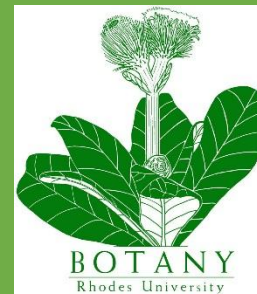


Investigating the impact of re-introducing herbivory (goats) to restored spekboom thicket

Yolandi Els, PhD Student, Botany Department, Rhodes University

Thicket Forum, Grahamstown, 5 September 2013



Background

- Extensive work by projects such as the Eastern Cape Restoration Project has shown that landscape-scale **restoration of severely degraded *Portulacaria afra* (spekboom)-dominated sub-tropical thicket is a viable land-use option** (van der Vyver et al., 2013).
 - Logistical & practical feasibility of restoring thicket at a farm scale was successfully demonstrated
 - Quantitative information on biodiversity gain and carbon sequestration rates in restored sites has been collected.
- Benefits of such restoration
 - include a variety of ecosystem goods and services that contribute to the economy,
 - promotes the sequestration of carbon



Photo: A Mills

Background continued...

- Gap in information and knowledge about whether and how the previous land-use (goat pastoralism) is to be re-introduced to restored spekboom landscapes
 - The importance of **rest from herbivory** for extended periods following planting of truncheons shown to be essential for successful restoration (Powell, 2009)
- Case for restoration of degraded thicket will continue to be motivated amongst farmers due to its environmental and socio-economic benefits (fuelled by emerging global carbon economy).
- Food security and profitability of livestock farming will ensure it staying an important land-use in the region
 - *P. afra* remains a valuable fodder plant, and restored landscapes could supplement income through sustainable browsing of livestock, wildlife, or both, at the appropriate stocking rate.

“The Sceptical Farmer”

SO YOU'RE TELLING ME...



FARMERS SHOULD FARM WITH CARBON
AND NOT WITH LIVESTOCK?

Eastern Cape Farmers' perceptions and views on carbon-farming

- **Majority open to considering it**, largely because they recognise spekboom's role in providing fodder in winter periods (Clark et al, 2012)
 - 89% of interviewed farmers open for considering carbon-farming
 - Farmers with large farms were more open for experimentation on their farms (i.e. farm size can be a constraint on buy-in)
 - 83% of interviewed farmers believed carbon-farming market needs further development before real commitment can be made
- There is however a huge difference between the theoretical- and practical potential of carbon-farming.

“The Sceptical Farmer”

- “Within the farm, capital first tends to be invested in the most profitable part of the enterprise and to spread gradually to investments giving a lower return.” (Tiffen, 1996)
- “How can resource-constrained farmers be expected to adopt practices that in the long term may improve production, but in the short term realise no net benefits or even net losses?” (Giller et al, 2009)
- WOCAT (Critchley & Mutunga, 2003)
 - 18 projects in Africa, examined and reviewed examples of technologies for sustainable land management devised by the farmers themselves
 - Most innovations had been developed for improved production or income, runoff control or other aims were sometimes pursued as co-benefits
 - **“Conservation is never divorced from production in the eyes of the innovators”**

Objectives

- General objective is to better our understanding and quantify the impact of re-introducing livestock, specifically goats, to restored spekboom landscapes.
- Questions addressed:
 - What is the impact of browsing on the production and carbon-stocks of restored spekboom landscapes?
 - What is the effect of defoliation at plant level?
 - What are farmer's perspectives and views on whether and how restored spekboom can be utilised?
 - Can livestock production and carbon-farming take place simultaneously on restored spekboom landscapes or not?



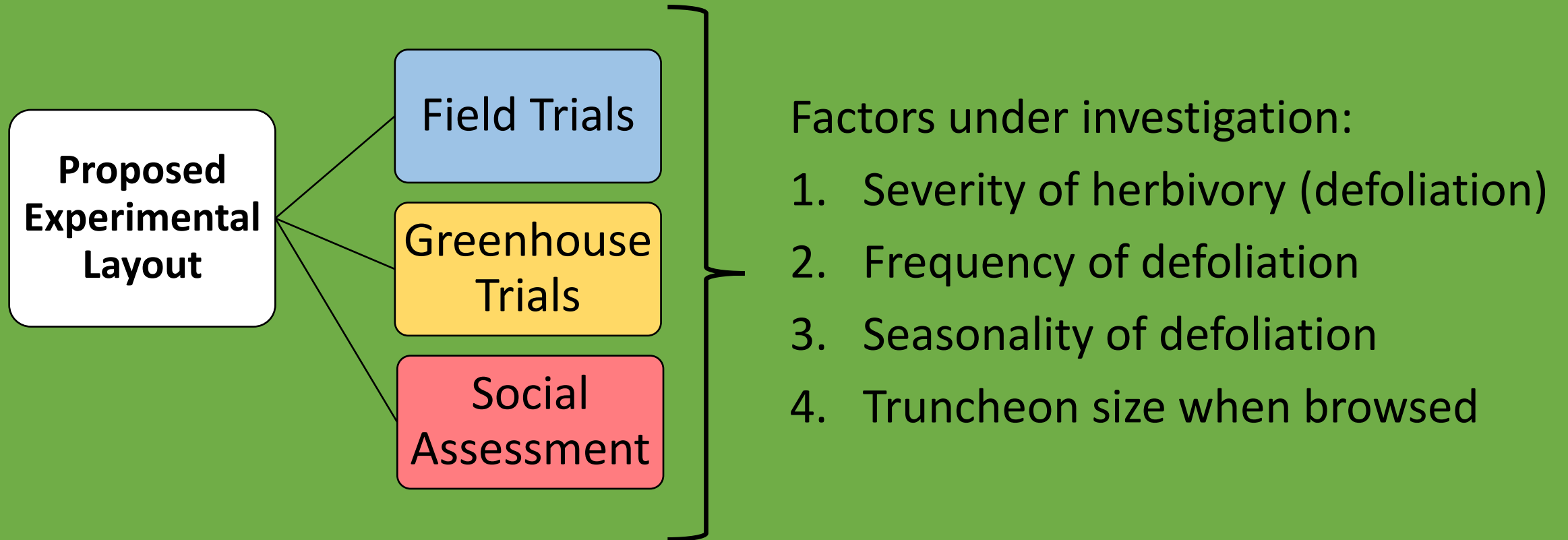
Photo: A Mills

Why goats?

- Although the number of game farms have increased significantly in the E. Cape, goats remain the **most appropriate and popular domestic livestock type** for subtropical thicket.
- Gross value of chevon (goat meat) > R700,000,000 in 2010 (DAFF, 2011)
 - Eastern Cape largest producer of chevon in the country (37%)
 - Mohair market has been consistently profitable to producers and recent years show an upward trend (current market indicator close to R112 per kg)
- Recent literature indicate the switching to more heat- and drought tolerant livestock types such as goats as appropriate adaptation strategy to climate change



Experimental Layout



→ Duration of study: end of 2013 to mid- 2016

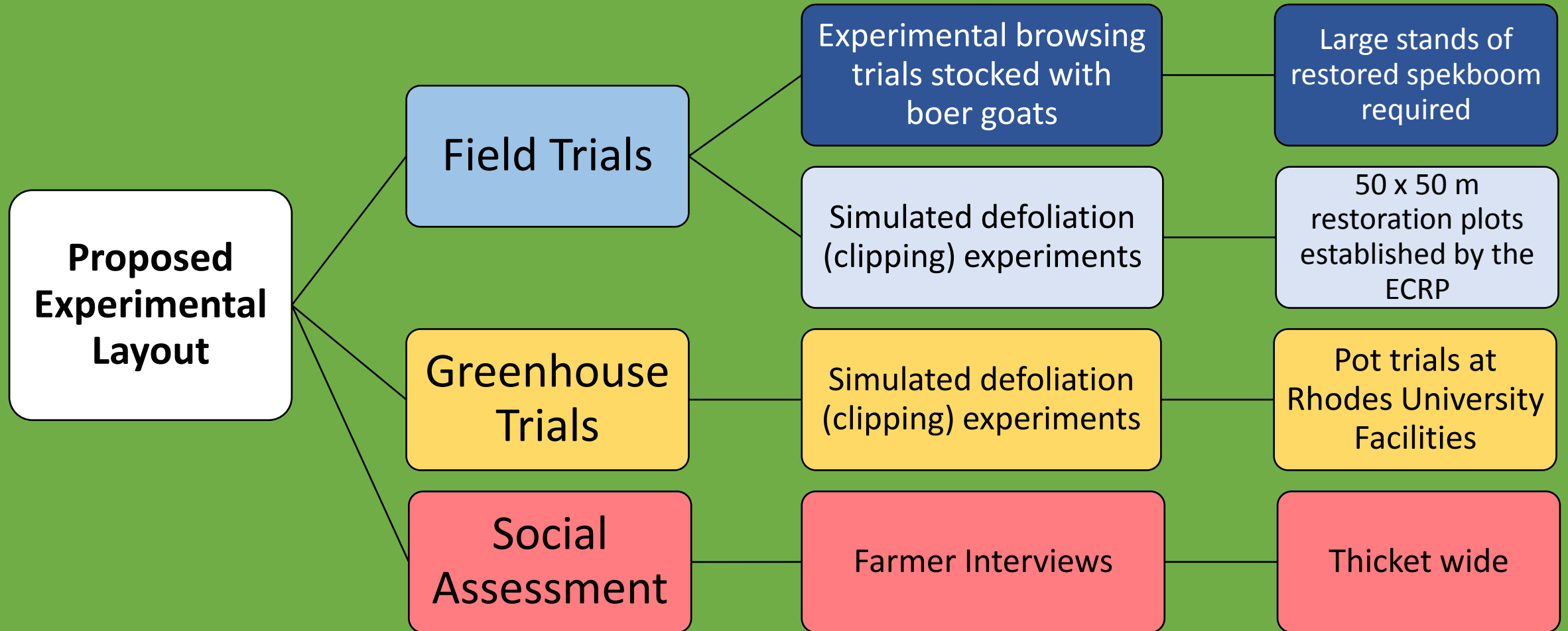
What happens to a plant when browsed?

- Herbivores function as **ecosystem engineers** altering the plant community through direct consumption, as well as indirectly through modulation of the ecosystem and landscape (alteration in shrub canopy, soil trampling, etc.) (Hobbs, 1996).
- Given the duration of this study, mostly **short-term effects of ecosystem engineering** will be investigated
 - Above-ground effects such changes in plant structure (height, canopy size, stem circumference, mortality), increased number of broken branches accumulated on the ground
 - The allocation of carbohydrate reserves (CR) in reaction to browsing
 - CR are accumulated in a variety of plant tissues (roots, stems, leaves) for later use in respiration, growth and synthesis of plant compounds, essential role in the survival of a plant following disturbances such as herbivory

What happens to spekboom when browsed?

- Defoliation trials by Aucamp et al (1980)
 - Essential to increase production potential of *P. afra*
 - $\geq 25\%$ and $\leq 50\%$ required to maintain a productive state whilst conserving the plant
 - $> 50\%$ lead to mortality after two years of high leaf production
 - Recommended defoliation treatment for total production potential (leaves & twigs):
 - Moderate defoliation during summer followed by rest for about 15 months, followed by moderate defoliation in subsequent autumn followed by another rest of 12 months
 - **Gap in study: plant reserve-allocation data to explain observations.**
- Prof Aucamp of opinion that livestock can be farmed in restored spekboom landscapes
 - The effect of goats & sheep on spekboom biomass to be carefully monitored to ensure the rate of growth of spekboom is not compromised and that maximal spekboom growth rates are achieved.

Experimental Layout



Field trials - experimental browsing trials stocked with boer goats

- Sites still to be selected
- Site requirements
 - Previously transformed spekboom thicket successfully restored by planting of truncheons.
 - **Sundays spekboomveld** or **Baviaanskloof spekboom thicket** (Vlok et al., 2003) → comprehensive baseline data (carbon stocks, climate) available.
 - **Different-aged large stands** of restored spekboom (e.g. Krompoort and Rhinosterhoek sites used by van der Vyfer et al, 2013).
 - Ideally comprehensive information on historical grazing management available.
 - Conservation areas likely to be excluded as management does not foresee re-introduction of livestock .
 - Support and consent from land-owners.

Field trials - simulated defoliation (clipping) experiments

- Sites still to be selected
- Site requirements
 - **50 x 50 m restoration plots** established by the ECRP in either Sundays spekboomveld or Baviaanskloof spekboom thicket (Vlok et al., 2003), ideally same vegetation type as selected for browsing trials → comprehensive baseline data (carbon stocks, climate) available.
 - Ideally comprehensive information restoration methods and techniques used (time of planting, size of truncheons, posture & micro-damming, etc.).
 - Conservation areas can be included.
 - Support and consent from land-owners.



50 x 50 m Restoration plot (Photo: Y Vermaak)

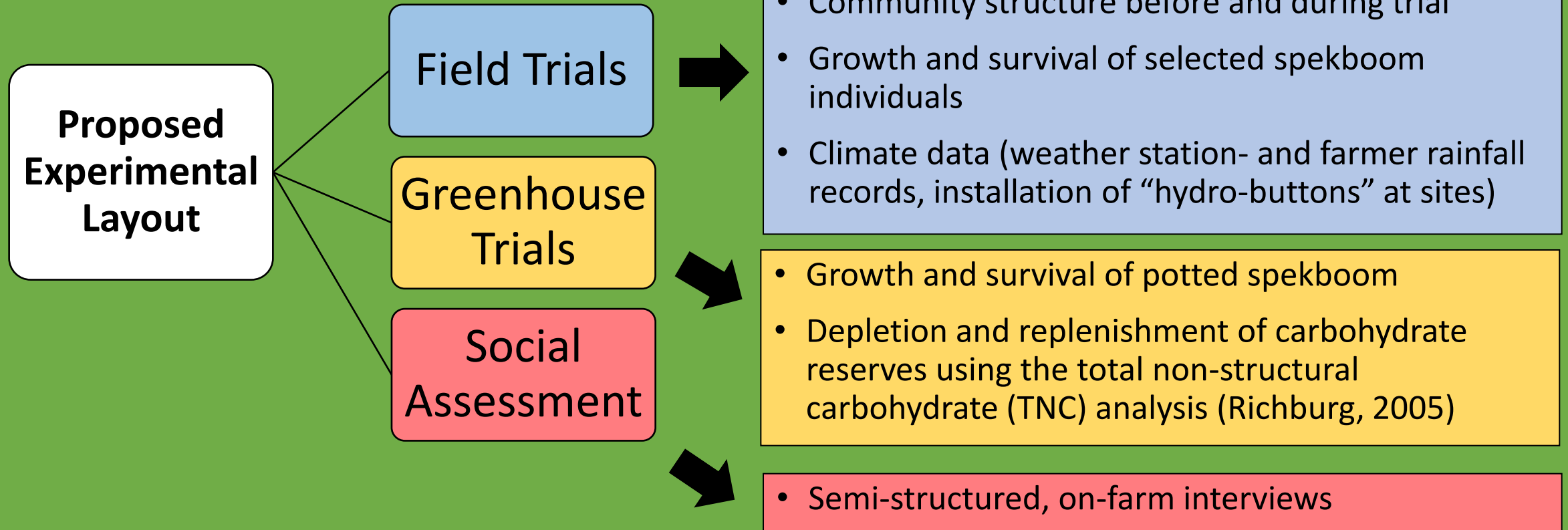
Greenhouse trials – simulated defoliation (clipping) experiments

- **Pot-trials** at Department of Botany Facilities, Rhodes University
- **Different-aged spekboom truncheons** with known planting technique
- Defoliation treatments and climatic conditions of field trials simulated

Social Assessment

- Thicket-wide random sampling of **livestock farmers** (incl. owners of farms where field trials are located)
- Semi-structured interviews conducted with farmers on their farms
- Social assessment of farmers' views on **livestock utilisation of restored thicket (e.g. grazing systems and stocking rates), carbon farming**
- To approach and involve formal agriculture

Data collection



Objectives

- General objective is to better our understanding and quantify the impact of re-introducing livestock, specifically goats, to restored spekboom landscapes.
- Questions addressed:
 - What is the impact of browsing on the production and carbon-stocks of restored spekboom landscapes?
 - What is the effect of defoliation at plant level?
 - What are farmer's perspectives and views on whether and how restored spekboom can be utilised?
 - Can livestock production and carbon-farming take place simultaneously on restored spekboom landscapes or not?



Photo: A Mills

....contribute
to conceptual
model of the
Carbon
budget of
spekboom

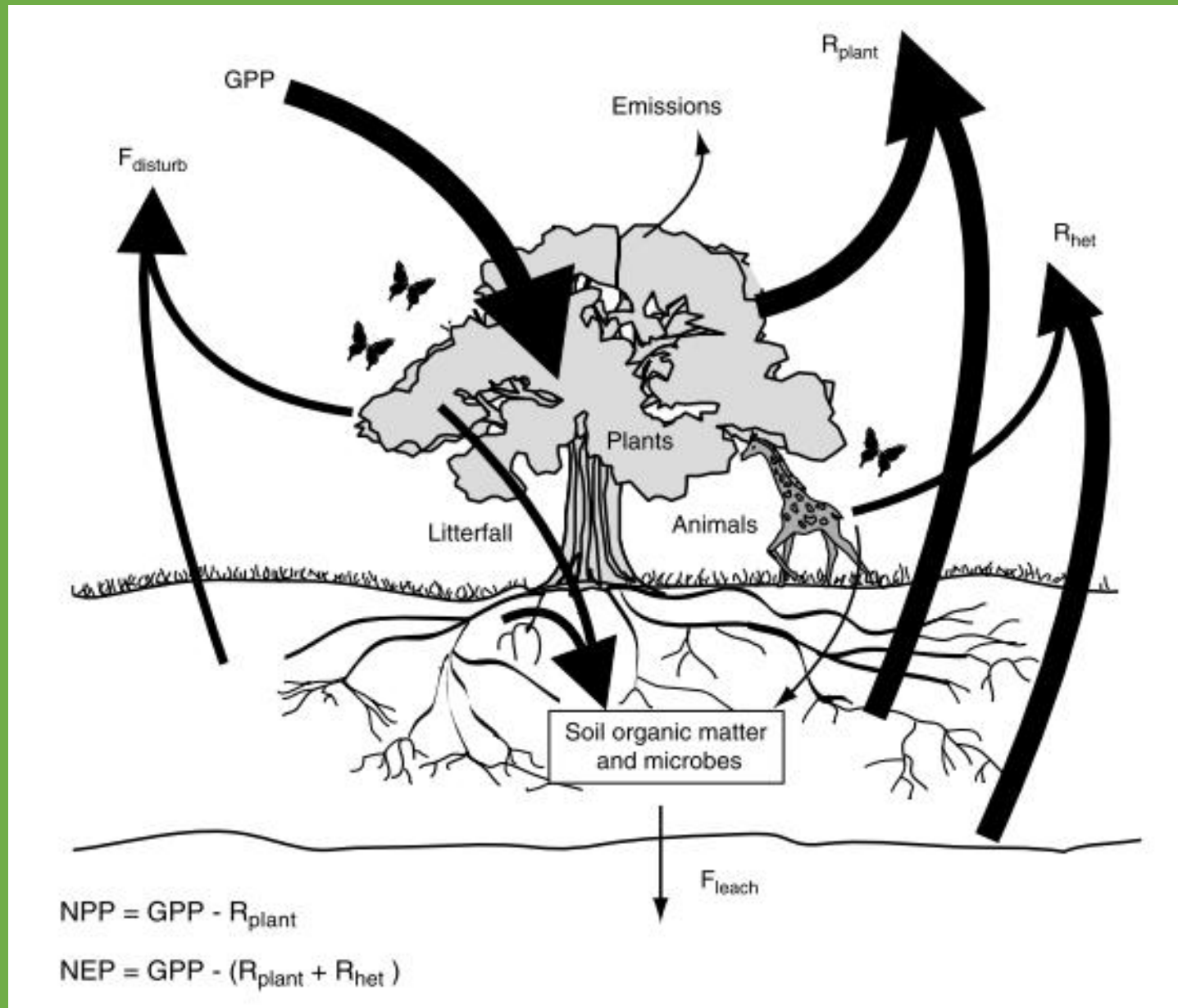
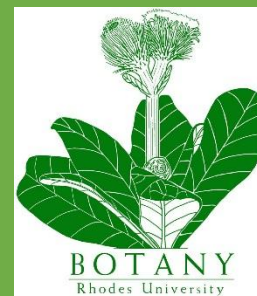


Illustration of the major carbon fluxes of an ecosystem
(Figure from Chapin et al, 2011)

Acknowledgements

- Funding from the Eastern Cape Restoration Project via DEA's Working for Natural Resources Programme
- Funding from the Global Change Grand Challenge Grant via the NRF
- Dr Susi Vetter, PhD Supervisor
- Prof Richard Cowling, Prof Amie Aucamp, Dr Brad Ripley, Kathleen Smart, Martin van der Vyfer



THANK YOU



References

- **Aucamp, A.J., Howe, G.L, Smith, D.W.W.Q. and Grunow, J.O. (1980)** 'Die invloed van ontblaring op *Portulacaria afra*', Proceedings of the Annual Congresses of the Grassland Society of Southern Africa, vol 15(1), pp179-183
- **Clarke, C.L., Shackleton, S.E. and Powell, M. (2012)** 'Climate change perceptions, drought responses and views on carbon farming amongst commercial livestock and game farmers in the semiarid Great Fish River Valley, Eastern Cape province, South Africa', *African Journal of Range and Forage Science*, vol 29(1), pp13-23
- **Critchley, W. and Matunga, K. (2003)** 'Local innovation in a global context: Documenting farmer initiatives in land husbandry through WOCAT', *Land Degradation & Development*, vol 14, pp143-163
- **Department of Agriculture, Forestry and Fisheries. (2011)** 'A profile of the South African goat market value chain', Report, pp1-37
- **Giller, K., Witter, E., Corbeels, M. and Tittonell, P. (2009)** 'Conservation agriculture and smallholder farming in Africa: The heretics' view', *Field Crops Research*, vol 114, pp23-34
- **Tiffen, M. (1996)** 'Land & capital: Blind spots in the study of the "resource-poor" farmer', in M. Leach and R. Mearns (eds) *The Lie of the Land: Challenging Received Wisdom on the African environment*, The International Institute/James Currey Ltd., Oxford/London, UK, pp168-185
- **van der Vyver, M. L., Cowling, R. M., Mills, A.J. and Difford, M. (2013)** 'Spontaneous return of biodiversity in restored subtropical thicket: *Portulacaria afra* as an ecosystem engineer', *Restoration Ecology*, doi: 10.1111/rec.12000