

FERTILIZATION OF MOPANE VELD: SHORT-TERM HERBACEOUS RESPONSES

TEMBO



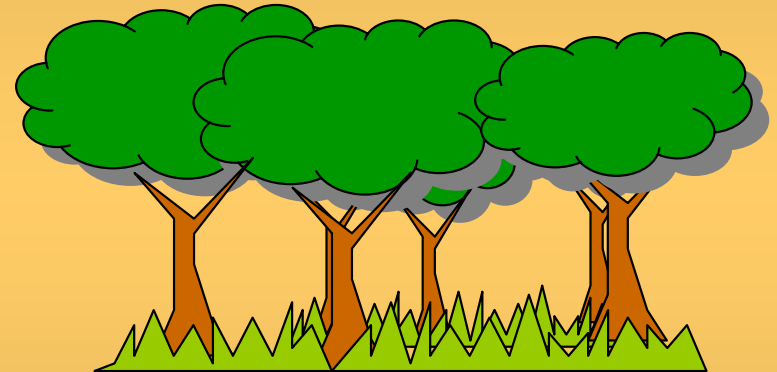
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Resource Ecology Group
Wageningen University
The Netherlands

Introduction

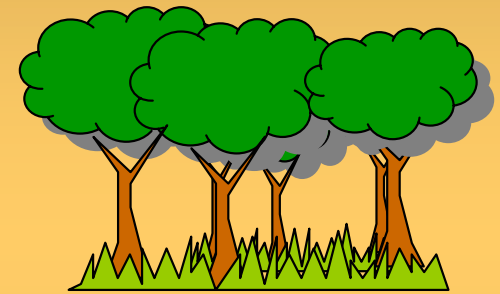
Drivers of savanna species composition and structure:

- Fire
- Herbivory
- Water availability
- **Soil nutrients**



Intro (cont.)

- **New advances in plant ecology suggest that plant community structure is not only affected by soil fertility, but also the spatial configuration of how nutrients are supplied**

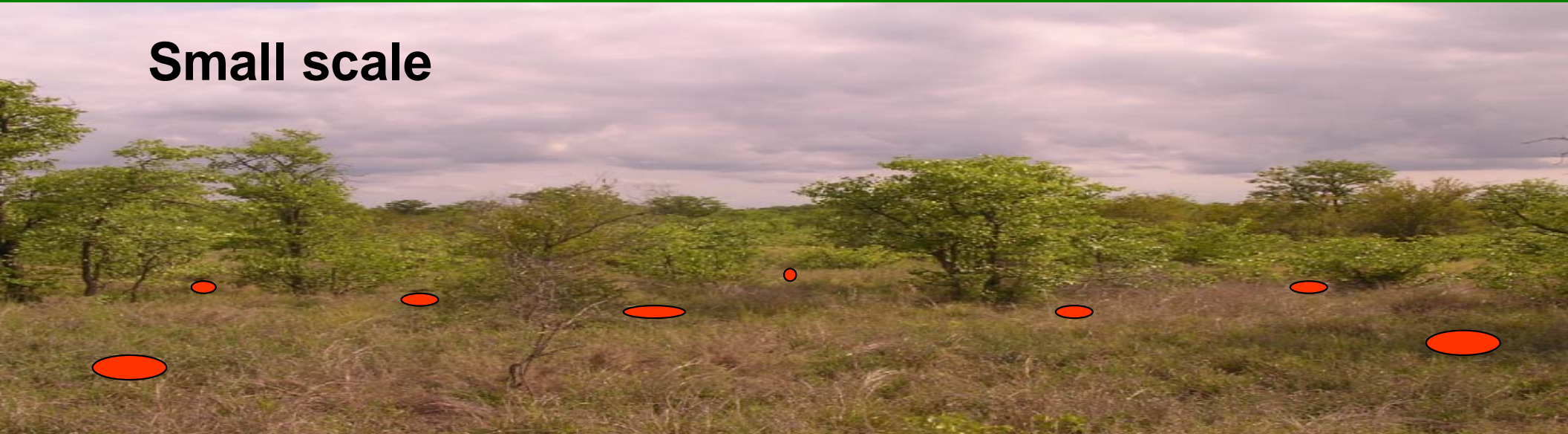


Savannas: trees or grasses benefit?

Large scale

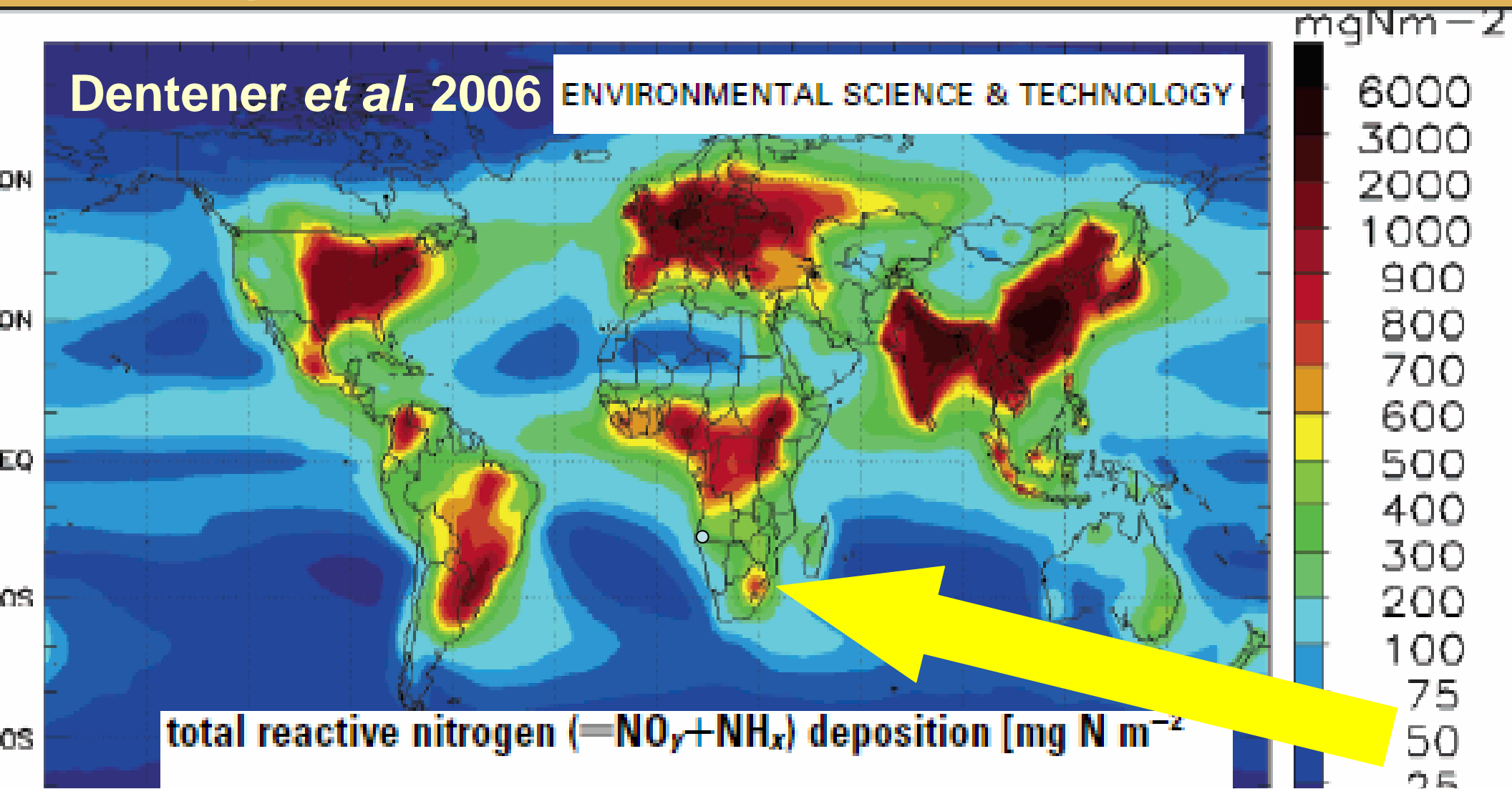


Small scale



Introduction (cont.)

Nitrogen deposition measured in KNP in 2000
> 20 kg N/ha! (Du Toit *et al.* 2003)



How will vegetation respond?

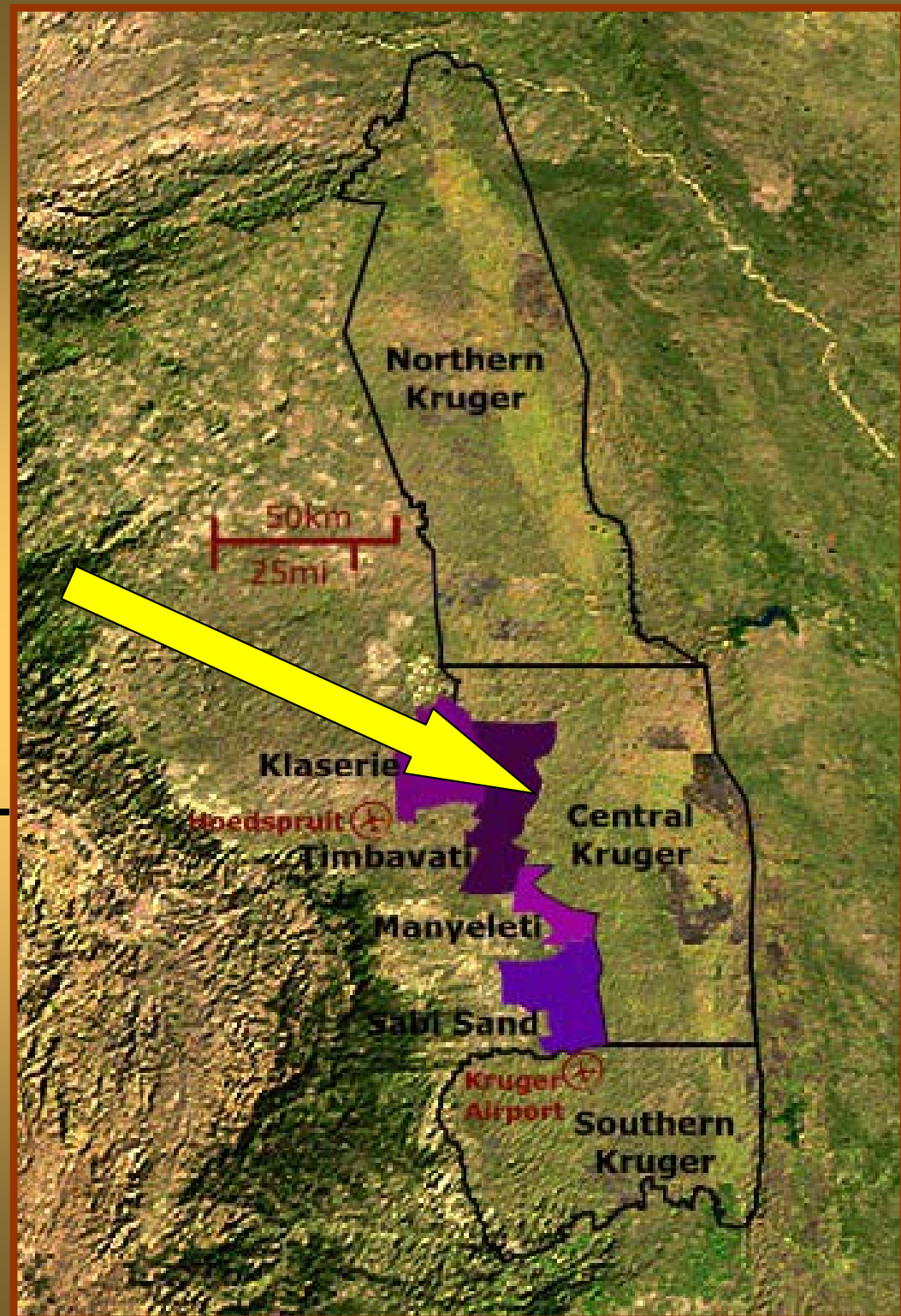


This presentation.....

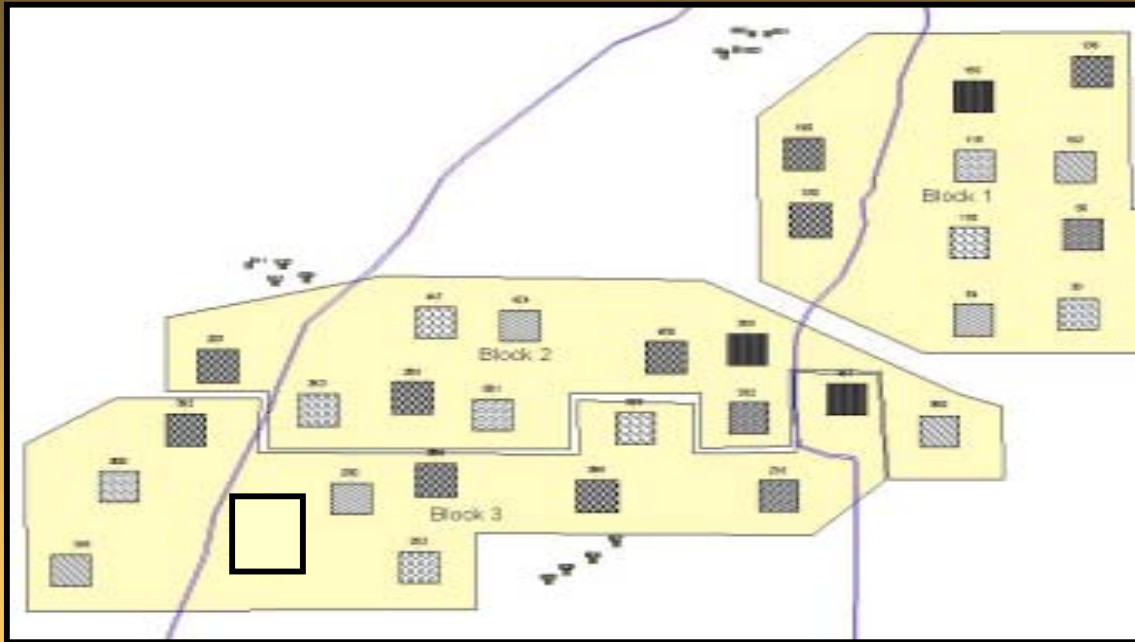
1. Herbaceous responses following fertilization at increasing rates and different spatial configurations in terms of:
 1. Standing crop
 2. Species composition
 3. Leaf chemistry
 4. Utilization patterns
2. [The effect of nutrient and water availability on Mopane sapling – grass competition]

Study area

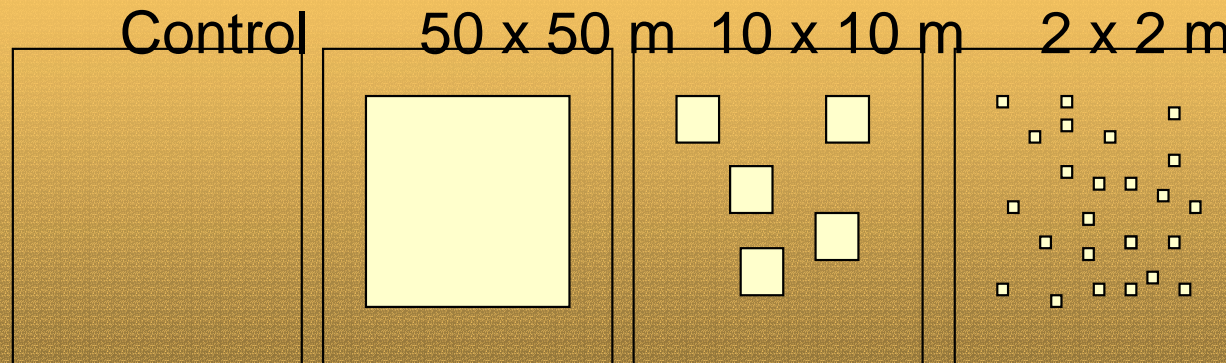
- Timbavati Private Nature Reserve
- Mean rainfall 450 mm
- Vegetation: woody layer dominated by Mopane trees and shrubs with a well developed herbaceous layer
- Soil derived from granite – nutrient poor
- Game free roaming – surface water freely available



Field fertilization experiment

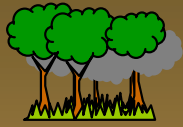


- Randomized block design (30 ha plots)
- NPK (3 N : 2 P : 1 K) applied in December 2004
- 3 different spatial scale treatments:



- 3 plot load levels: 0.6, 3 and 15 kg/plot

Supply
kg N / plot



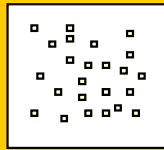
Patch size

2x2 m

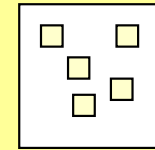
10x10 m

50x50 m

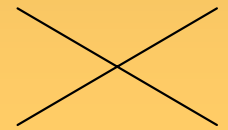
0.6



(6 g m⁻²)

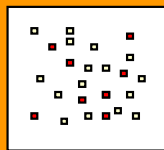


(1.2 g m⁻²)

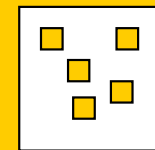


(0.24 g m⁻²)

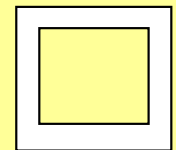
3



(30 g m⁻²)



(6 g m⁻²)

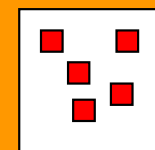


(1.2 g m⁻²)

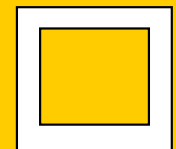
15



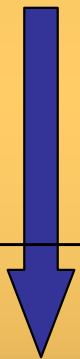
(150 g m⁻²)



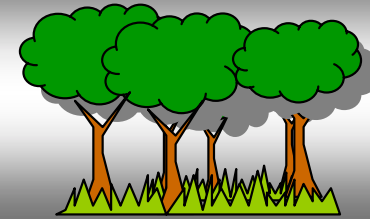
(30 g m⁻²)



(6 g m⁻²)

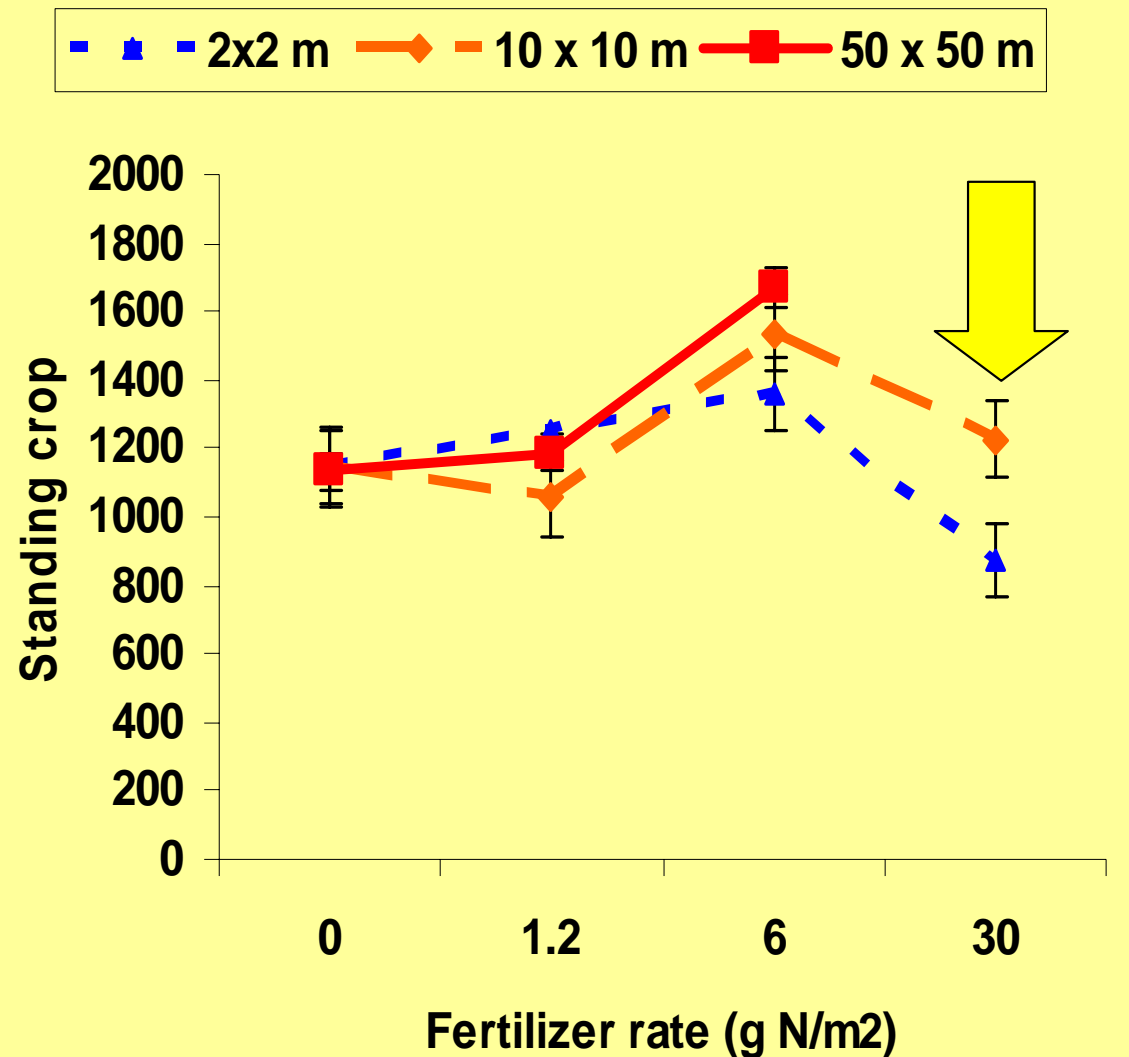


Herbaceous standing crop



Methodology

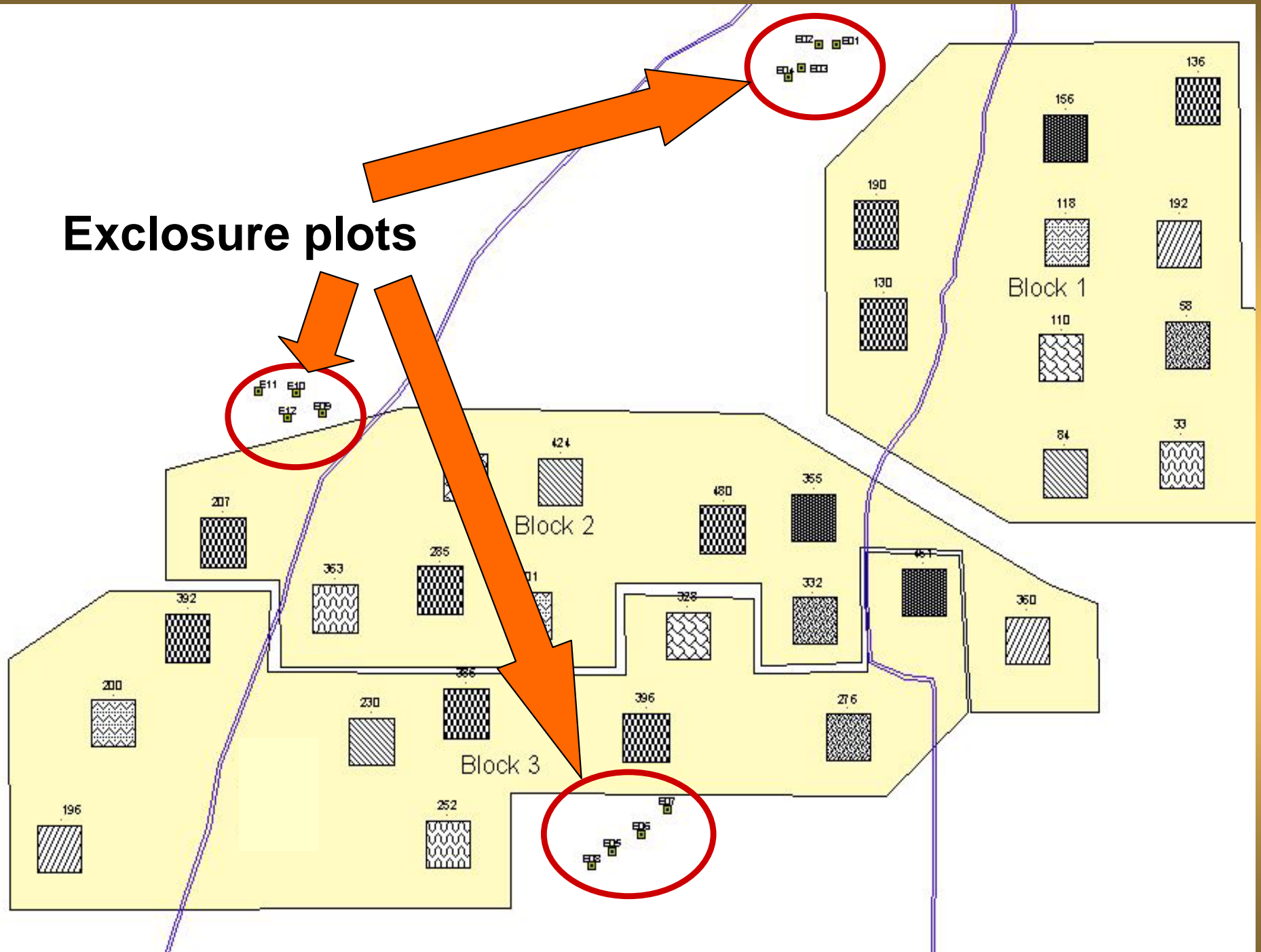
- Dry-weight-rank and Comparative Yield techniques
- DM per species
- 0.5 x 0.5 quadrat size
- N=100 per plot



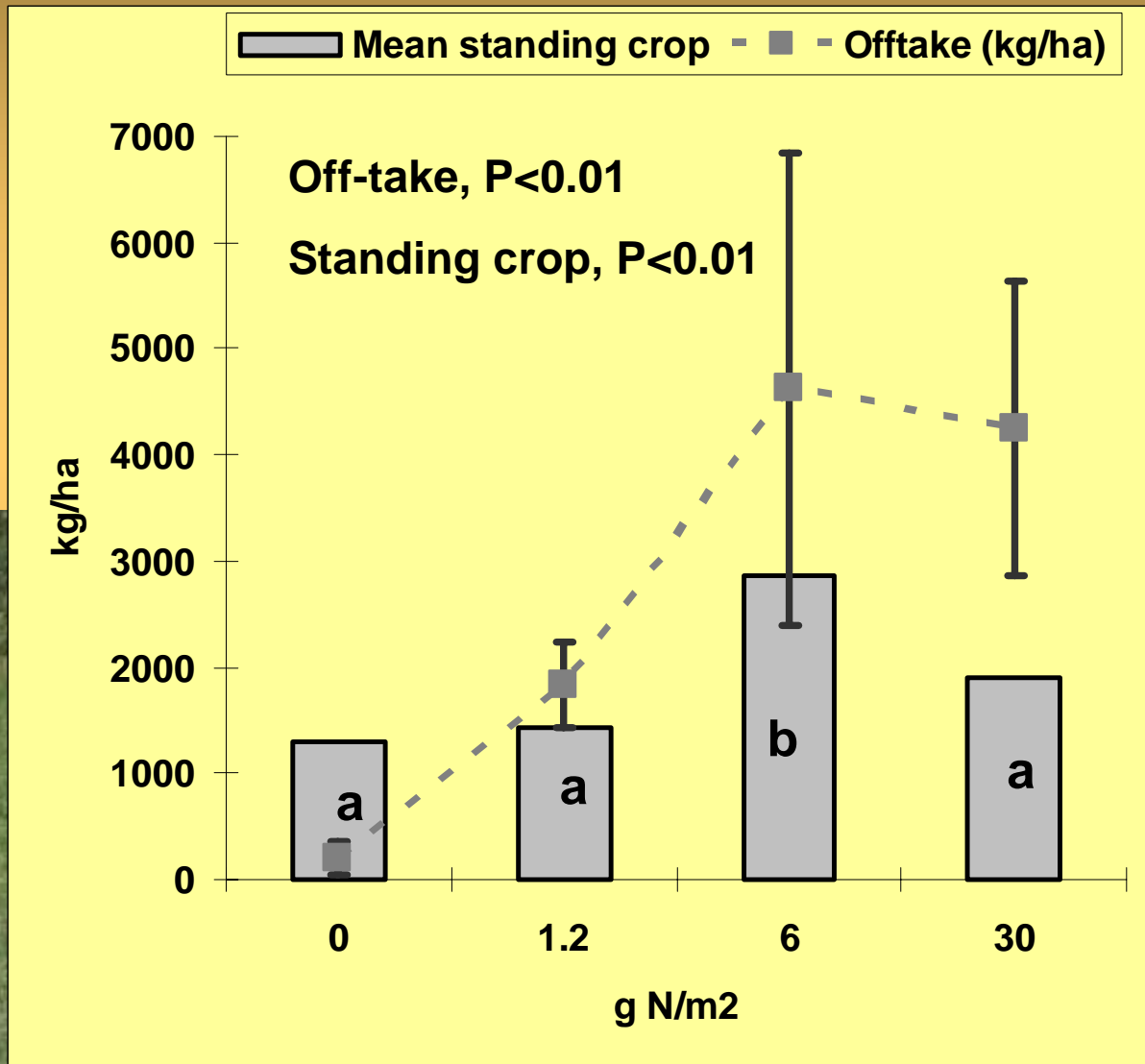
Movable grazing exclosures

- Fertilized 10 x 10 m areas at same local concentration rates as large-scale experiment: 0, 1.2, 6 and 30 gN/m²
- Move cages every 1.5 – 2 months for 1 year
- Disc Pasture Meter
- Calculated off-take as inside minus outside standing crop

Exclosure plots



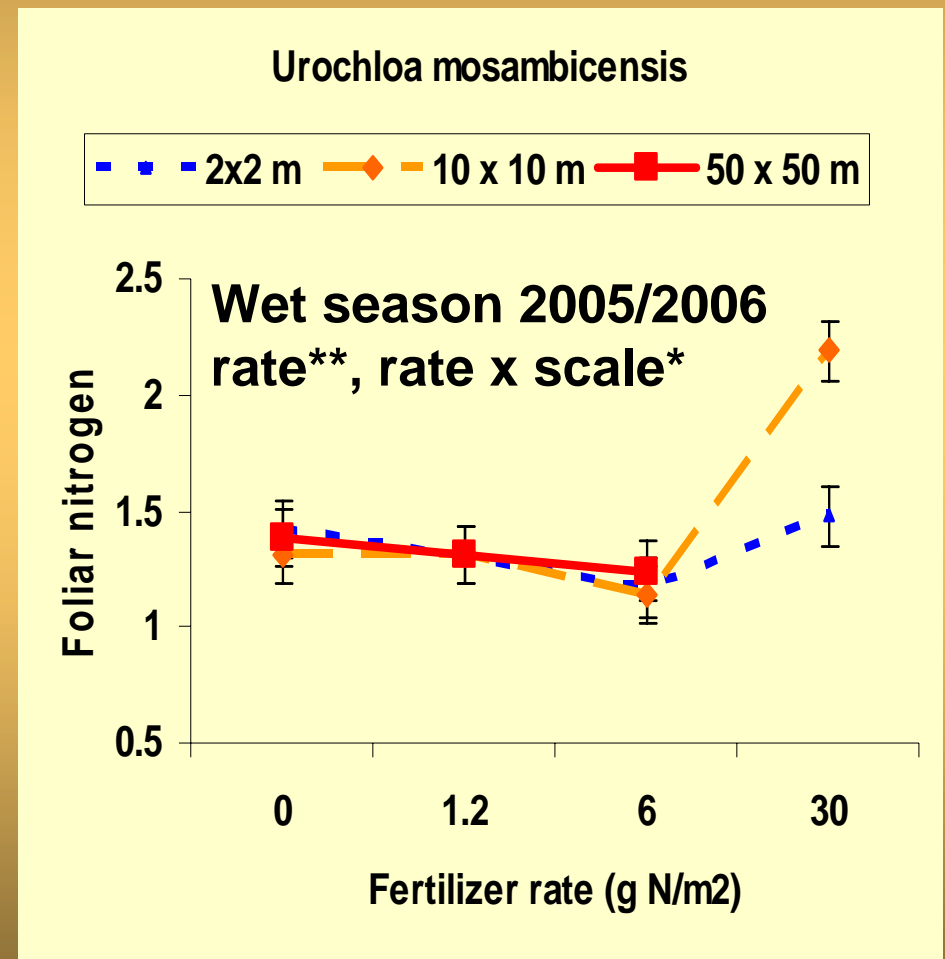
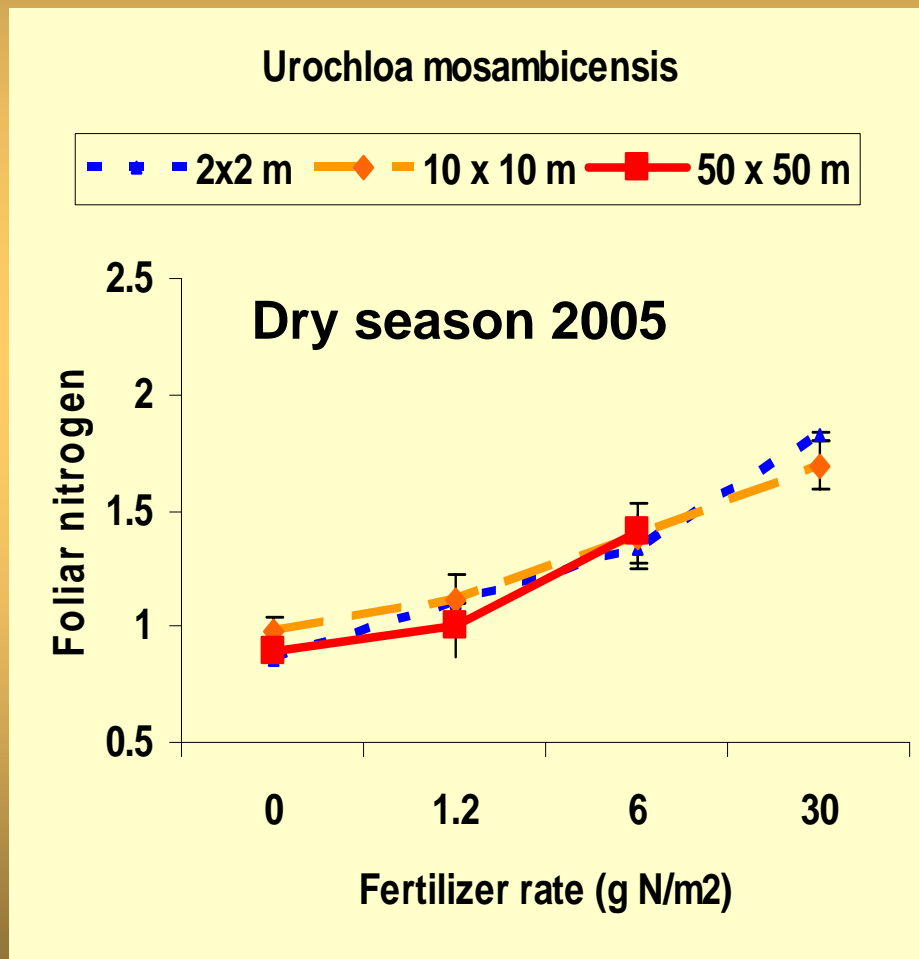
Annual off-take and mean standing crop



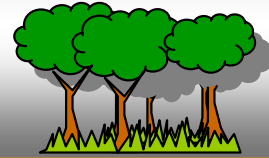
Leaf nitrogen in same year of fertilization compared to a year later



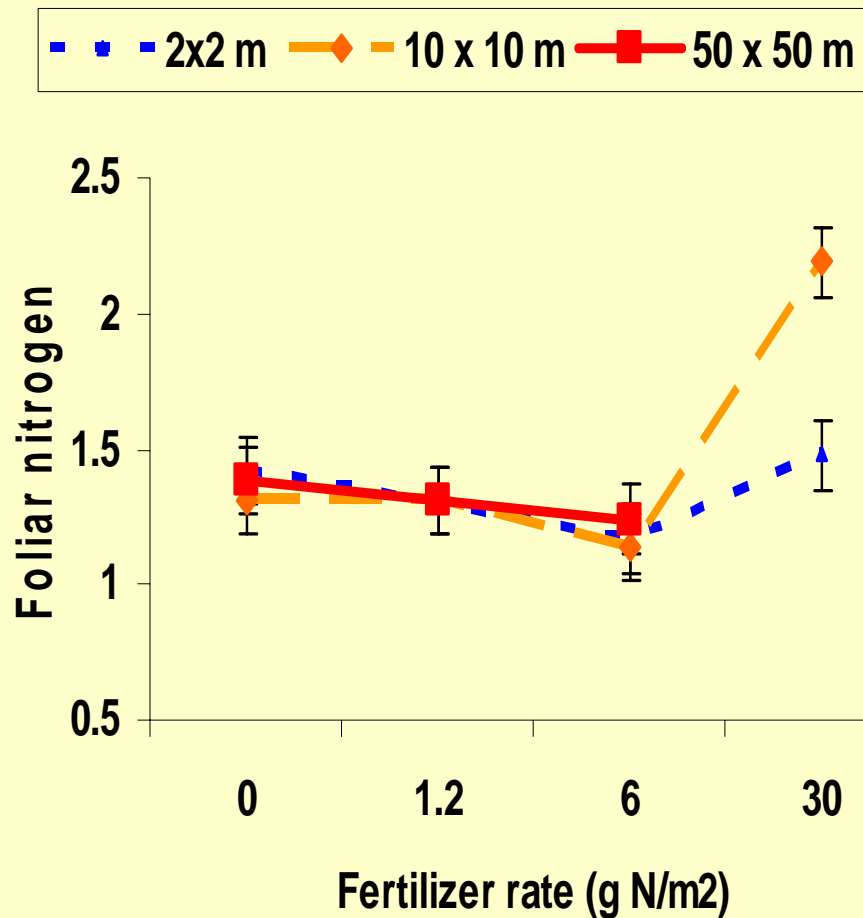
Fertilized in December 2004



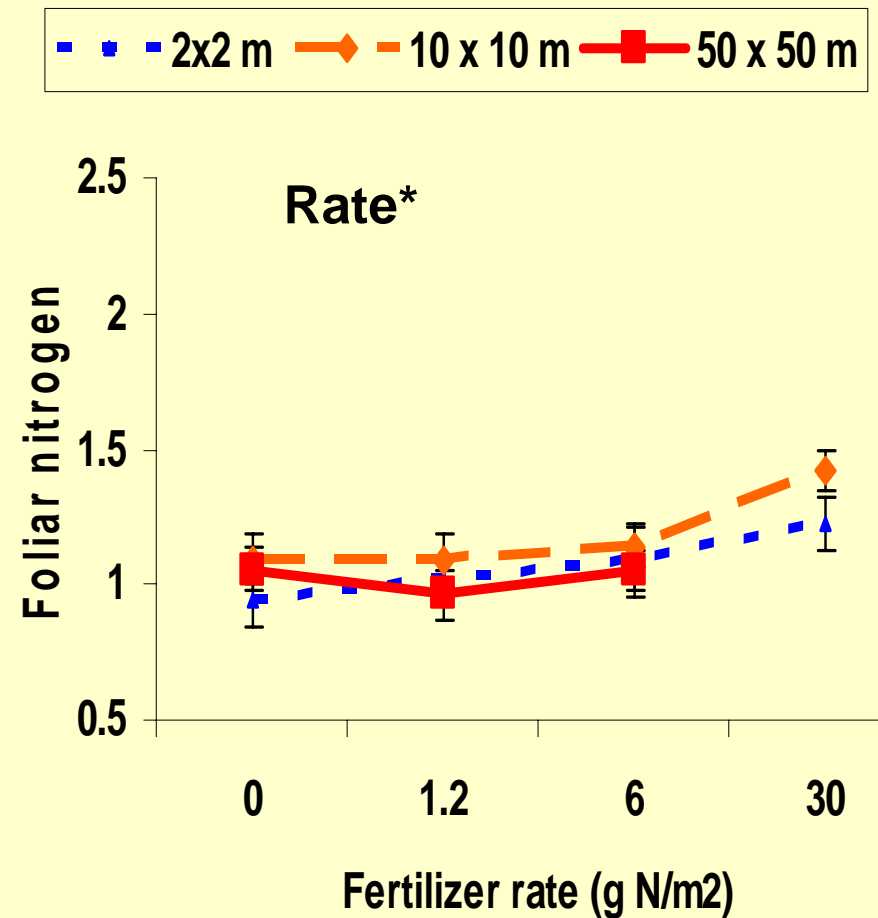
Leaf nitrogen: *Urochloa* vs. *Bothriochloa*



Urochloa mosambicensis



Bothriochloa radicans

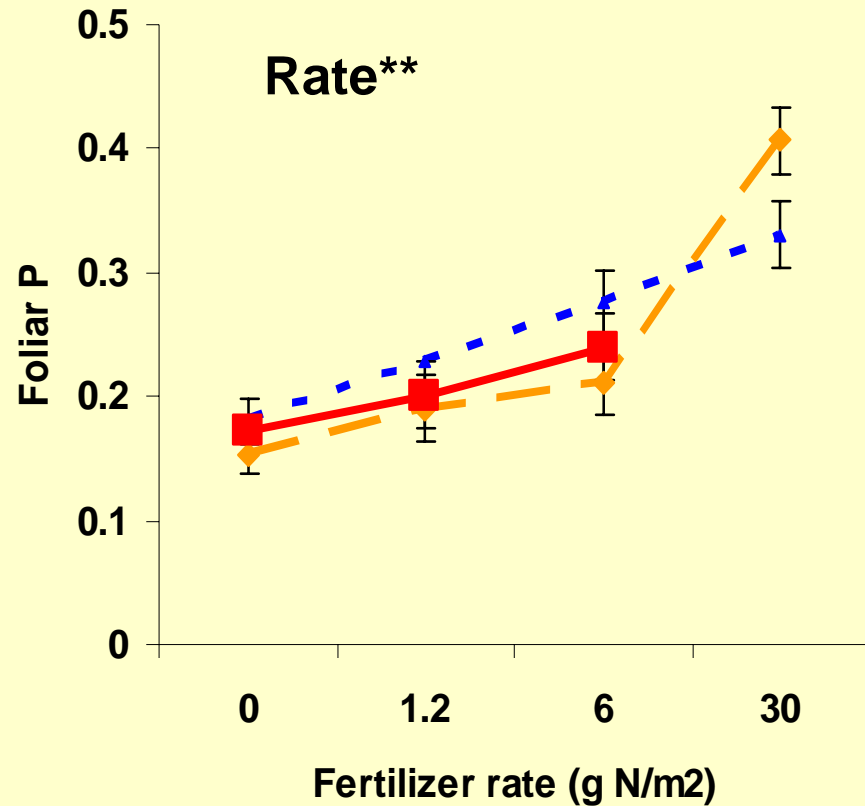


Leaf phosphorous: *Urochloa* vs. *Bothriochloa*



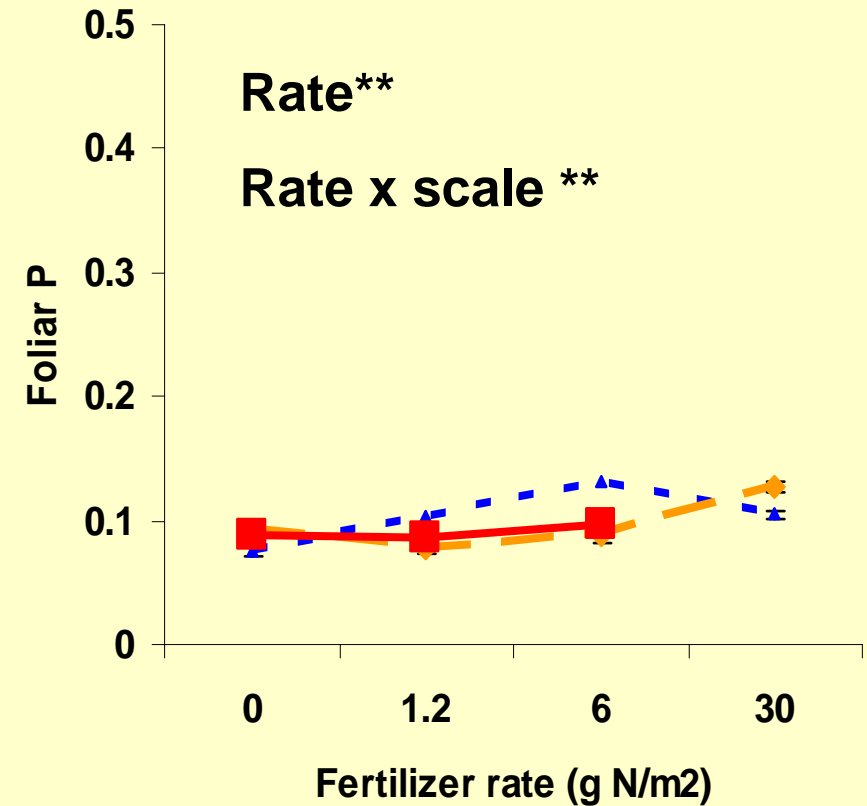
Urochloa mosambicensis

2x2 m 10 x 10 m 50 x 50 m

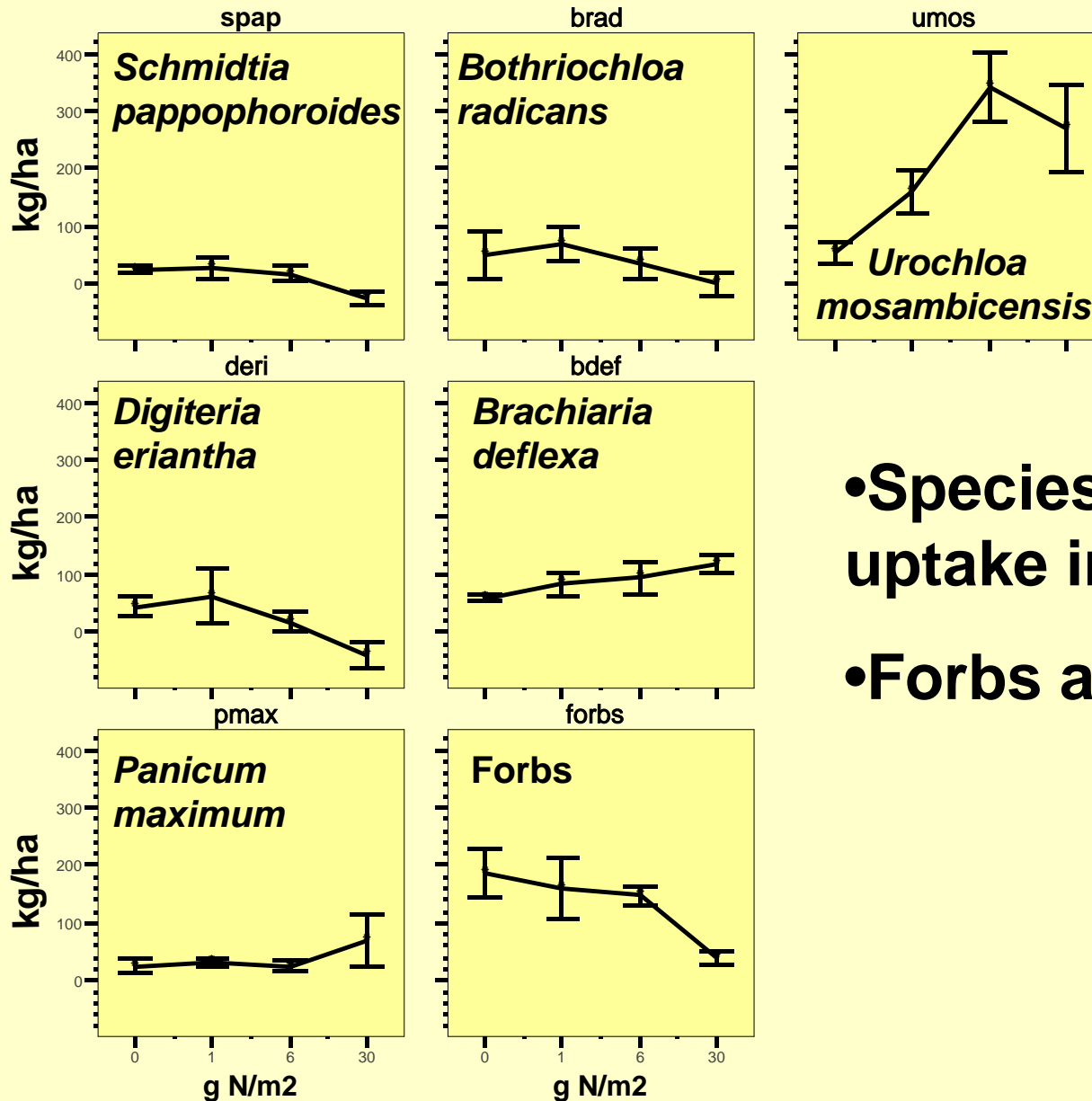


Bothriochloa radicans

2x2 m 10 x 10 m 50 x 50 m

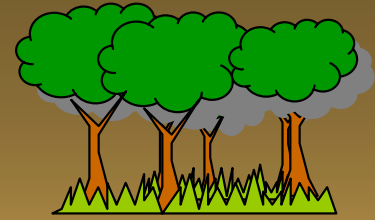


Species compositional changes in relation to fertilizer rate



- Species showing luxury N-uptake increased
- Forbs as a group declined

Conclusions



- **Grass production predictably increased with increasing nutrient availability, but was offset by high grazing off-take in fertile sites**
- **High soil nutrient availability resulted in intense grazing**
- **Foliar nitrogen does not necessarily reflect soil nutrient status**
- **Focal grass species differ in response to increasing soil fertility – changes relatively rapid compared to reported fertilizer responses in mesic areas**
- **Spatial configuration of fertile patches affected nutrient uptake by vegetation – ongoing research will relate relative nutrient uptake by swards and tree-stands across scale and nutrient load treatments**

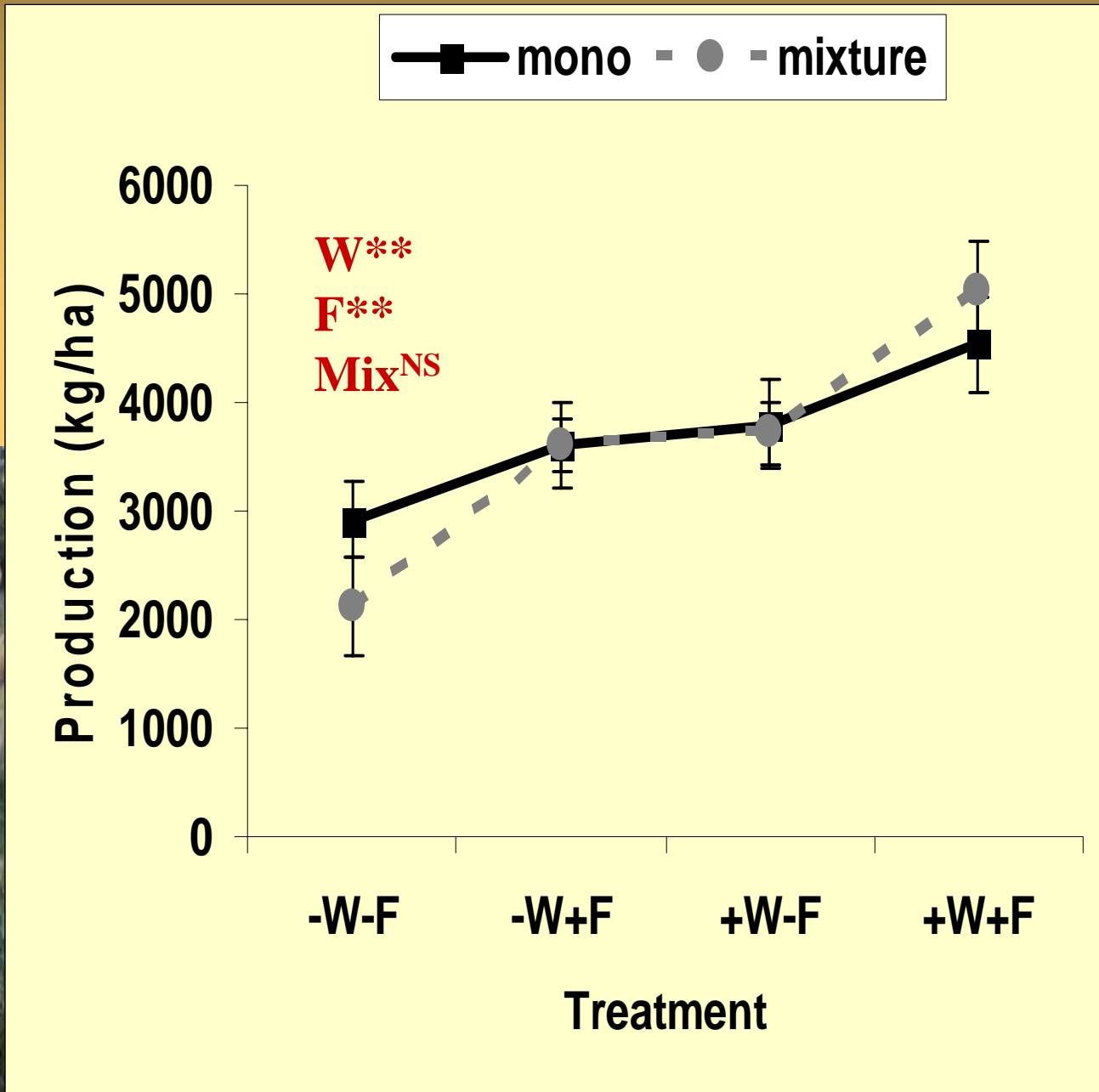
Garden experiment: Mopane saplings vs. grass

Layout and design

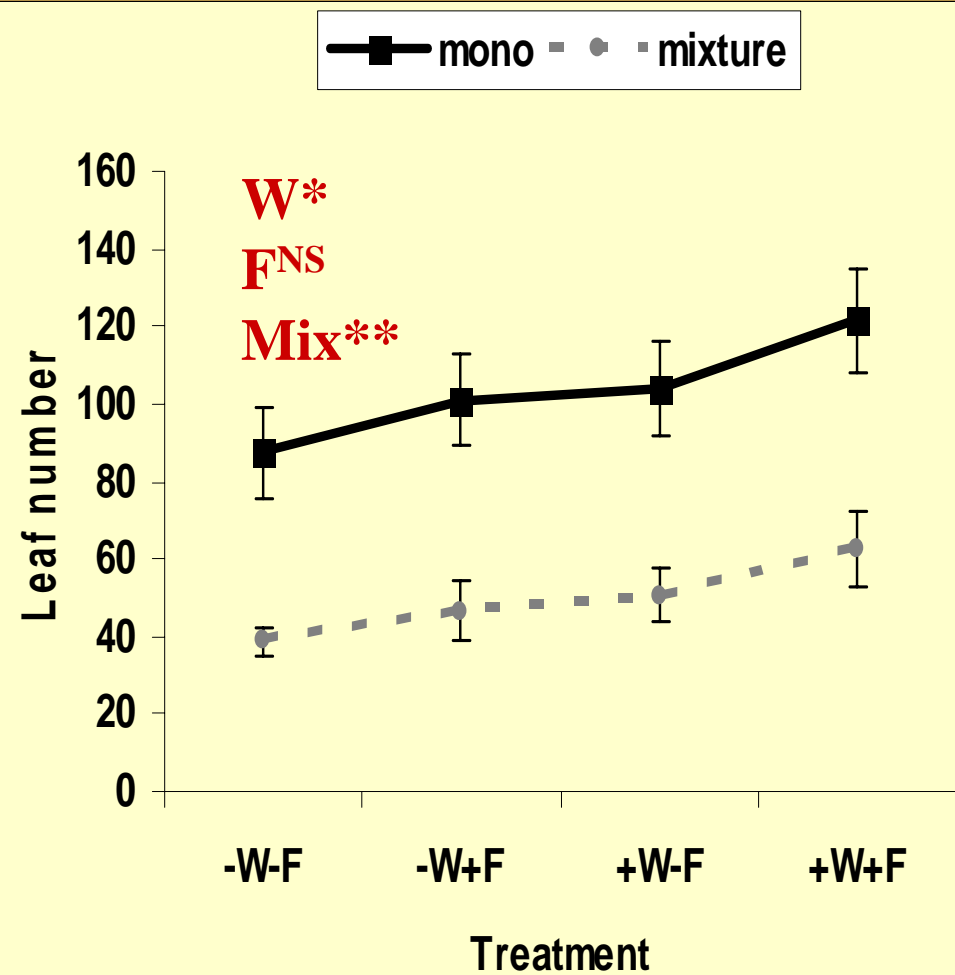
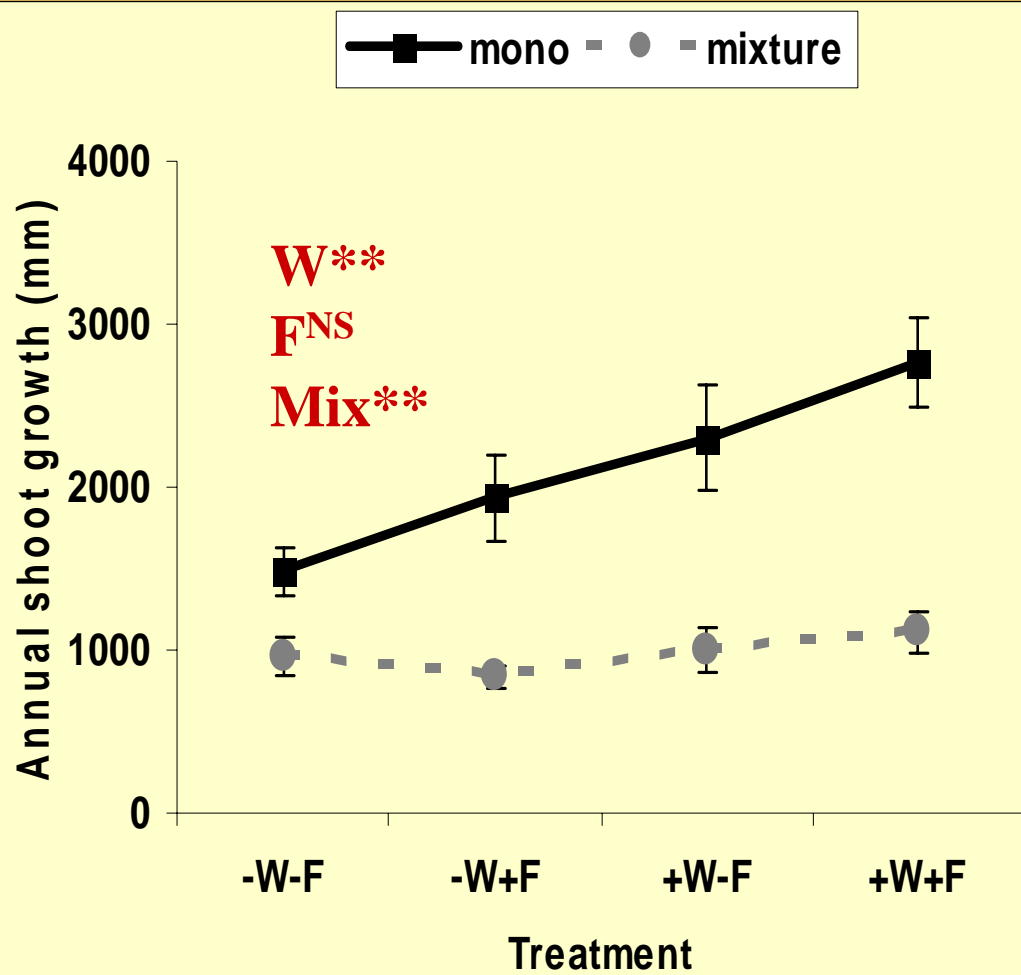
- Additive competition experiment
- Treatments:
 1. - water – fertilizer (control)
 2. - water + fertilizer
 3. + water – fertilizer
 4. + water + fertilizer
- Replications = 10



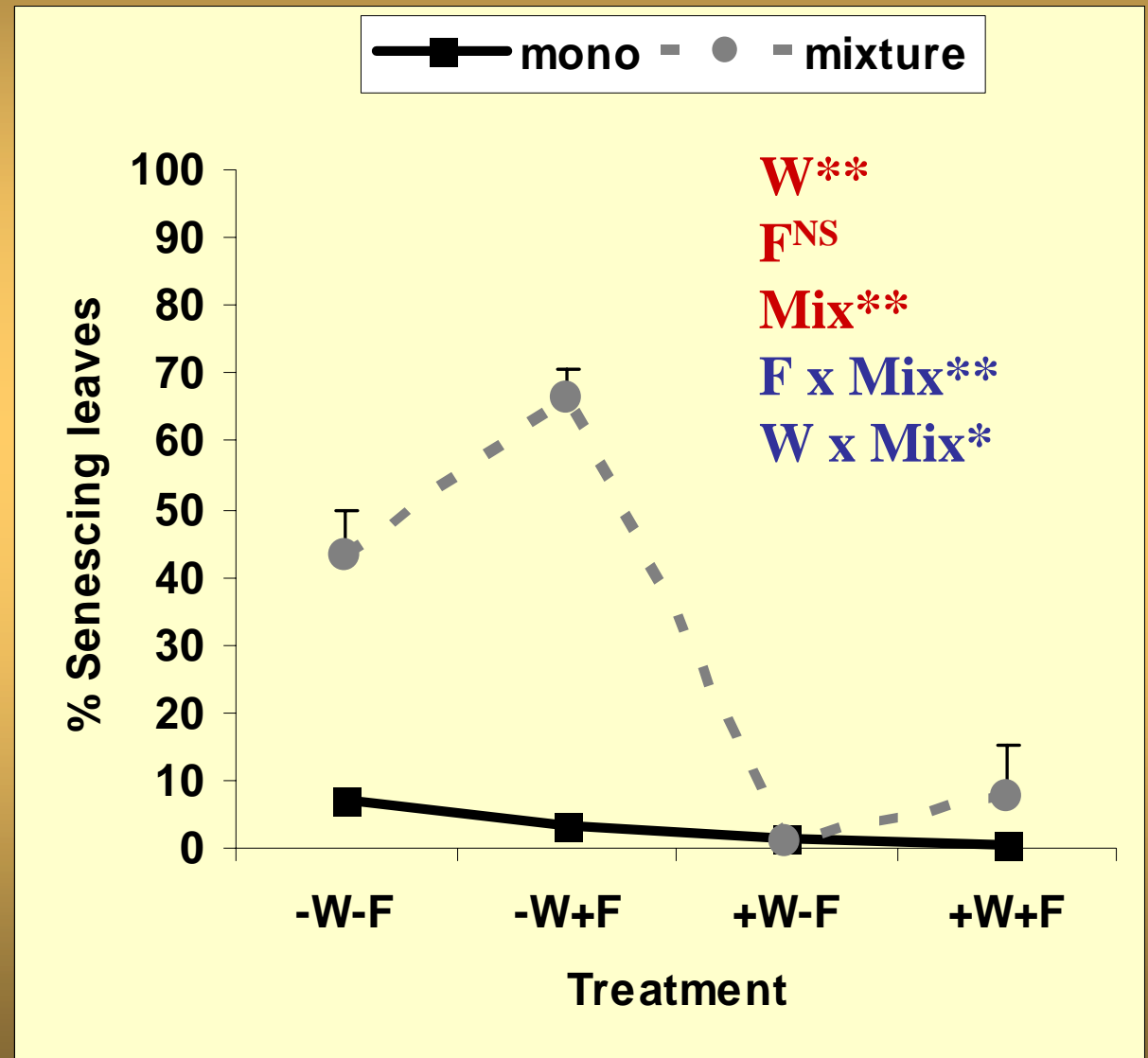
Garden experiment – herbaceous production



Mopane growth



Mopane leaf senescence



Garden experiment-conclusions

- **Fertilization increased herbaceous production with and without additional water**
- **Grasses severely retard Mopane sapling growth**
- **Early leaf senescence of Mopane saplings most severe in dry treatments and was exacerbated by fertilization**



Thank you!