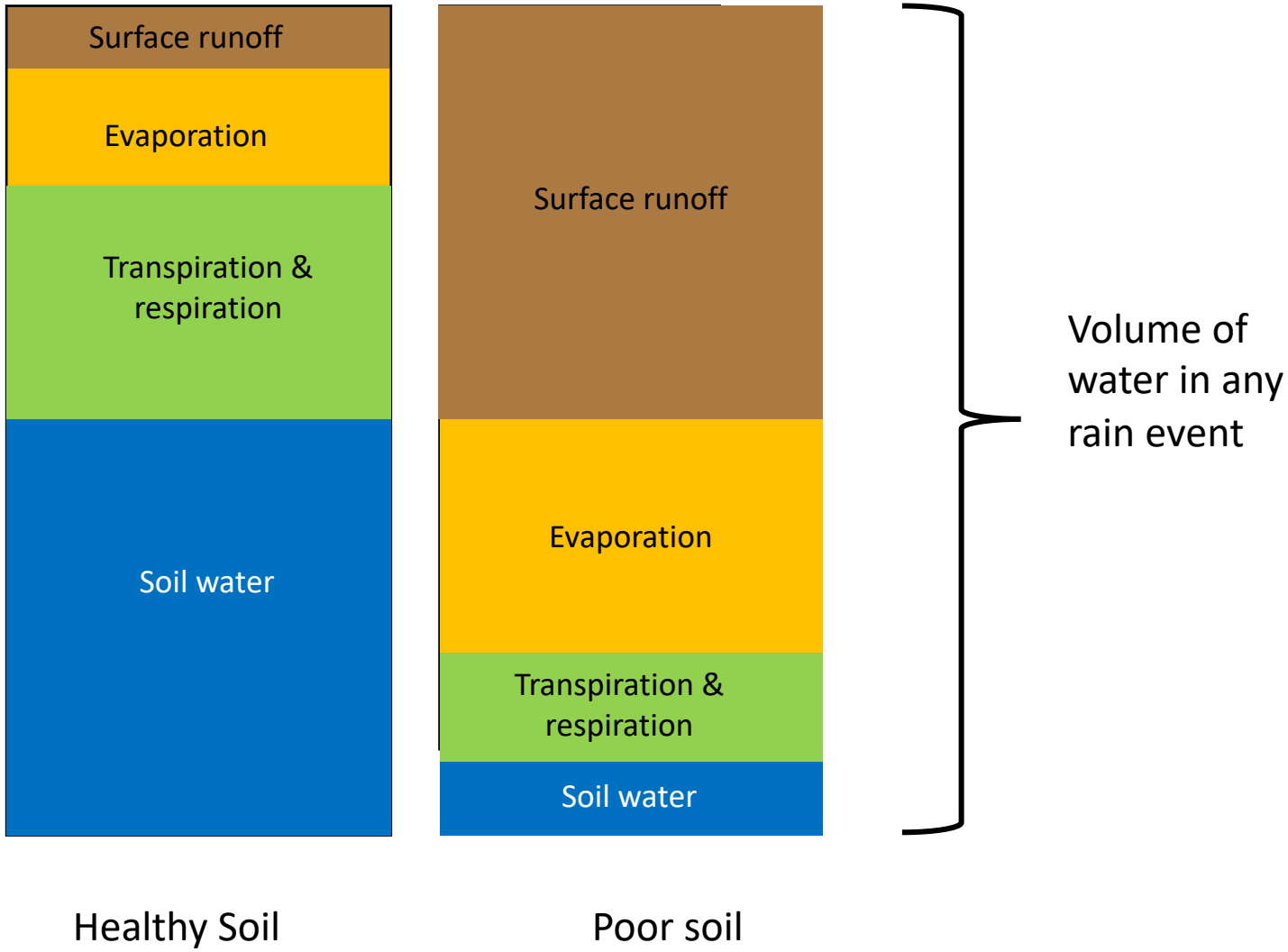

100% groundcover

Maximise groundcover to

- protect the soil surface
- limit water loss via evaporation
- optimise soil water infiltration
- optimise plant available water
- slow the movement of water across the soil surface
- modify soil surface temperature

Plant basal cover - density




Surface runoff
Evaporation
Transpiration & respiration
Soil water
Surface runoff
Evaporation
Transpiration & respiration
Soil water
Volume of water in any rain event
Healthy Soil
Poor soil

Influencing plant growth with management

4 key factors that are within your control

- Recovery period → Growing season
  → Non or slow growing season
- Graze period
- Residual herbage mass
- Stock numbers – stocking rate

Recovery period

- Critical considering the effect of defoliation on plants
- Will depend on pasture growth rate
- Distinction between rest and recovery
- Getting it ‘right’ is a challenge

Graze period

- Will be a function of the recovery period required
- Aim to avoid a second bite on growing plants
- When plants grow quickly graze period will be shorter and when growth is slow the graze period can be longer

Maintain residual

The more you leave behind the faster it grows

- Stabilise soil surface temperature
- Maintain root biomass
- Increase biological activity
- Improve soil structure
- Ensure maximum groundcover
- Reduce undesirable species
- Increase water infiltration rate

Residual herbage mass

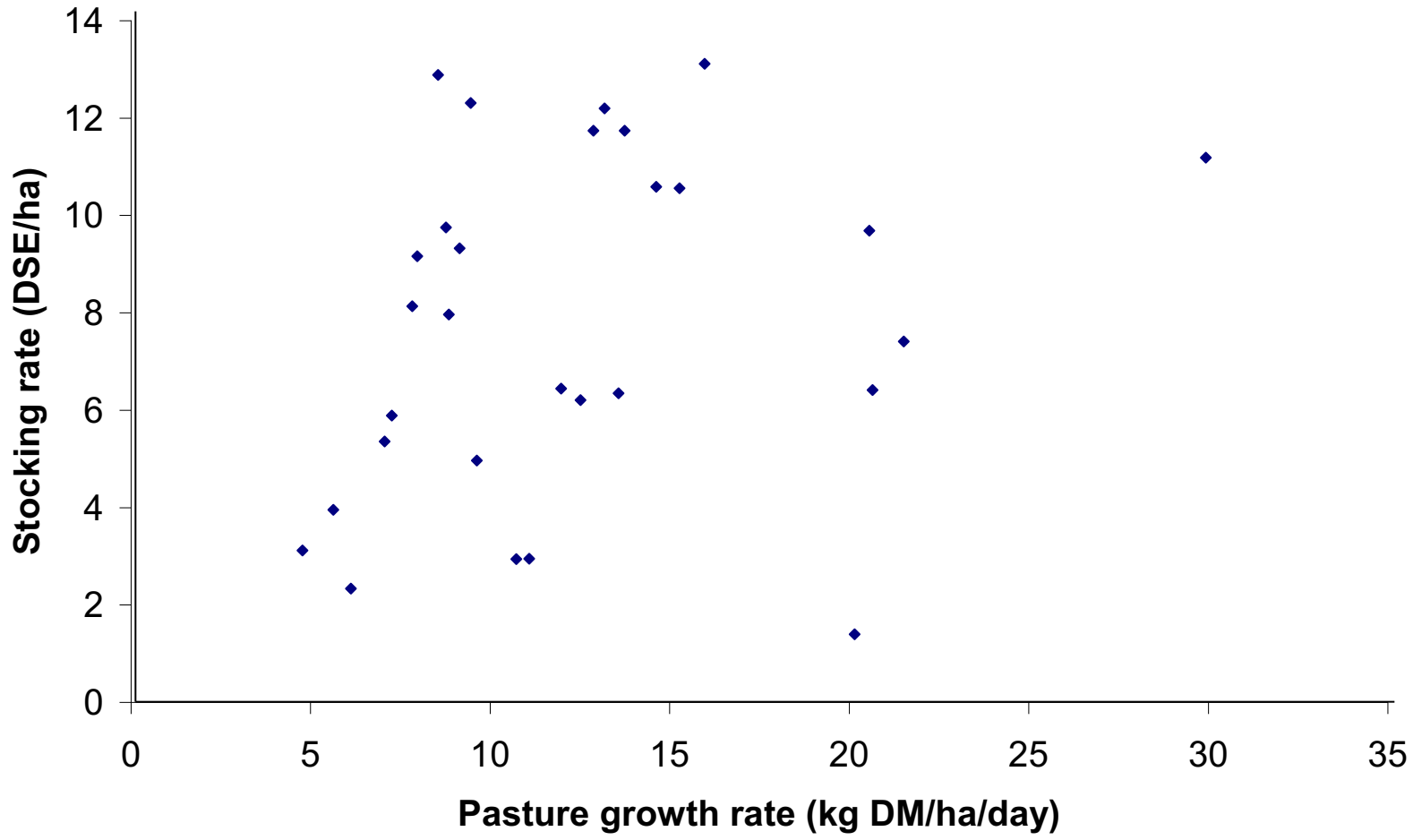
Grazing ….. occurs one plant at a time

Residual leaf 5cm height

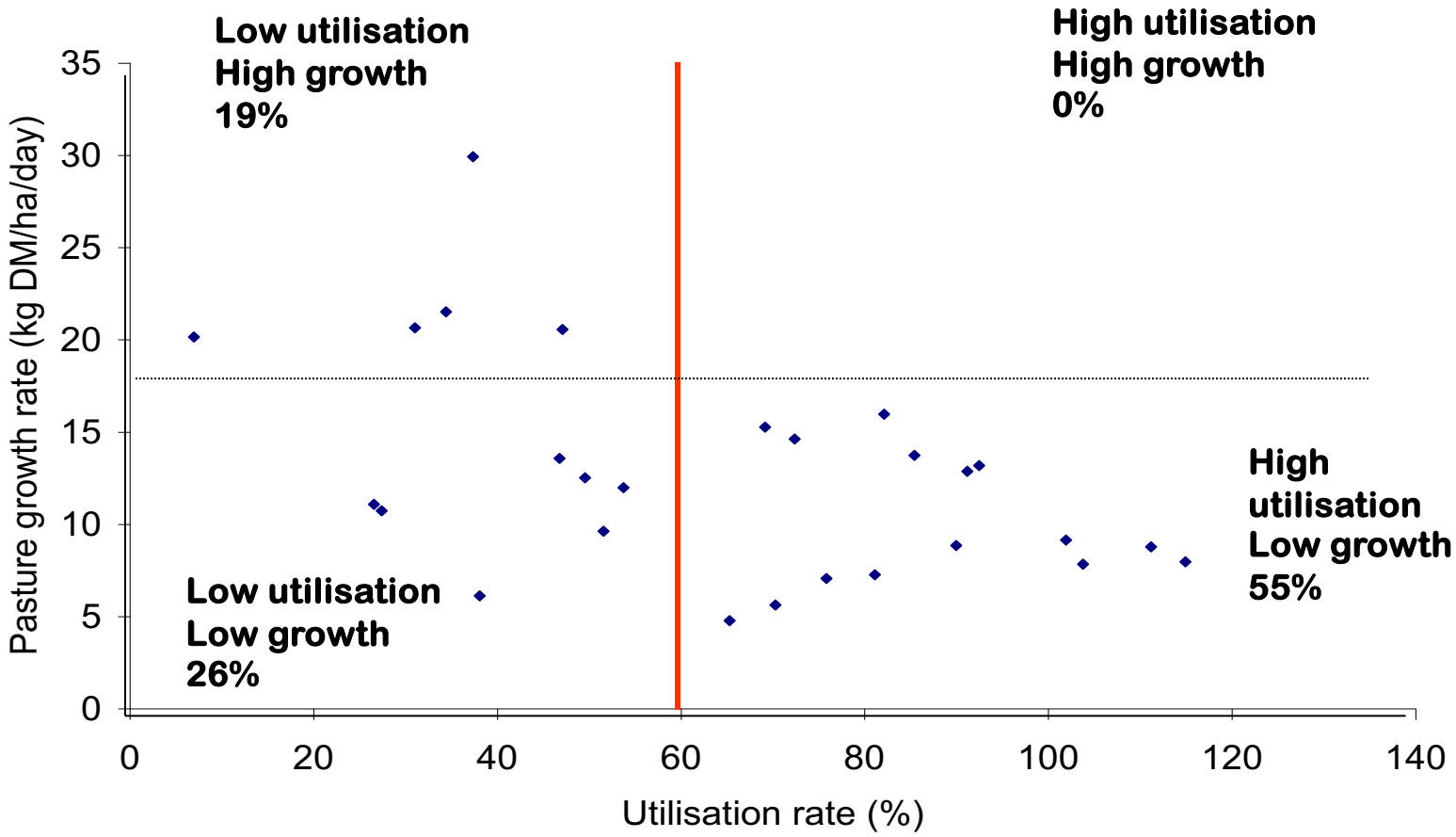
The number of animals – Stocking rate

- Is the number of animals carried (DSE/ha)
- Usually calculated over a 12 month period
- Should always be matched to carrying capacity
- A key driver of enterprise profitability ?

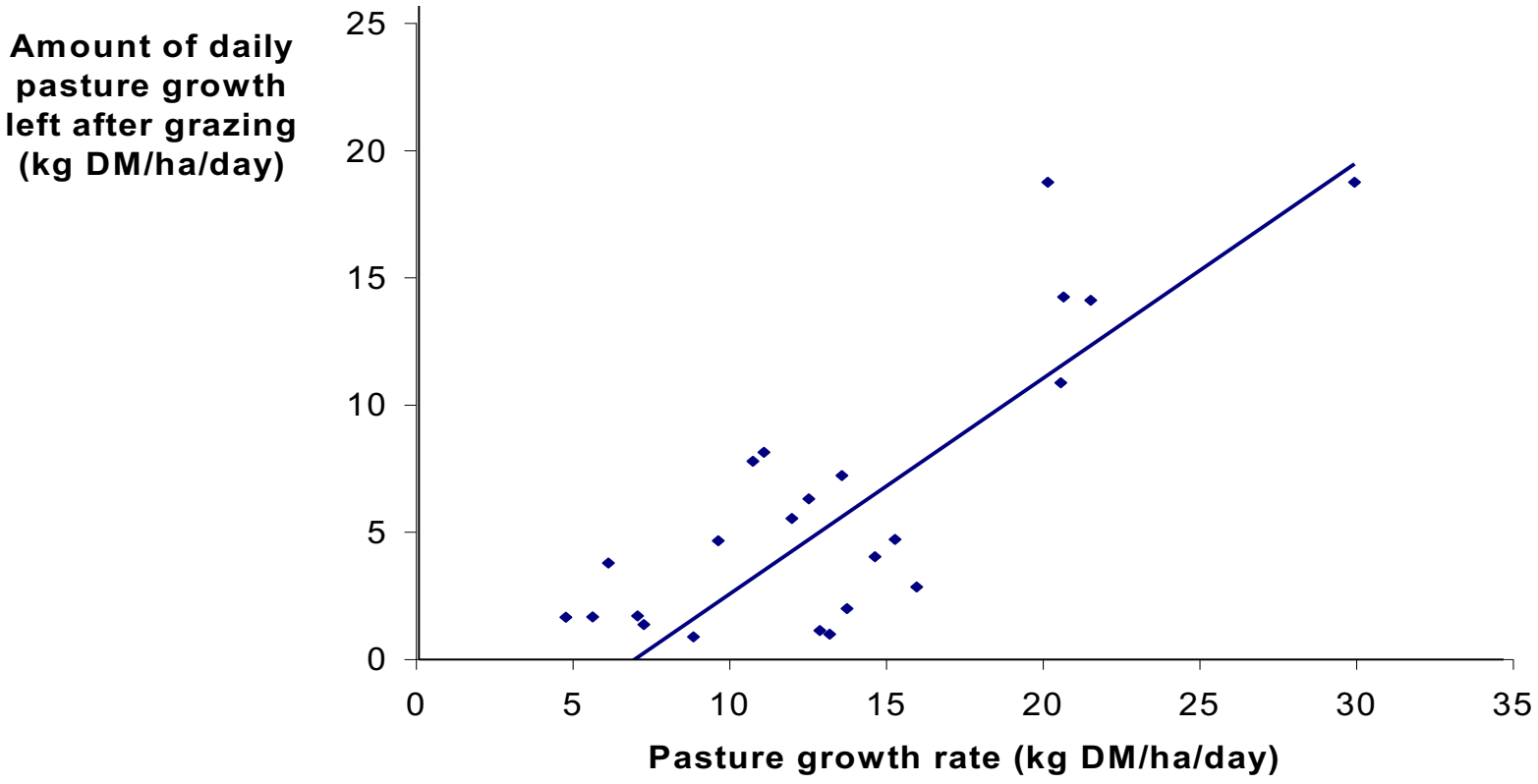
Stocking rate had no effect on pasture growth rate



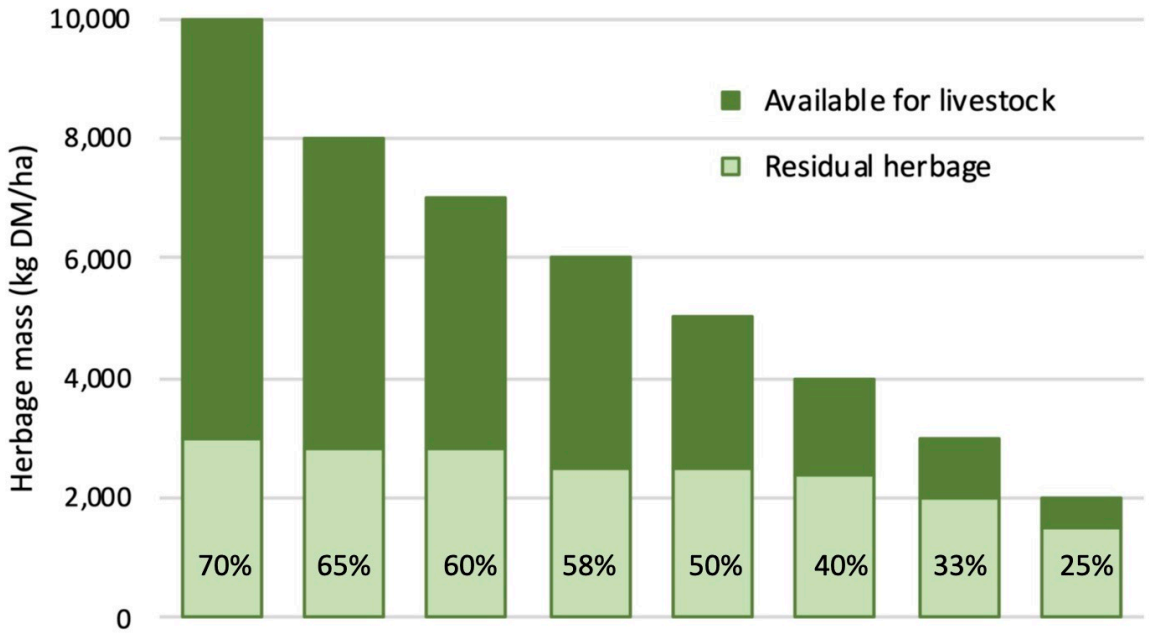
Pasture growth and utilisation rate



Grow more by leaving more

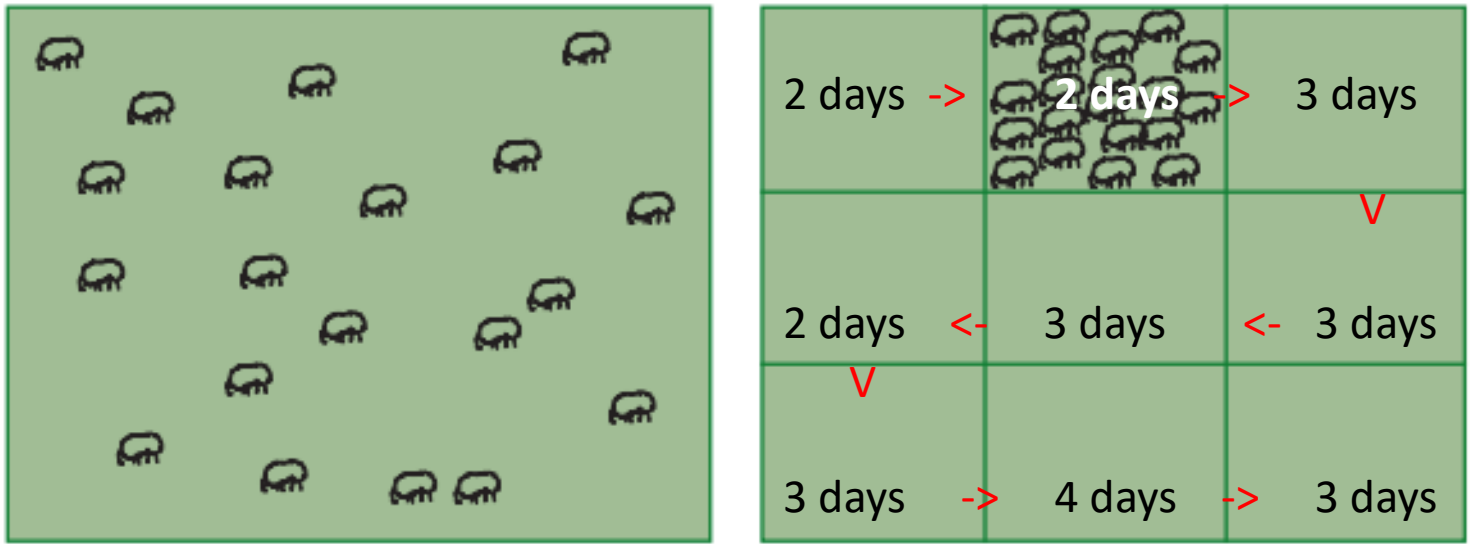


Grow more - use more - leave more



Stocking rate & stock density

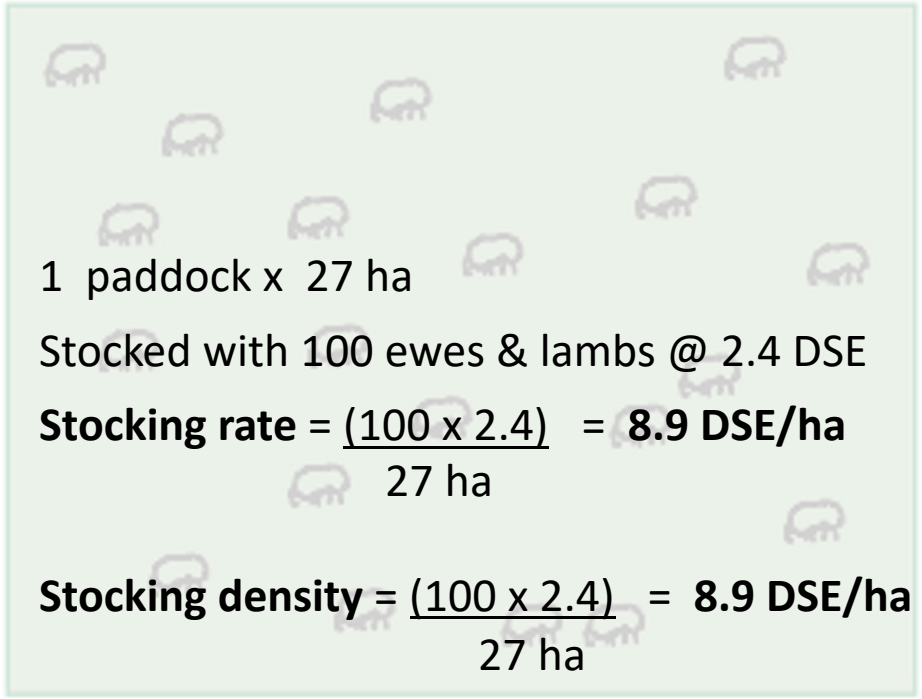
Uncontrolled grazing vs Controlled grazing



Same grazing area same number of stock

Stocking rate & stock density

Uncontrolled grazing vs Controlled grazing

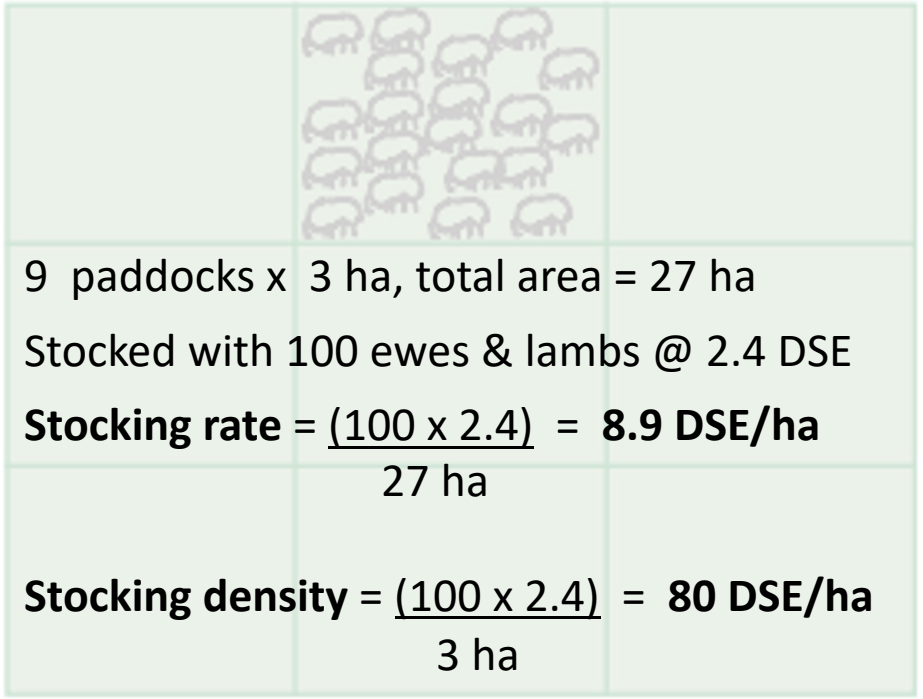


1 paddock x 27 ha

Stocked with 100 ewes & lambs @ 2.4 DSE

Stocking rate = $\frac{(100 \times 2.4)}{27\ ha}$ = **8.9 DSE/ha**

Stocking density = $\frac{(100 \times 2.4)}{27\ ha}$ = **8.9 DSE/ha**



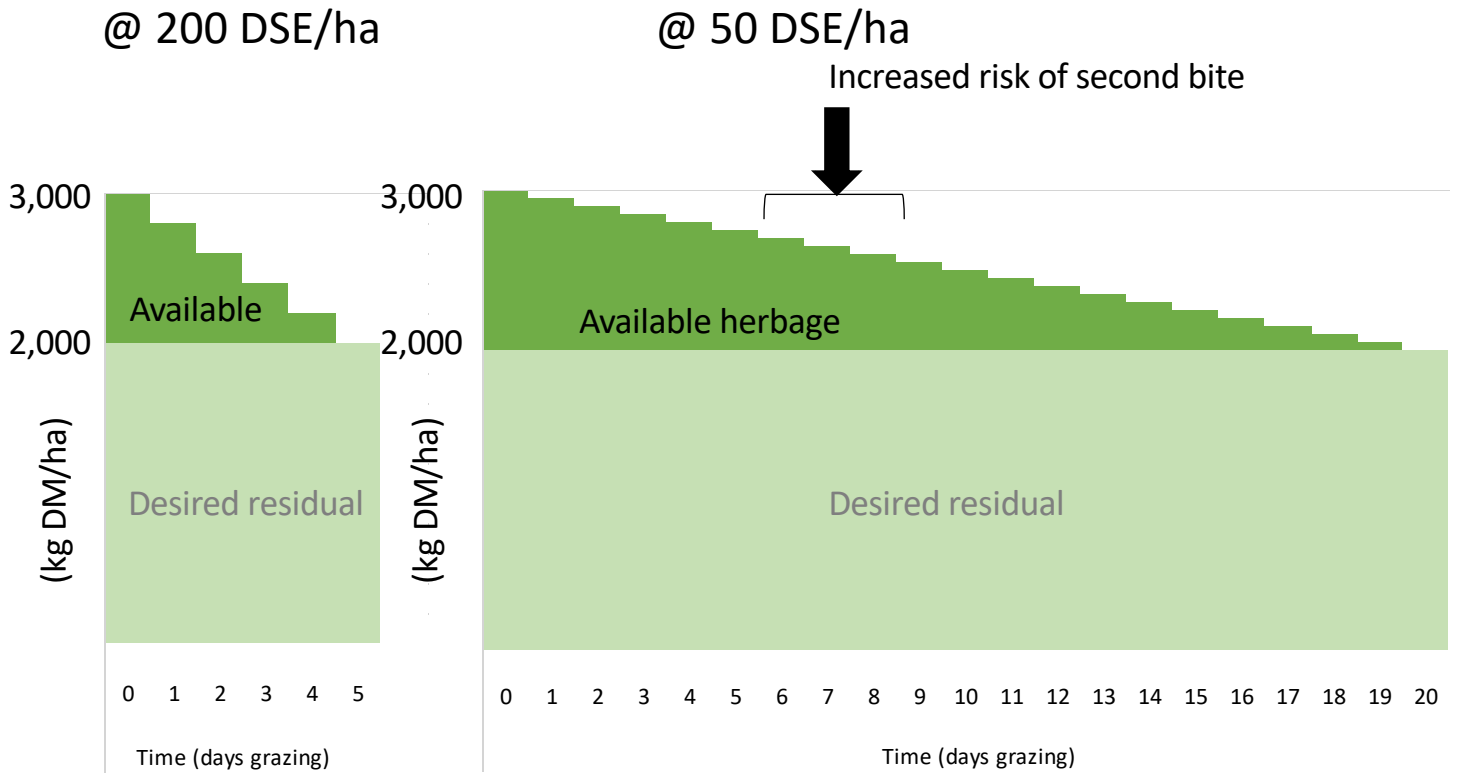
9 paddocks x 3 ha, total area = 27 ha

Stocked with 100 ewes & lambs @ 2.4 DSE

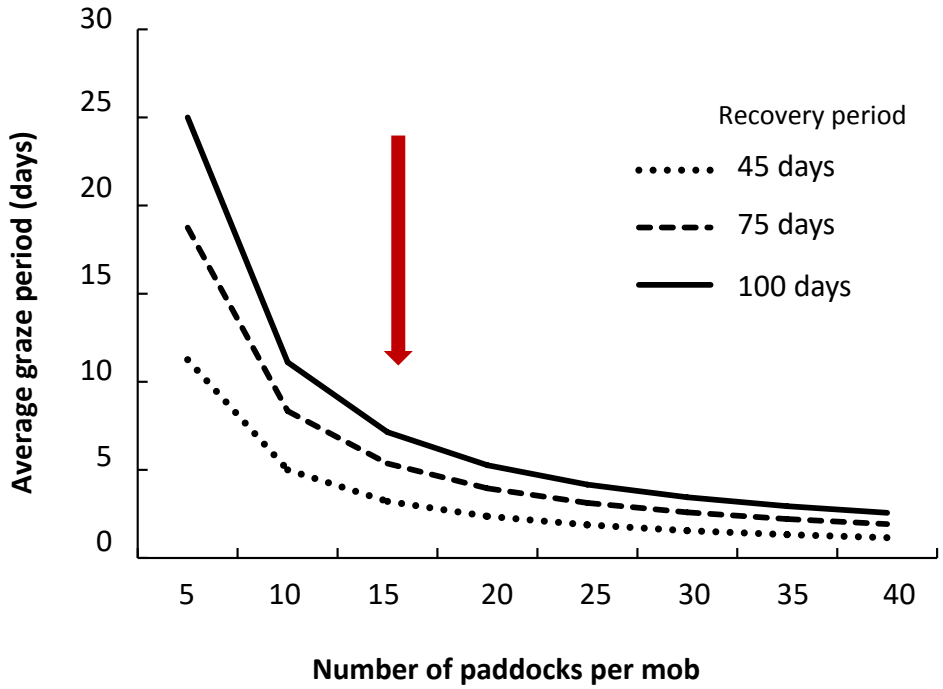
Stocking rate = $\frac{(100 \times 2.4)}{27\ ha}$ = **8.9 DSE/ha**

Stocking density = $\frac{(100 \times 2.4)}{3\ ha}$ = **80 DSE/ha**

Stock density



Effect of number of paddocks per mob on the average graze period

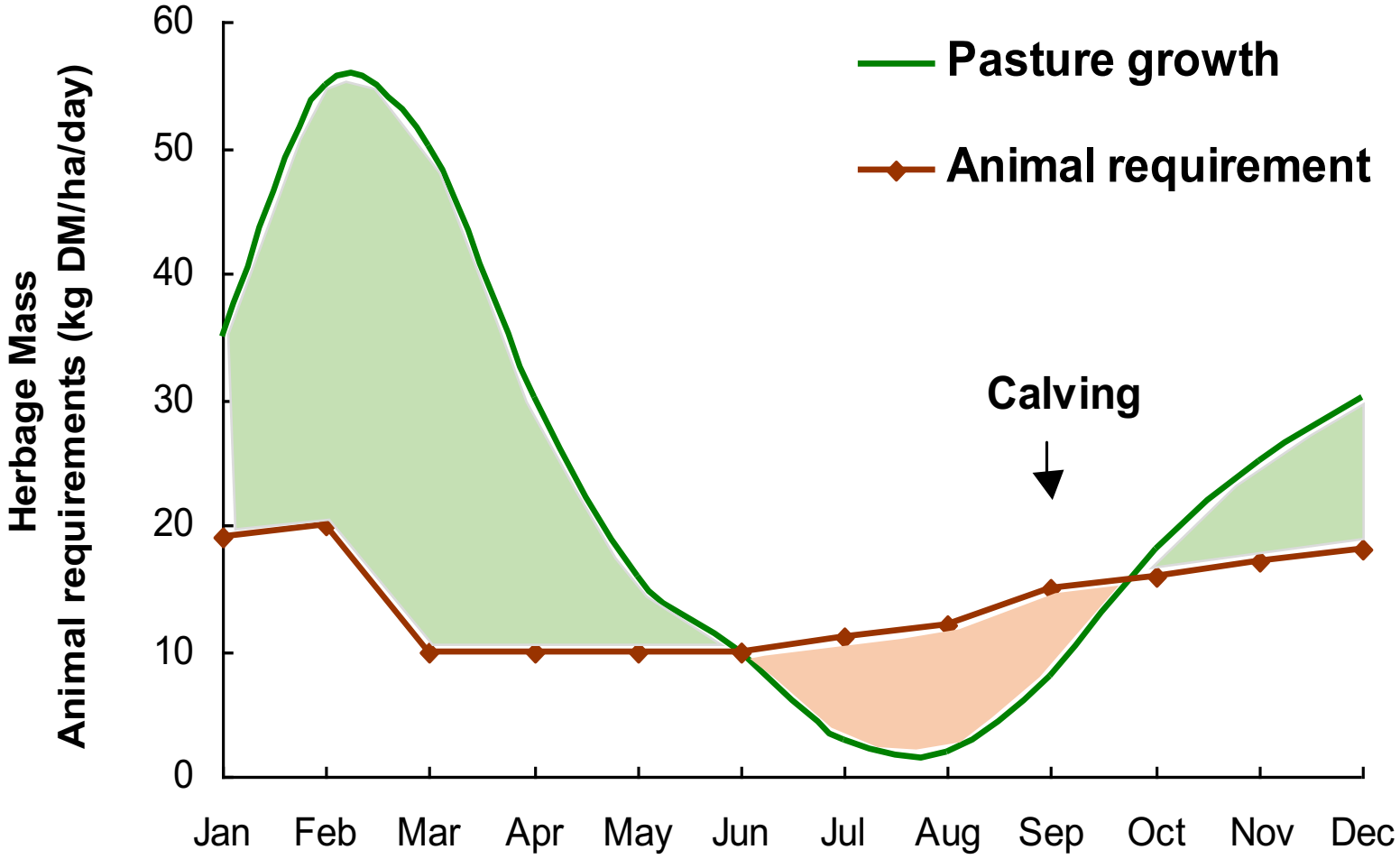


Adapted from Savory (1999)

Increasing paddocks per mob - advantages

- The capacity to use stock density to improve pastures and soil health
- More control over pasture utilisation
- More even pasture utilisation
- More plants impacted more evenly in any grazing event
- More even distribution of dung and nutrients
- More even plane of nutrition for grazing livestock
- Livestock move frequently onto fresh pasture
- Livestock become quiet to handle with frequent moves
- Regular inspection of stock to identify any health issues early

Feed year


Herbage Mass
Animal requirements (kg DM/ha/day)
60
50
40
30
20
10
0
Pasture growth
Animal requirement
Calving
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Feed budgeting

- A process aids decision making about selling, keeping or feeding livestock
  - how much pasture is available
  - how much pasture needs to remain
  - what's the likely pasture growth

- Calculate feed budgets using this information
  - how many animals can I carry and for how long

Feed budget

Grazable area

Time

Feed

Animal requirements

How many animals

Farm area (ha)	400	
Start of period (date)	1/9/23	
End of period (date)	31/12/23	
Length of period (days)	**121**	*
Start herbage mass (kg DM/ha)	2500	
Desired end herbage mass (kg DM/ha)	2000	
Pasture growth rate (kg DM/ha/d)	0.0	
Available feed (kg DM/ha/d)	**4.1**	*
Type of stock	Cows	
DSE/head	15.0	
Number of stock units/ha	0.3	*
Number of stock units	**110**	*

Control of the grazing process

Planning the grazing allows you to control

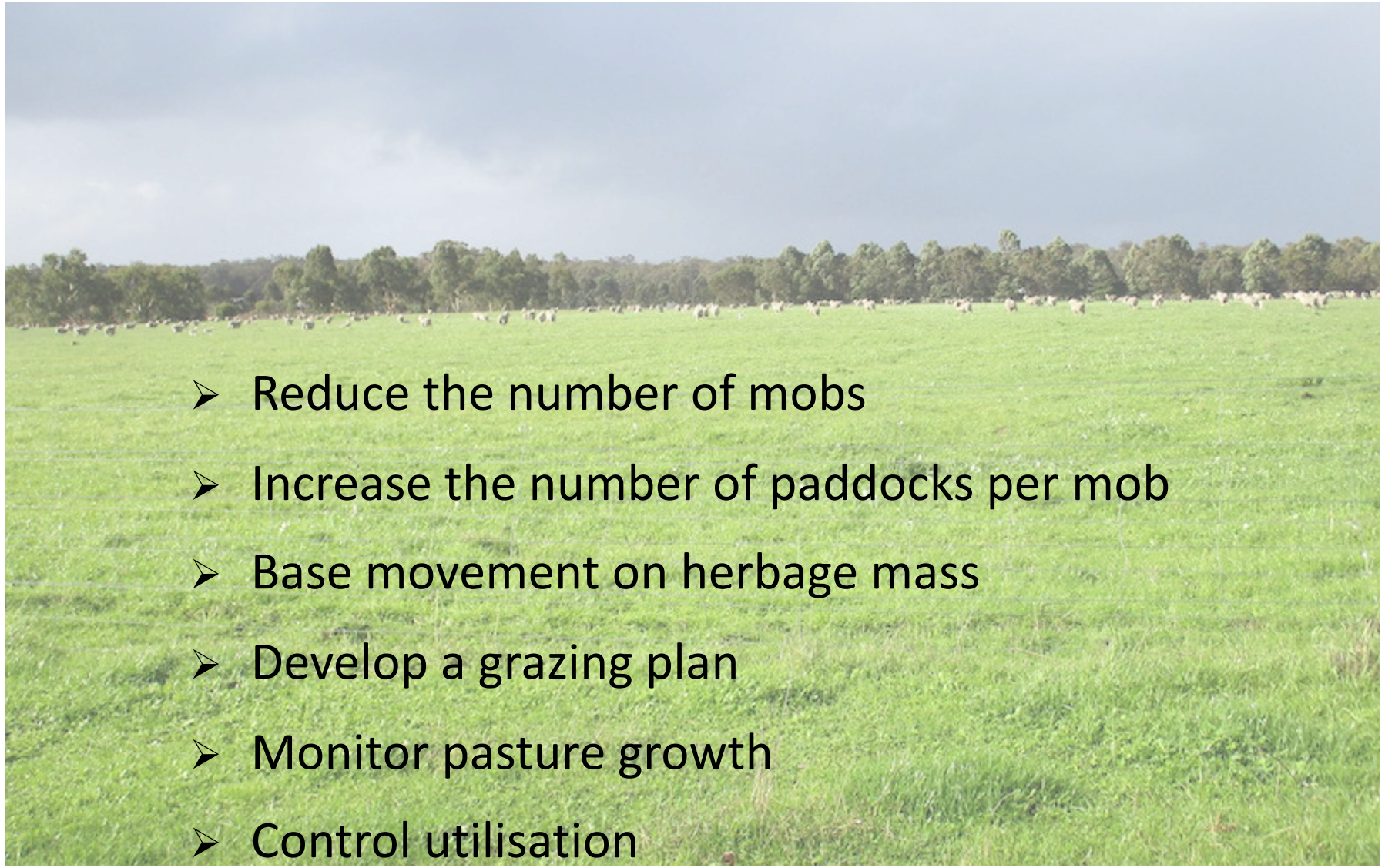
- plant competition
- plant and pasture growth rates
- pasture utilisation
- pasture composition
- species diversity

Control of the grazing process

Fewer & bigger mobs
→ more paddocks per mob

- **Increases period between grazing events**
- **Provides relative advantage to selectively grazed species**
- **Provides potential to use stock density**
- **Provides potential to increase feed utilisation, stocking rate & pasture growth**

Regenerative Grazing Principles



- Reduce the number of mobs
- Increase the number of paddocks per mob
- Base movement on herbage mass
- Develop a grazing plan
- Monitor pasture growth
- Control utilisation

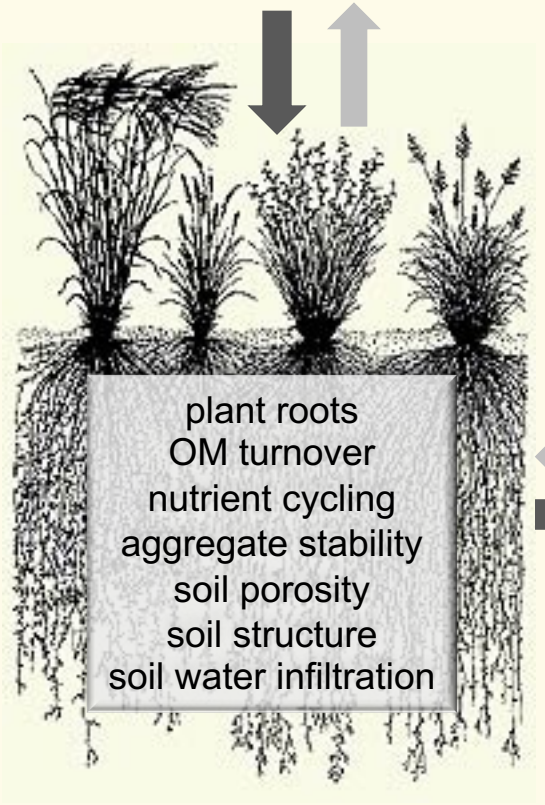
sunlight, water & atmospheric C (primarily CO_2)

plant residues
nutrients from animals

plant growth
pasture production

micro & macro organisms

<u>decomposers</u>
dung beetles
earthworms
mites
springtails
nematodes
mycorrhiza
fungi
bacteria

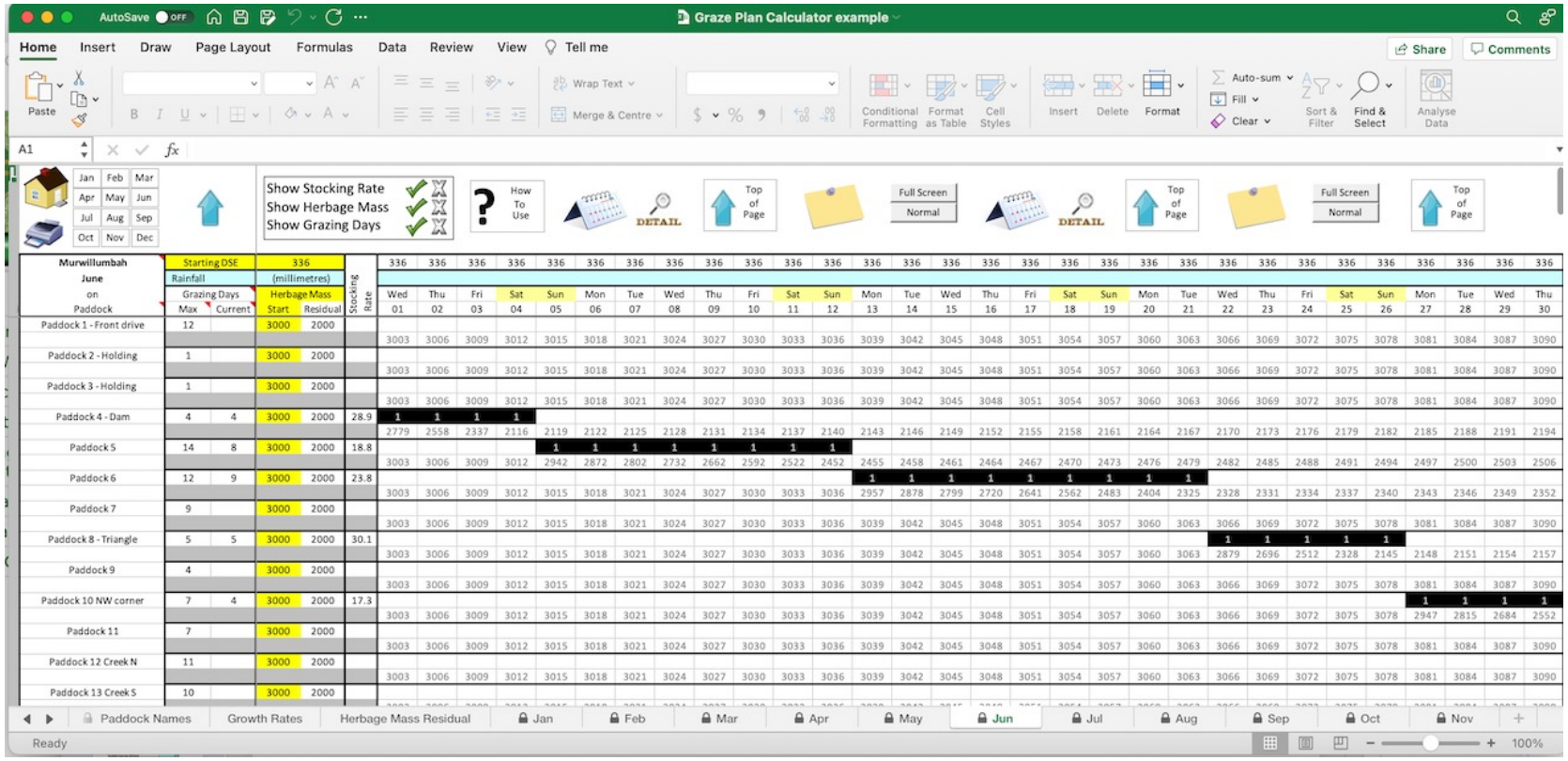


<u>active soil carbon</u>
soil animals
micro-organisms
root exudates

<u>stable soil carbon</u>
humus - chemically protected C
physically protected C

Grazing plan – feed budget based

AIMS graze plan calculator



www.aimsag.com.au/software Excel spreadsheet & Guide to use the calculator

Summary

Plan the grazing to optimise soil conditions, to optimise plant growth conditions for the maximium number of desirable species and you will go a long way towards regenerating land, restoring the water cycle, rejuvenating the mineral cycle, maximising carbon capture and maximising animal health and production.

Contact details

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