Thresholds of Potential Concern as benchmarks for the management of African savannas

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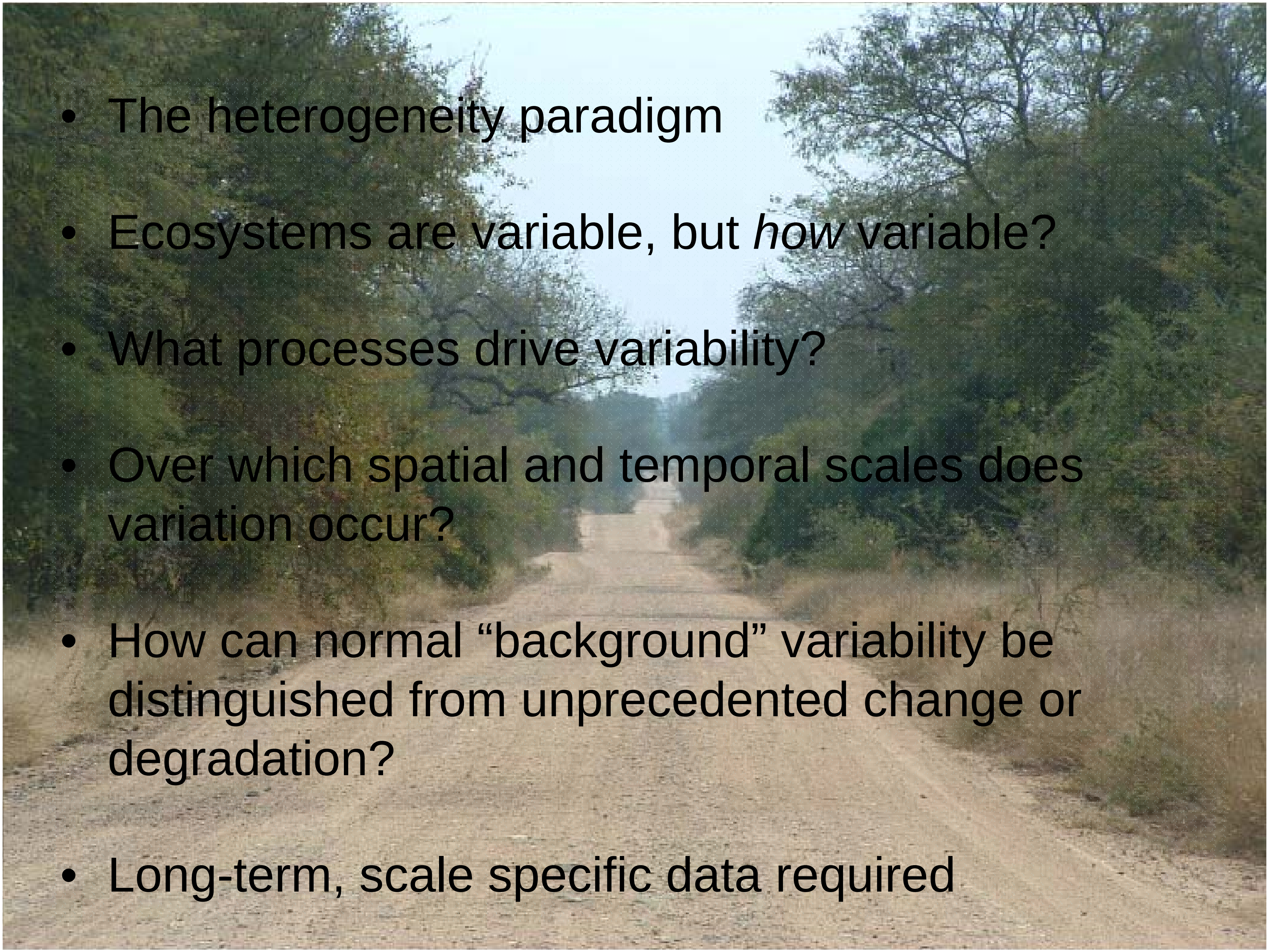
"Understanding the Future"

Using the past to understand the future:

- How can palaeoecology inform Thresholds of Potential Concern on woody vegetation cover?

- How has woody vegetation cover in the Kruger National Park changed over the last 5000 years?


• The heterogeneity paradigm
• Ecosystems are variable, but *how* variable?
• What processes drive variability?
• Over which spatial and temporal scales does variation occur?
• How can normal “background” variability be distinguished from unprecedented change or degradation?
• Long-term, scale specific data required

Thesholds of Potential Concern

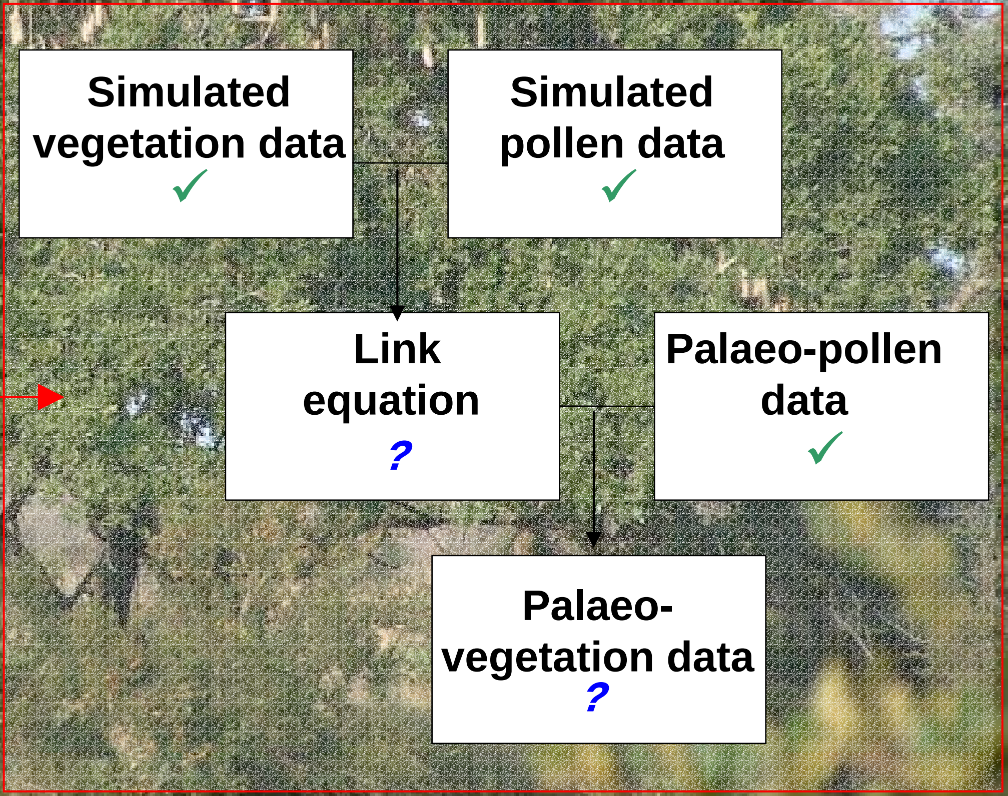
TPCs as monitoring endpoints to guide management decisions

Woody cover should not drop by more than 80% of its highest ever value

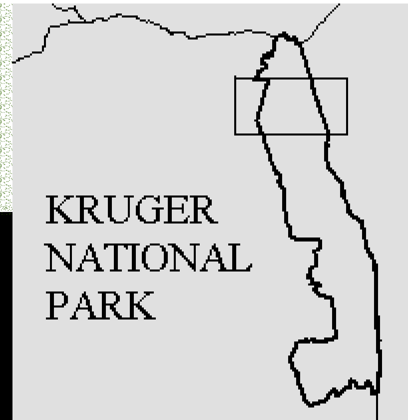
Methodology

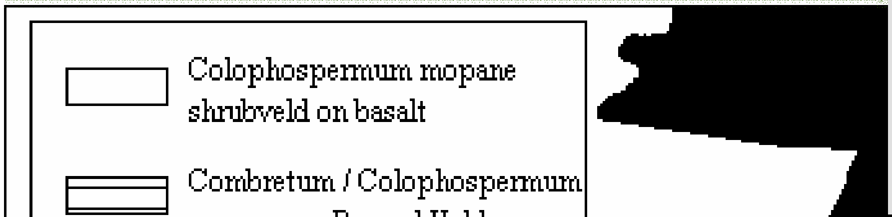
Long-term data: fossil pollen analysis and translation to long-term vegetation change in the KNP

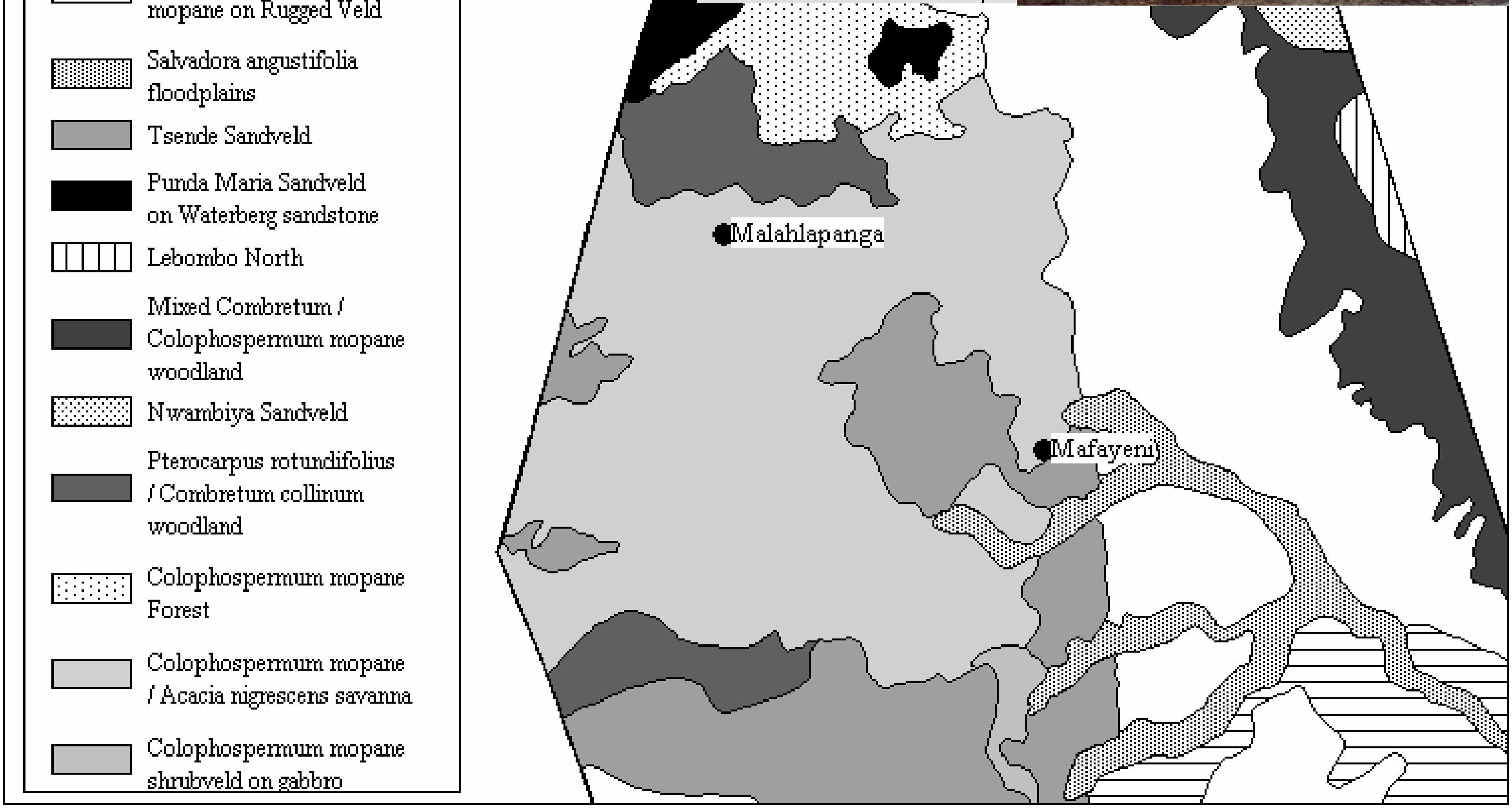
1. Changes in fossil pollen over time
2. Investigating the pollen-vegetation relationship
3. Changes in vegetation over time



2 sediment cores collected from pans in the north of the Kruger National Park







Methodology: Pollen sampling and analysis

Sediment core collection

Core subsampling and pollen extraction

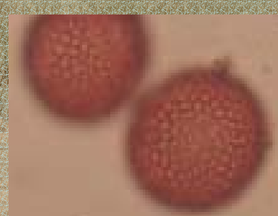
Pollen identification and counting

Sediment ^{14}C dating

Acacia xanthophloea

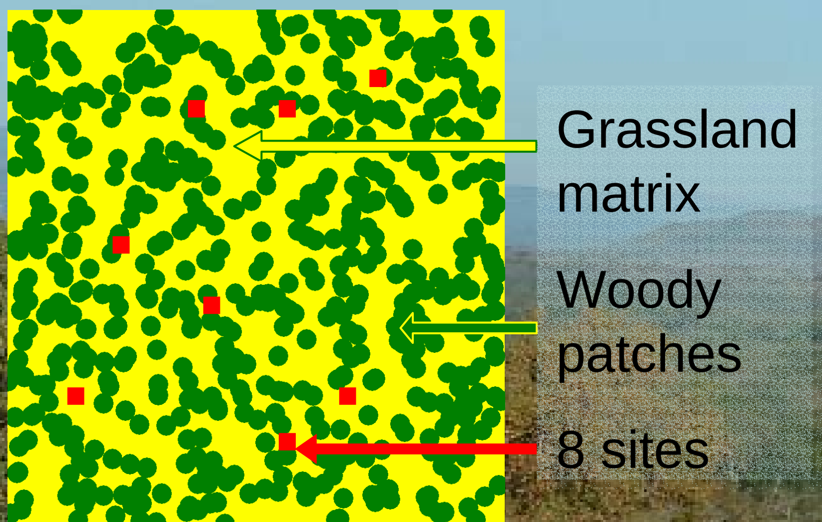
Lannea schweinfurthii

Combretum apiculatum



Colophospermum mopane

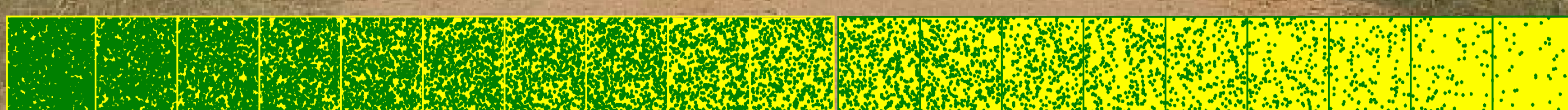
Methodology: Landscape scenarios



- 19 simple landscape scenarios with varying degrees of woody cover
- 10 maps of each landscape
- Community and taxon definition
- 8 sites per landscape, randomly located
- 1520 pollen loading simulations

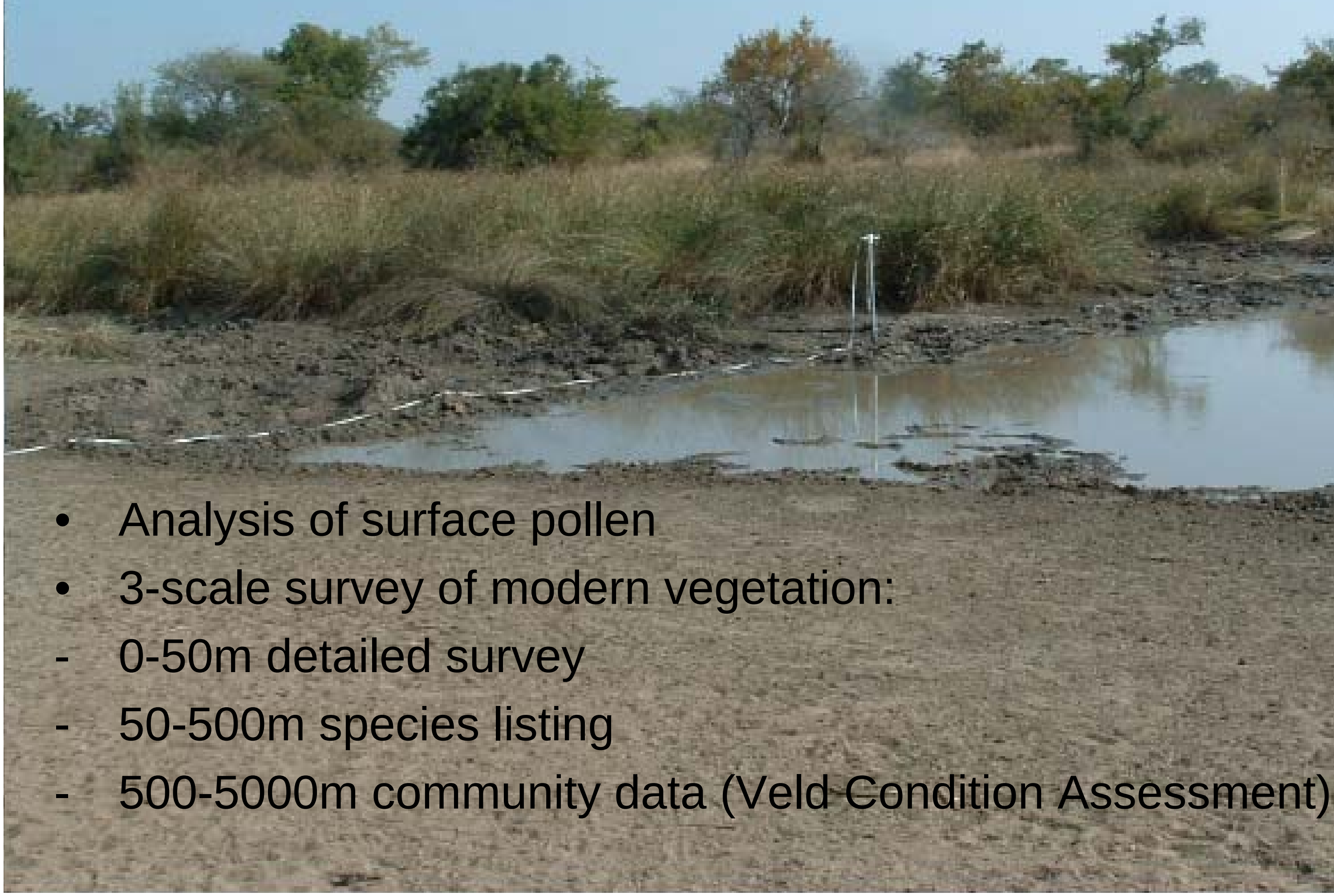
Properties: Pollen productivity (0.75 arboreal, 2.03 non-arboreal)

Pollen fall speed (0.019 arboreal, 0.041 non-arboreal)



Methodology: Pollen productivity and fall speed

Duffin and Bunting: Relative pollen productivity and fall speed estimates for southern African savanna taxa <u>Vegetation History and Archaeobotany</u> (submitted)

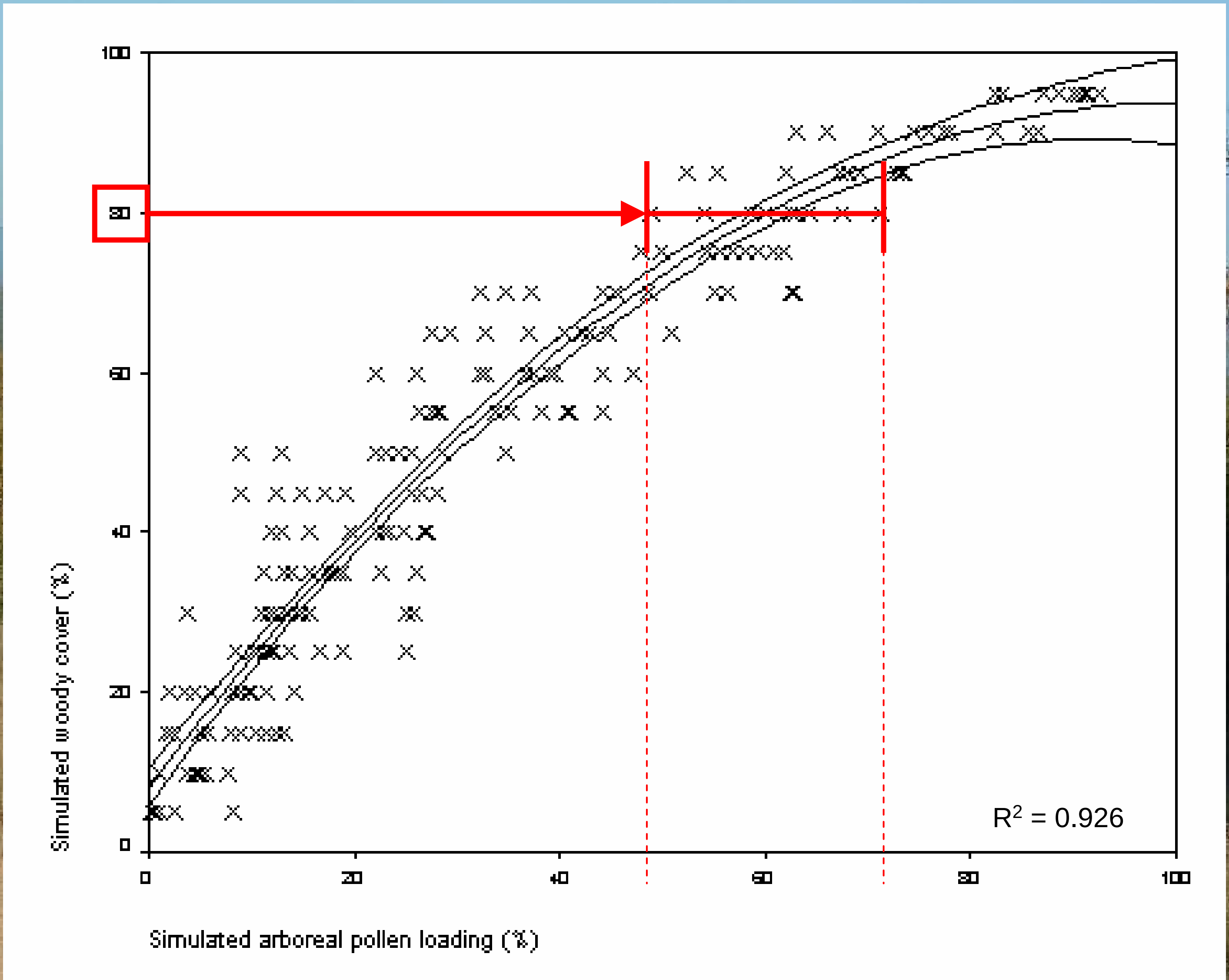


- Analysis of surface pollen
- 3-scale survey of modern vegetation:
- 0-50m detailed survey
- 50-500m species listing
- 500-5000m community data (Veld Condition Assessment)

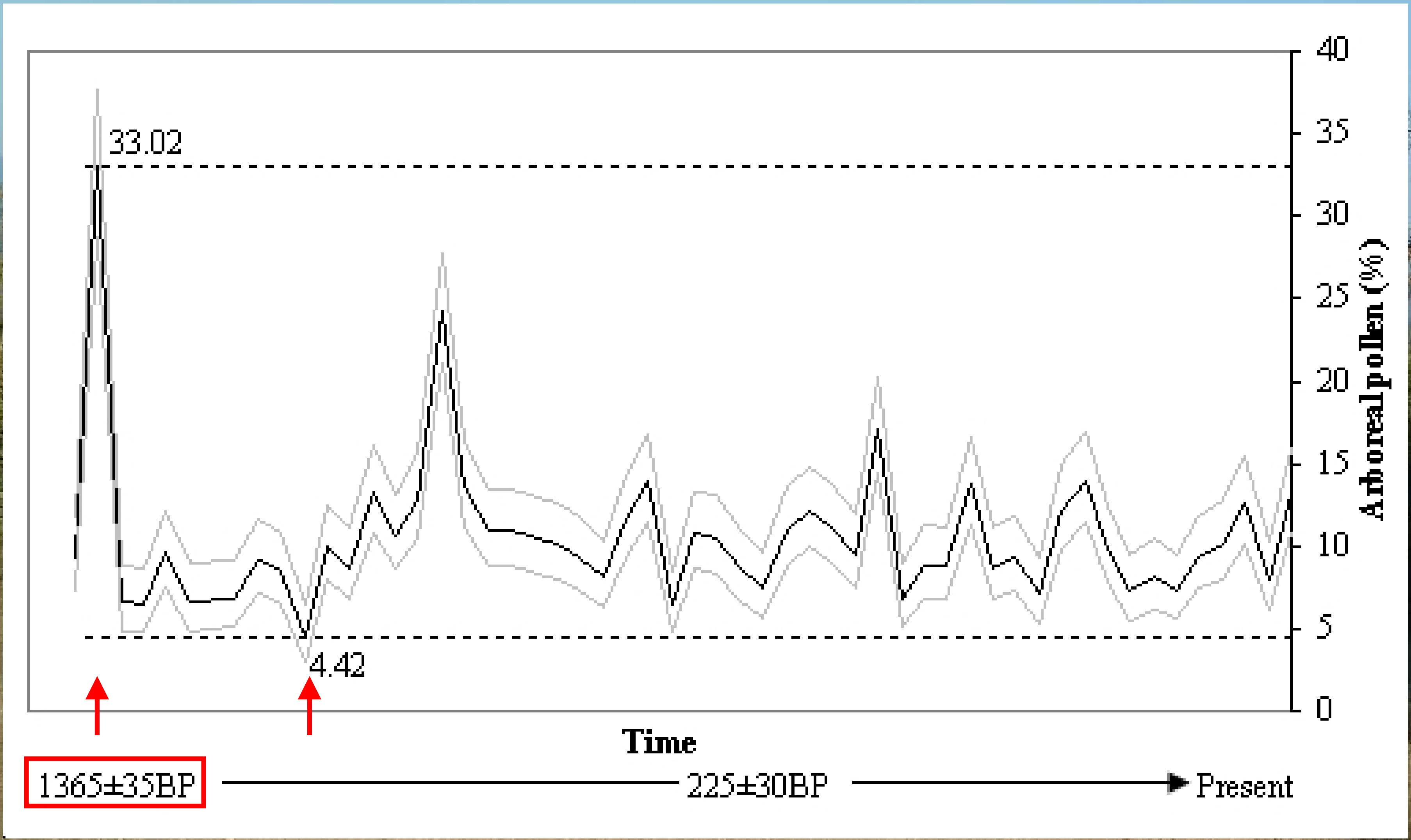
Results: the pollen-vegetation relationship

Quadratic equation:

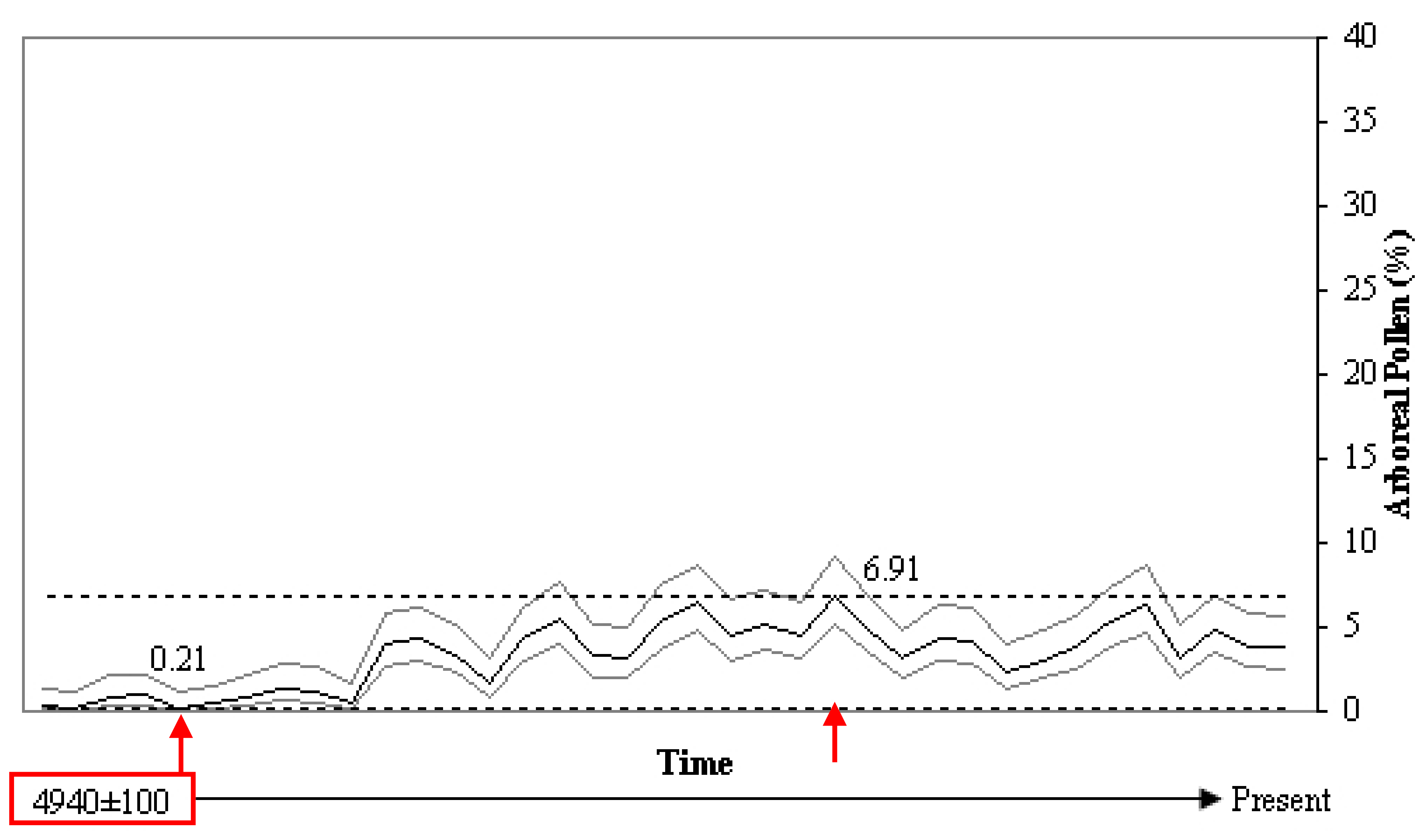
$y = -0.0085x^2 + 1.7048x + 8.1163$



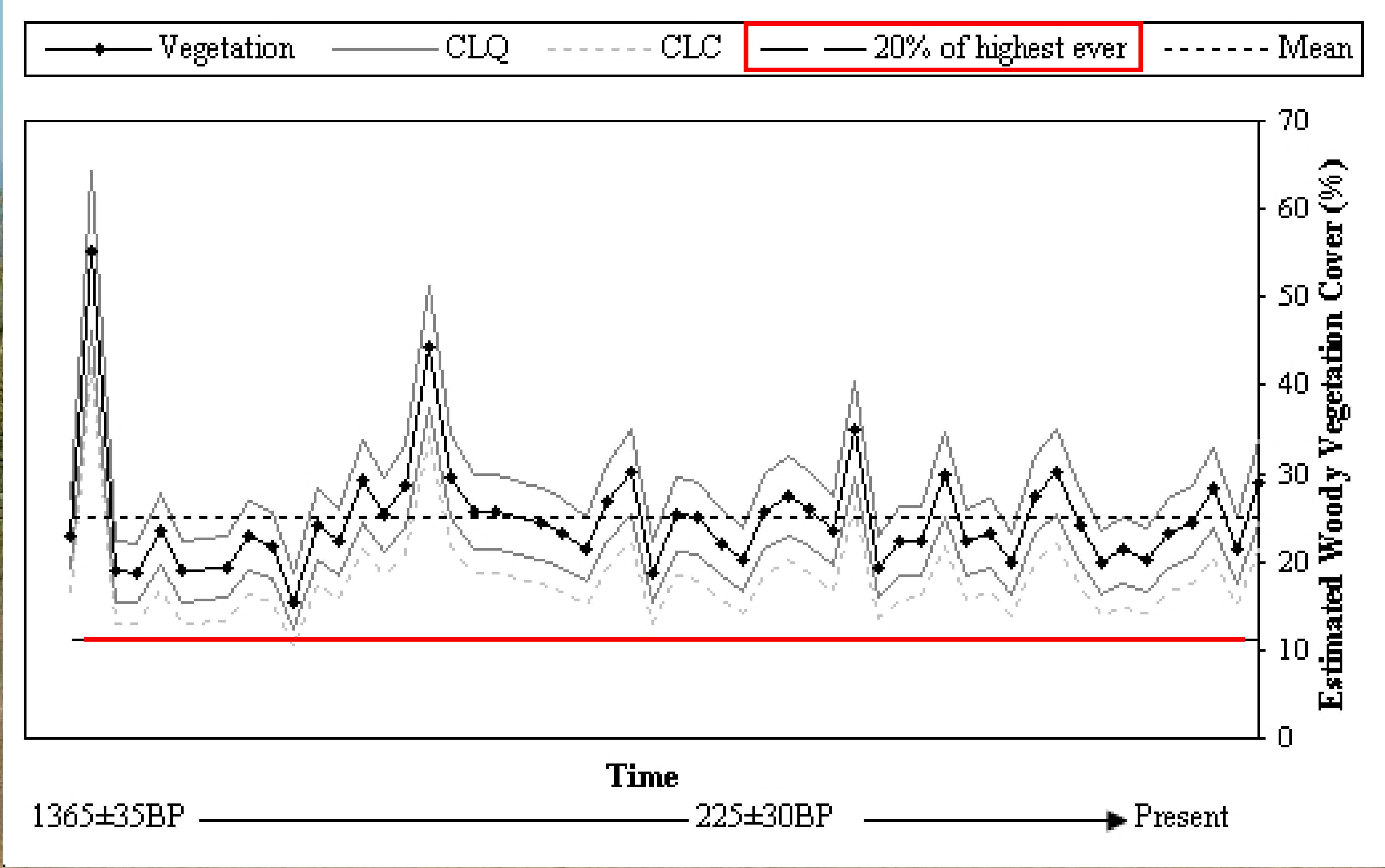
Results: Fossil pollen from Mafayeni



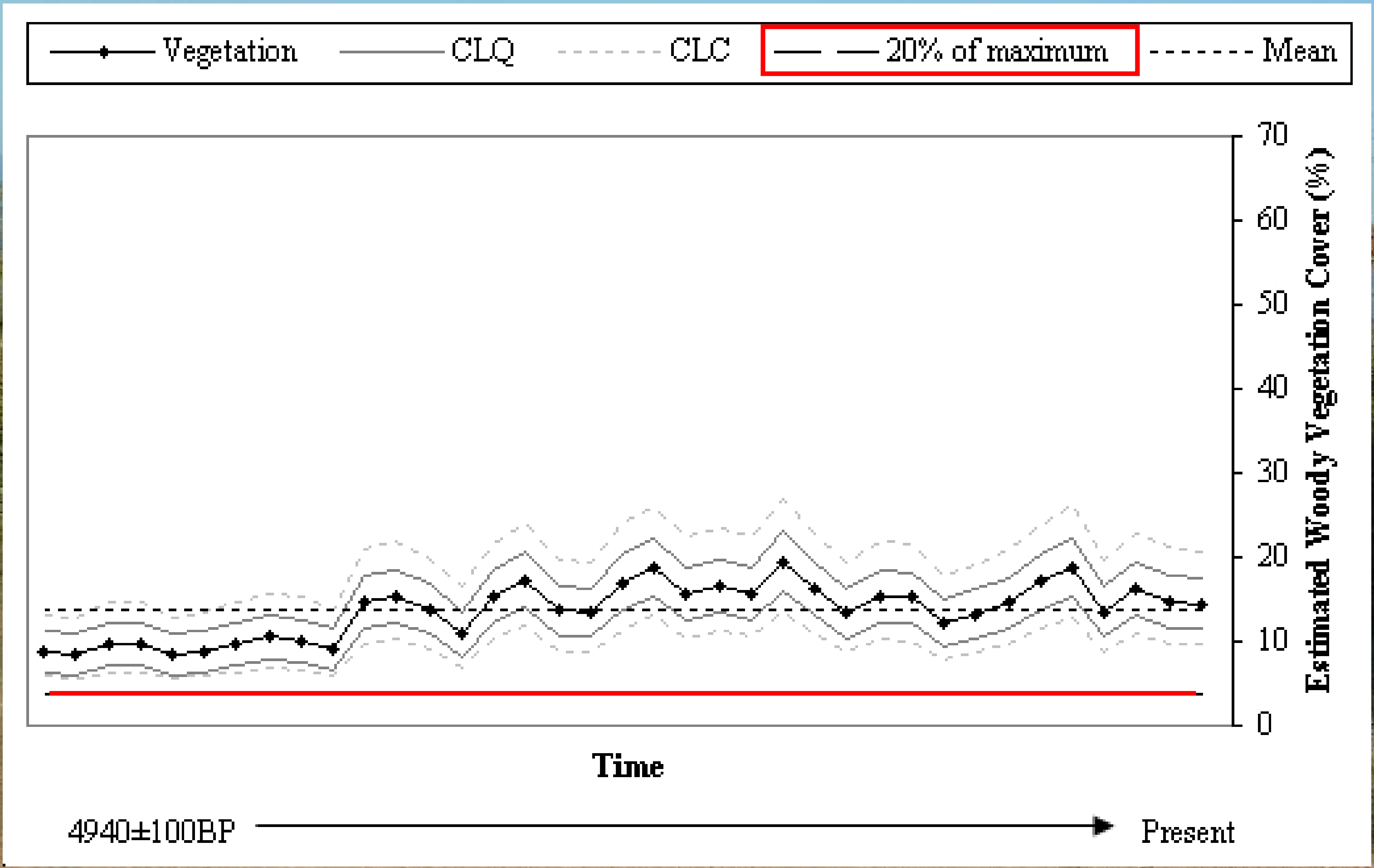
Results: Fossil pollen from Malahlapanga



Results: estimated woody cover at Mafayeni



Results: Estimated woody cover at Malahlapanga



Conclusions and Implications for Management (I)

- Fossil pollen often interpreted qualitatively, but here we have produced quantitative estimates of woody vegetation cover over time
- The methodology here can be applied to new palaeo-datasets from KNP as they emerge
- Mafayeni: mean woody cover = 25%
maximum woody cover = 55% (42-71%)
- Malahlapanga: mean woody cover = 13%
maximum woody cover = 19% (13-27%)

Conclusions and Implications for Management (II)

- Our pollen data shows no evidence of the TPC being exceeded
- Difference in maximum estimates highlights importance of site-specific TPCs
- Using “highest ever” is problematic as a benchmark for guiding management
- TPC based on derivation from the mean might provide a more useful guide to monitoring changes in woody cover
- However, a TPC of this type might preclude extreme peaks and troughs in woody vegetation cover, and thus potentially reduce the temporal heterogeneity of the ecosystem

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