

# Isotopic signatures across stable and unstable vegetation boundaries in Hluhluwe-iMfolozi Park, South Africa



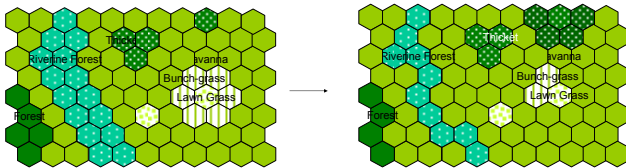
**Lindsey Gillson,**  
Plant Conservation Unit, Botany Department  
University of Cape Town,  
South Africa  
[Lindsey.Gillson@uct.ac.za](mailto:Lindsey.Gillson@uct.ac.za)

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## Background and Rationale

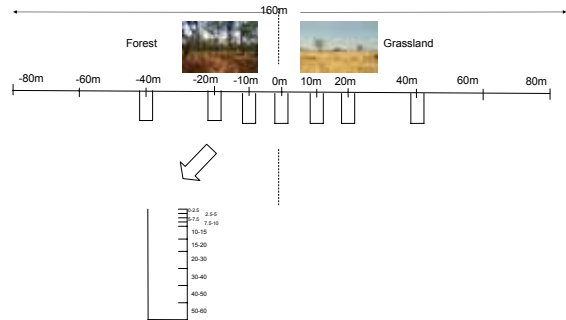
- The savannas of Hluhluwe-iMfolozi Park in Kwa Zulu Natal are Mosaic of  $C_3$  and  $C_4$  dominated components: grassland, savanna, thicket and forest components.
- The boundaries between these components represent
  - steep gradients in physical environmental variables
  - and / or threshold responses to gradual variables.
- In recent decades, there has been an increase in woody vegetation in some grassland and savanna areas, while other vegetation boundaries have remained stable.



- In general,  $C_3$  plants are becoming more dominant at the expense of  $C_4$  plants.
- Possible drivers include changes in fire, herbivory, CO<sub>2</sub> fertilisation. But the role of nitrogen is not known. In this project, I explore nitrogen and carbon ecology across stable and unstable boundaries using stable isotope analysis.

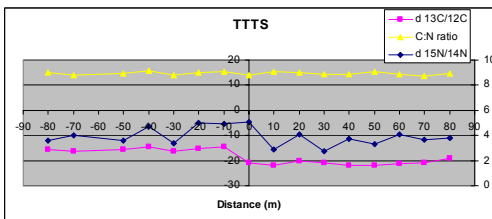
## Sample Design and Methods

- Soil samples were collected for isotopic analysis along transects crossing stable and unstable boundaries (spatial profile)
- At 0, 10m, 20m and 40m from the boundary, soils were also sampled in a vertical soil pit (temporal profile).
- $\delta^{13}C$  and  $\delta^{15}N$  were measured using standard mass spectrometry methods

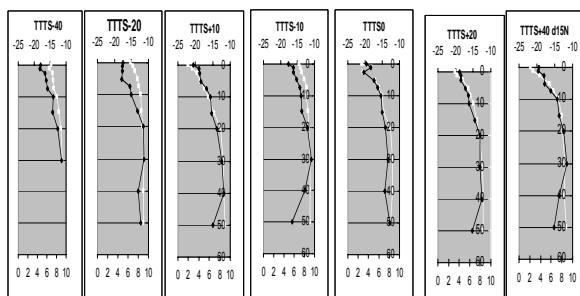


## Results 1: TTTS an unstable boundary where thicket is expanding into savanna

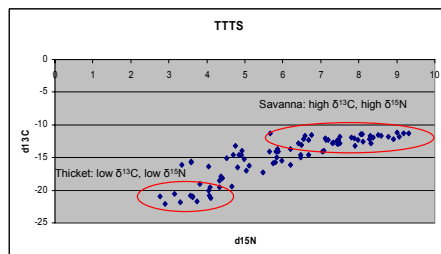
- $\delta^{13}C$  decreased with thicket expansion
- Conversion of savanna to thicket was reflected in both the spatial and temporal  $\delta^{13}C$  profiles
- $\delta^{15}N$  was higher in the savanna than in the thicket phase
- 3 Replicates showed the same pattern (replicates 2 and 3, data not shown)



Savanna ← Thicket

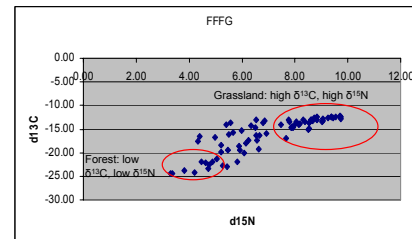
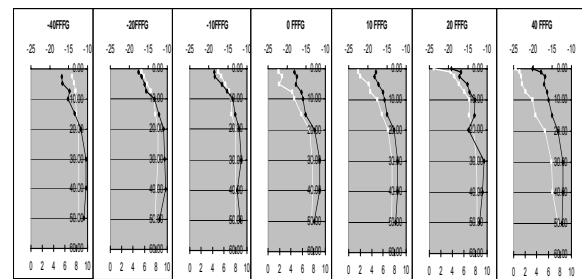


Savanna ← Thicket



## Results 2: FFFG TTTS an unstable boundary where thicket is expanding into savanna

- $\delta^{13}C$  decreased with forest expansion
- $\delta^{15}N$  was higher in the grassland than in the thicket phase



## Interpretation and Questions

- Savannas have higher  $\delta^{13}C$  and  $\delta^{15}N$  than thickets and savannas
- $\delta^{15}N$  decreases in savanna → thicket and savanna → forest transitions
- Is this cause or effect?
- What triggers the transitions?
- Do transitions in different vegetation units begin at the same time, suggesting regional drivers?
- Does the relationship hold across stable boundaries?
- Why was an opposite relation found in a grassland – savanna transition in KNP?

