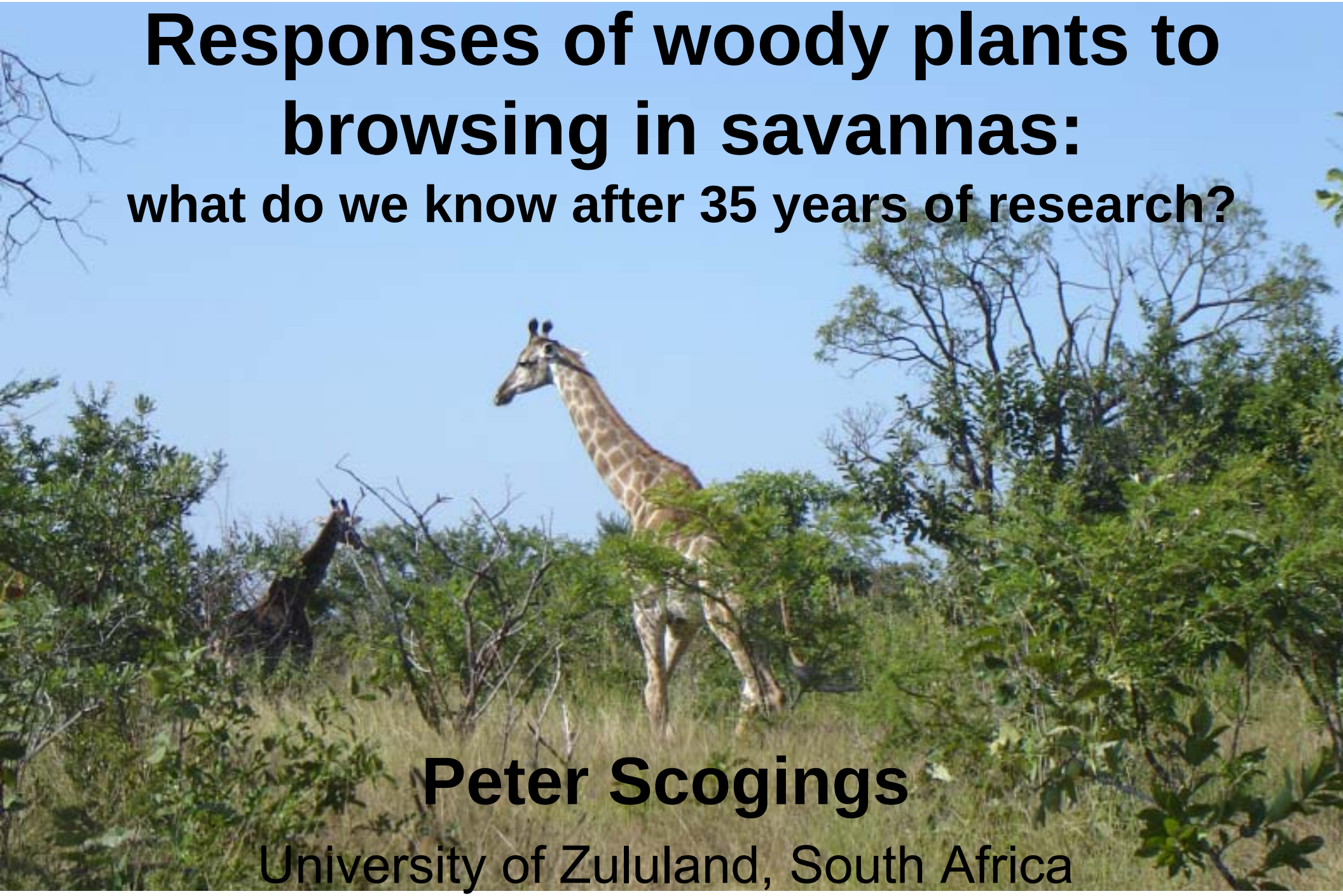
Responses of woody plants to browsing in savannas:

what do we know after 35 years of research?



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Wildlife
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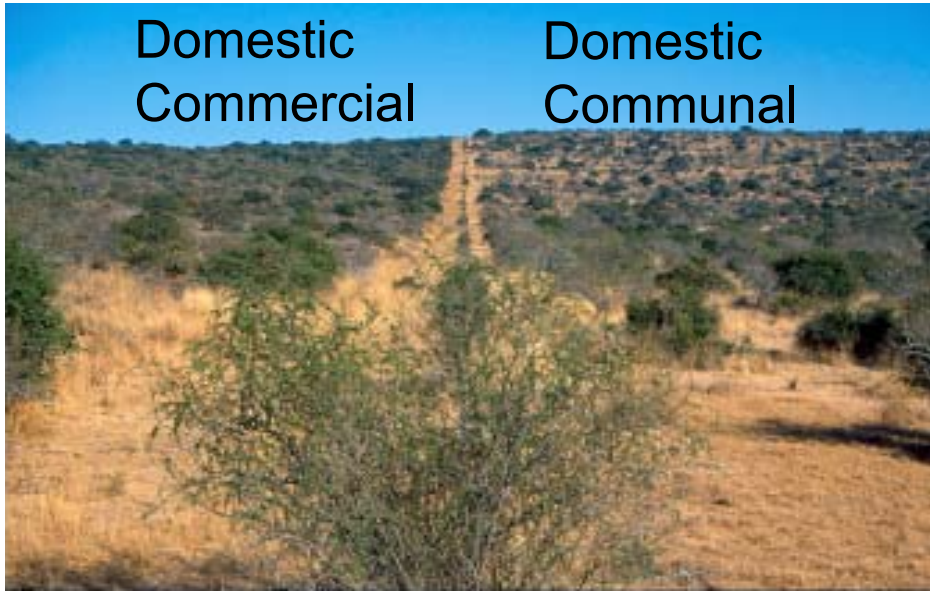
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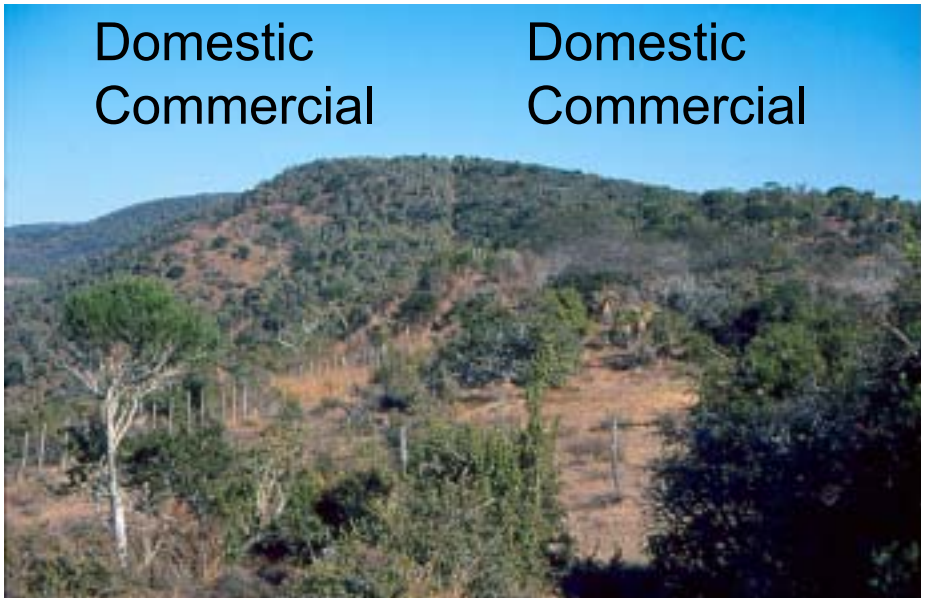
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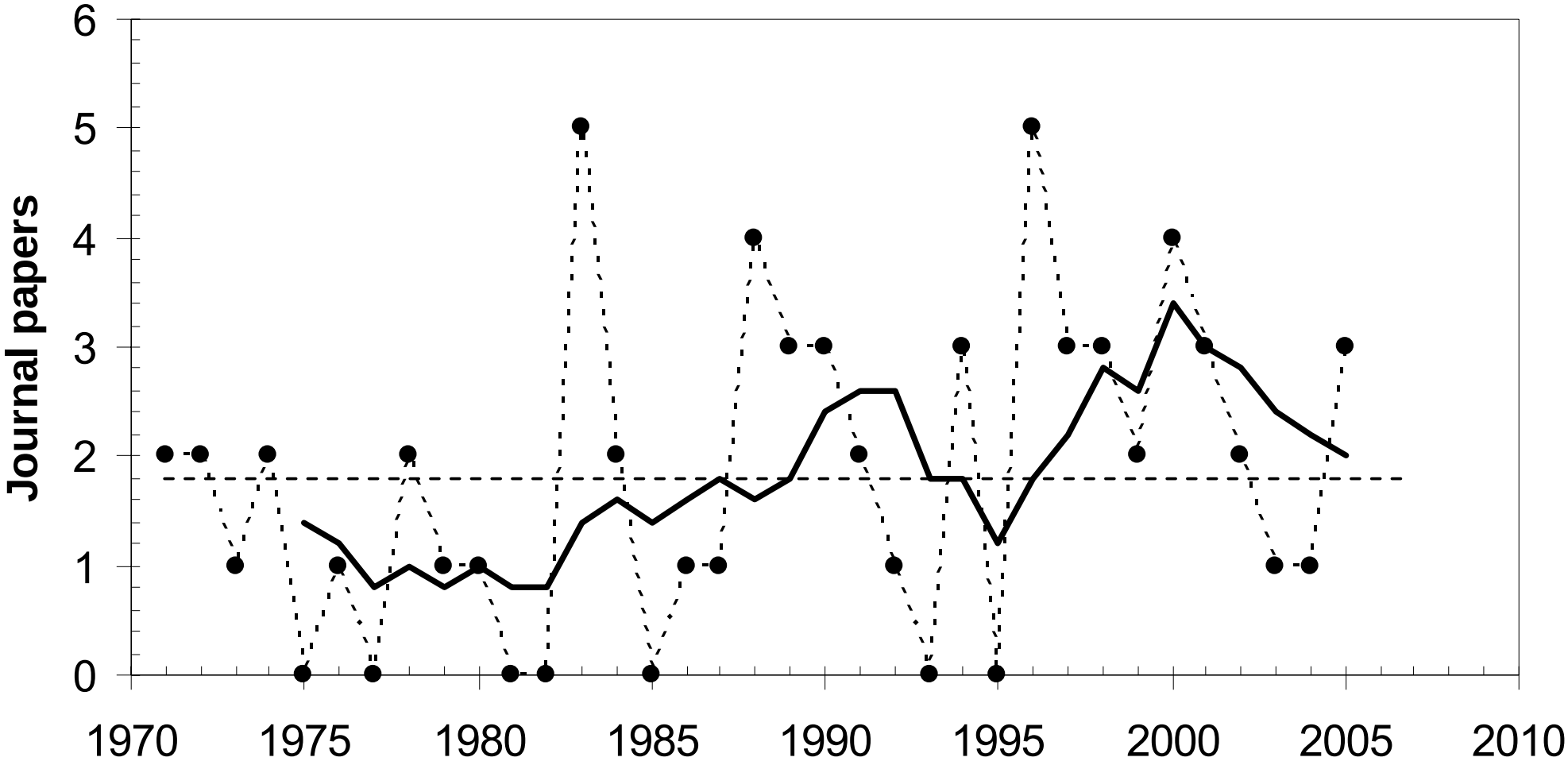
"... browsing is predicted as a consequence of animal size ... and availability of forage ... defoliation impacts are levied simply as reduction in plant part biomass ..."

(a description of the browse-browser component of a model of semi-arid savannas)

Outline

- Literature
- Plant growth
- Forage quality
- Plant populations
- Future research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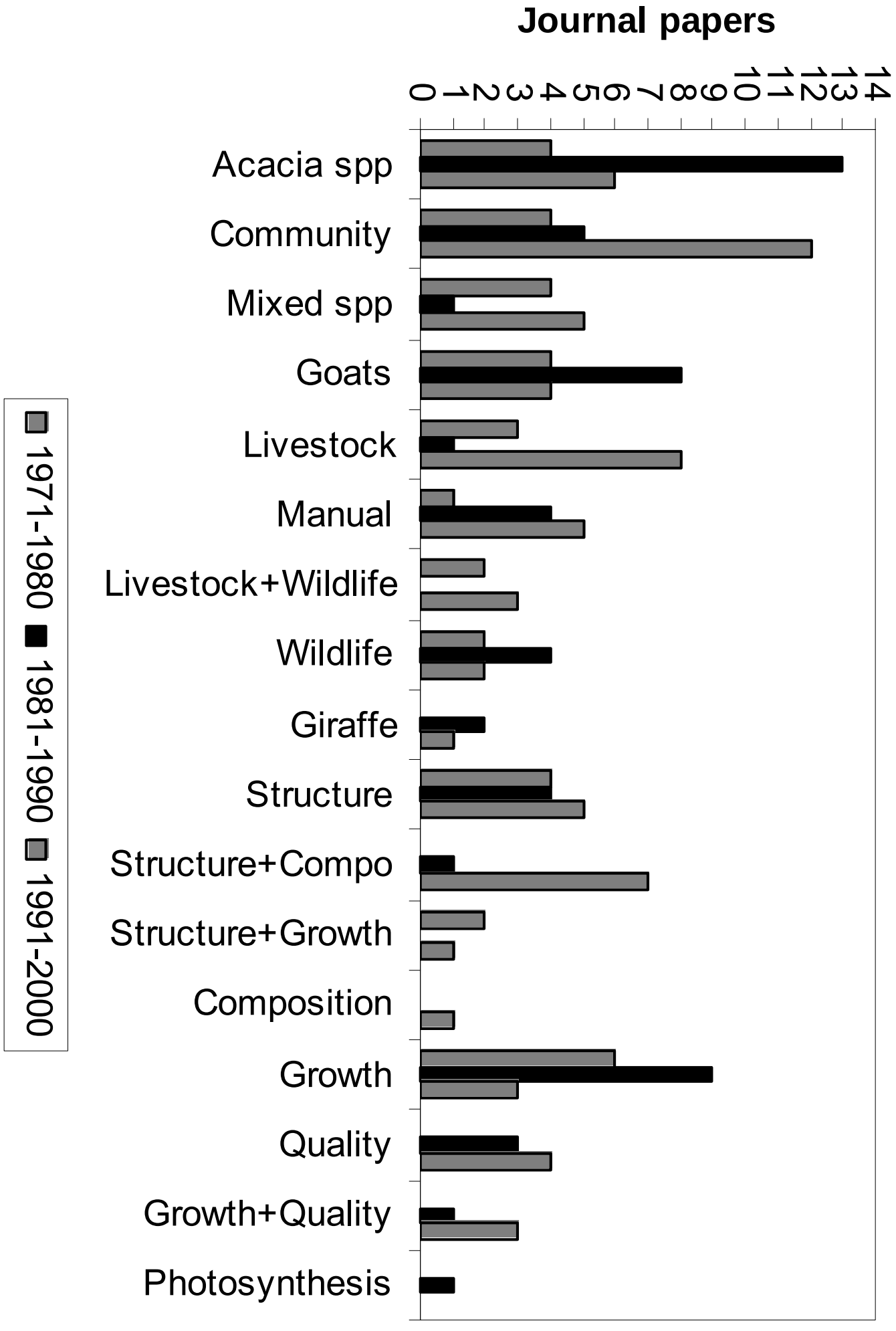
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Acacia spp
Community
Mixed spp
Goats
Livestock
Manual
Livestock+Wildlife
Wildlife
Giraffe
Structure
Structure+Compo
Structure+Growth
Composition
Growth
Quality
Growth+Quality
Photosynthesis
1971-1980
1981-1990
1991-2000

Plant growth

- Season, intensity: affect regrowth within a year
- Frequency: affects regrowth over many years

Short-term effects

- Summer: can stimulate production within growth season (fast recovery)
- Winter: no effect on production
- Moderate-heavy (>50%): tolerable after leaf-flush
- Light (25%): tolerable during leaf-flush
- Infrequent (2-3 mo): stimulatory
- Frequent (2 weeks): tolerable

Long-term effects

- Infrequent, heavy: tolerable; can stimulate shoot growth; effects persist for <1 yr after exclusion
- Frequent, heavy: reduces plant growth rate; increases plant mortality; effects persist for >1 yr after exclusion

Forage quality - spines

- Irreversible
- Coupled to growth, shoot morphology and demography
- Induced by pruning in growth season

Forage quality - chemical

- Changes not easily detected
- Changes more variable in deciduous
- Improved quality persists longer
- Reduced quality related to intensity

Populations - abundance

- Plants <2m most affected
- Canopy cover reduced first (<1 yr)
- Populations affected later (>2 yrs)
- Population responses variable (many factors)

Populations - recruitment

- Seedlings most sensitive when switching from cotyledons to roots for nutrients
- Recruitment of juveniles to mature classes restricted

Populations - mortality

- Browsing alone seldom causes direct mortality
- Main impact is in combination with other factors (fire, drought, disease, etc.)

Knowledge gaps - 1

- Evergreen, succulent and broad-leaf deciduous species
- Basic ecophysiology (e.g., growth rates, photosynthetic rates, resource requirements, allocation)
- Physiology of responses (e.g., compensatory photosynthesis, C allocation, C replenishment rates)

Knowledge gaps - 2

- Effects of altered shoot growth on overall plant fitness (↑ shoot growth = ↑ fitness?)
- Persistence of altered growth rate
- Premature mortality (monitor to mortality)
- Root growth responses (in relation to shoot and whole plant growth)
- Response thresholds

Knowledge gaps - 3

- Effects of season, frequency or intensity of browsing on forage quality
- Responses of nitrogen-rich secondary metabolites
- Rapid chemical responses
- Persistence of responses
- Response thresholds

Knowledge gaps - 4

- Effects of browsing on
  - seed production and survival
  - clonal propagation
- Response thresholds

Future research – aims 1

- Understand whole plant physiology, including below-ground, in relation to:
  - available resources
  - acquisition/allocation of resources
  - patterns of herbivory (dis/continuous)
  - types of herbivory (leaf/shoot)
  - time-frame of interest (persistence of effect)

Future research – aims 2

- Understand browsing thresholds above/below which:
  - shoot/root growth is stimulated
  - plant growth is reduced
  - forage quality is reduced
  - plant populations are reduced/increased

Future research – do

- Carefully designed, controlled experiments in lab and field
- Simulations that reflect actual patterns of browsing
- Use more plants and different species
- Develop models (plant to ecosystem)

Enjoy it! Have fun!