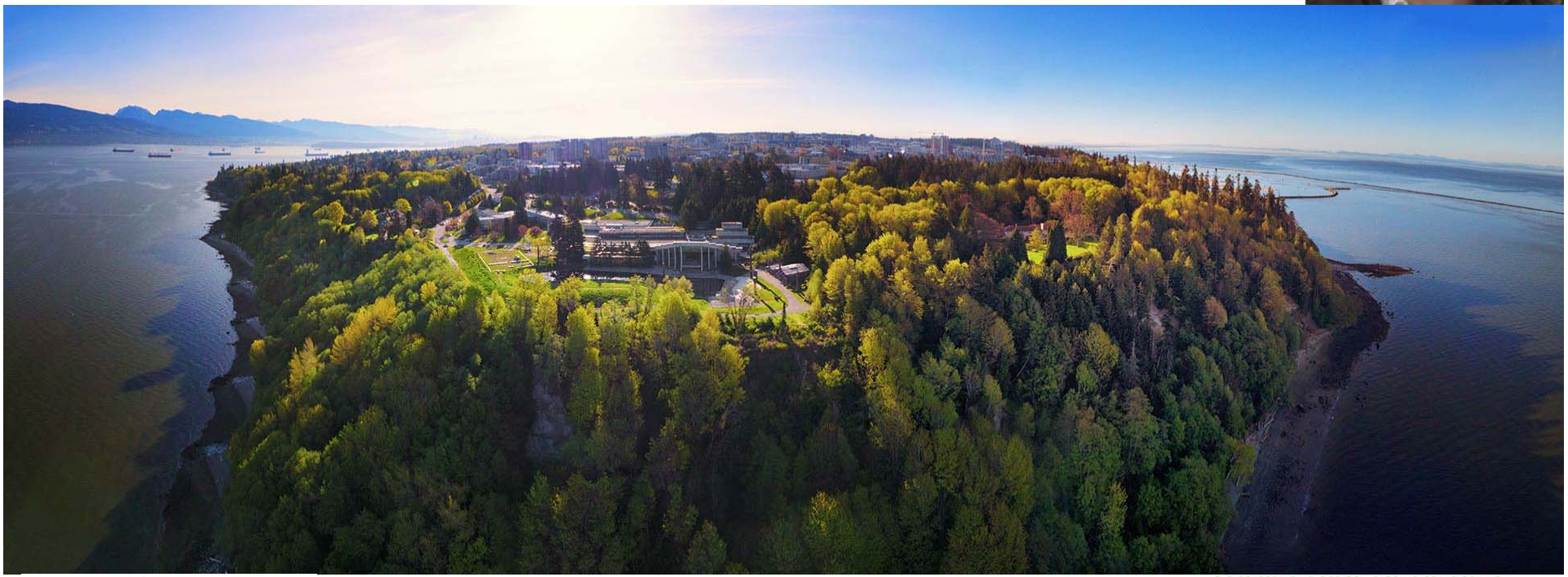
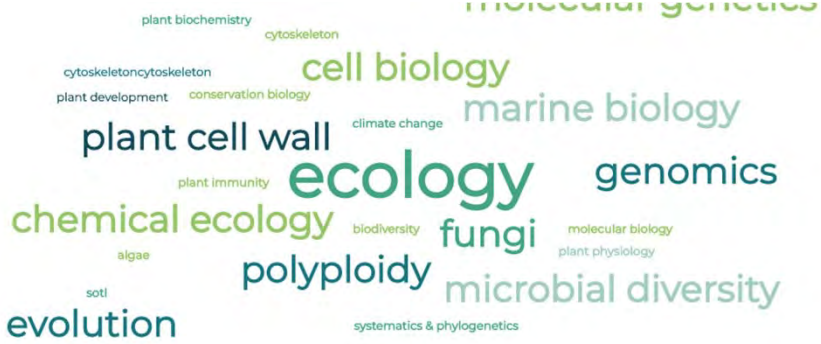
THE UNIVERSITY OF BRITISH COLUMBIA

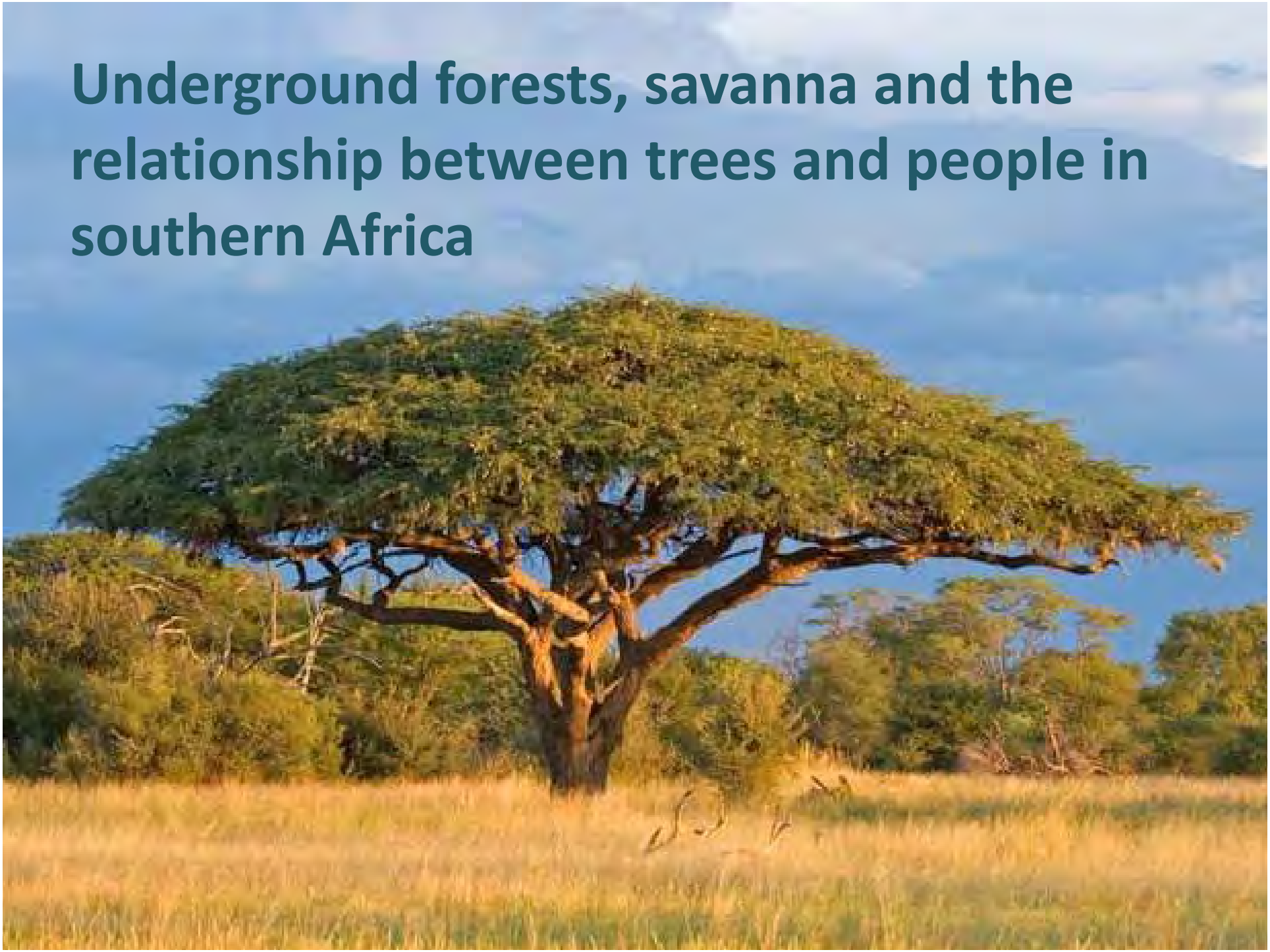
Jonathan Davies



Faculty of Science
Department of Botany

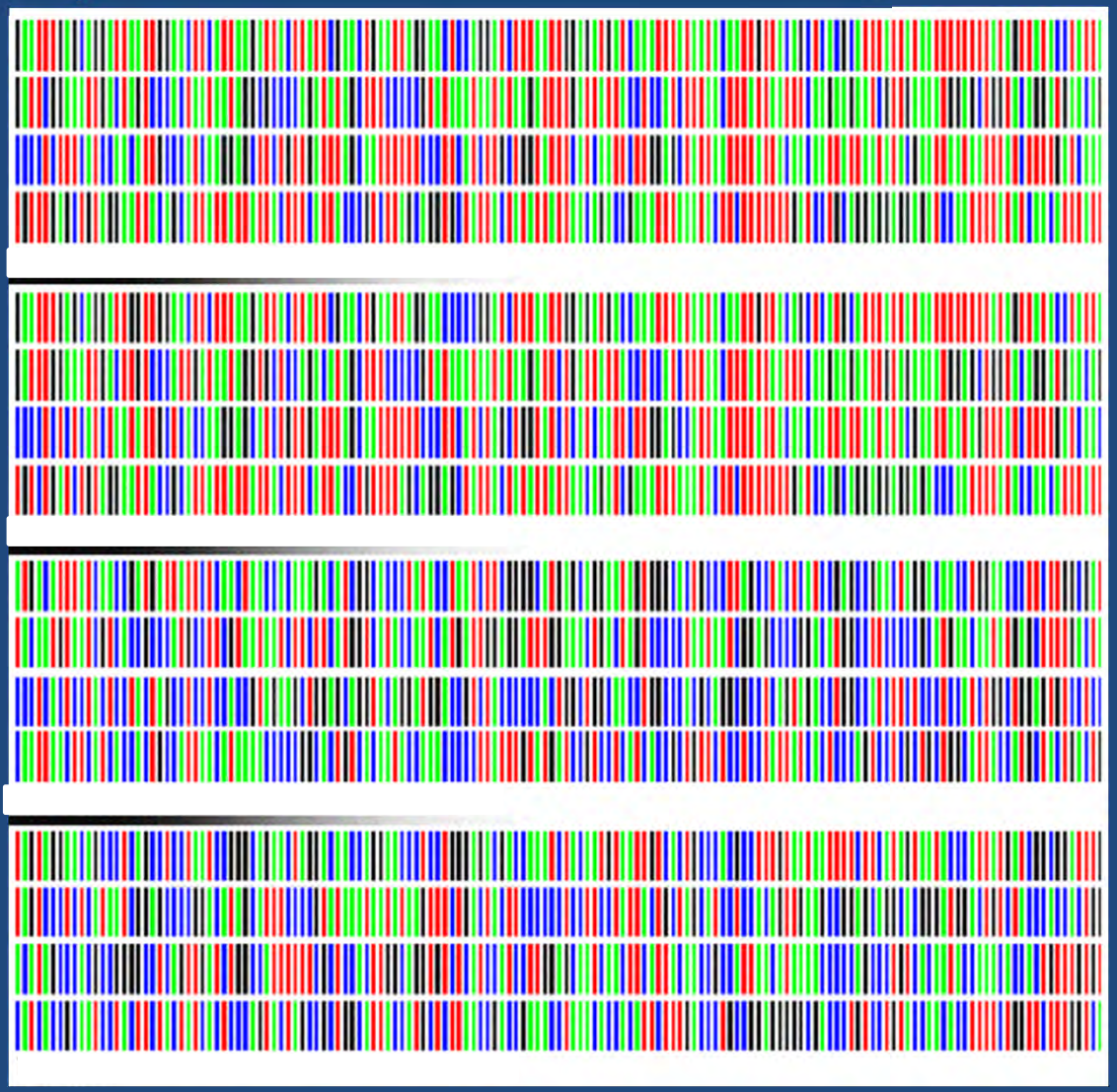


Underground forests, savanna and the relationship between trees and people in southern Africa



DNA barcoding the Trees of Africa

AFRICAN CENTRE FOR DNA BARCODING



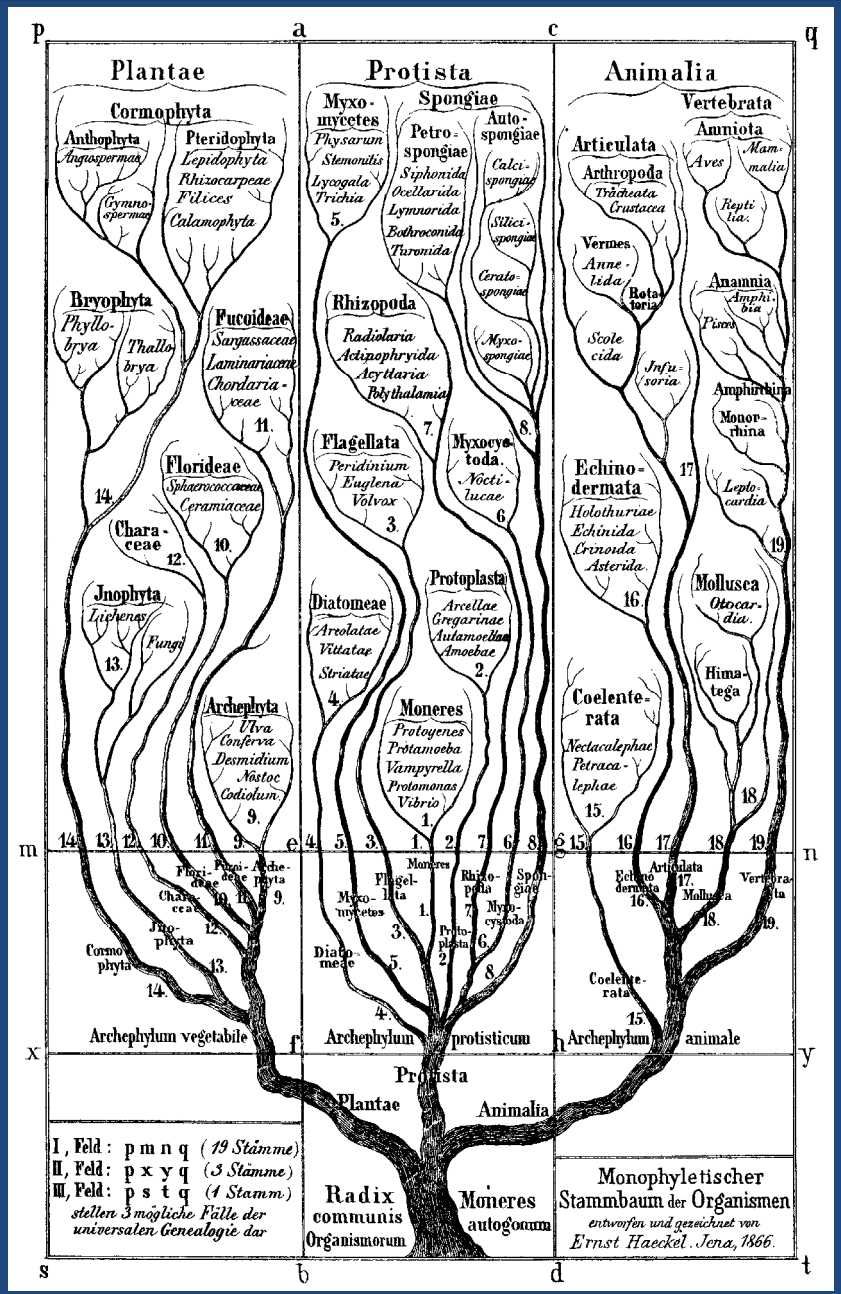
DNA barcoding the Trees of Africa

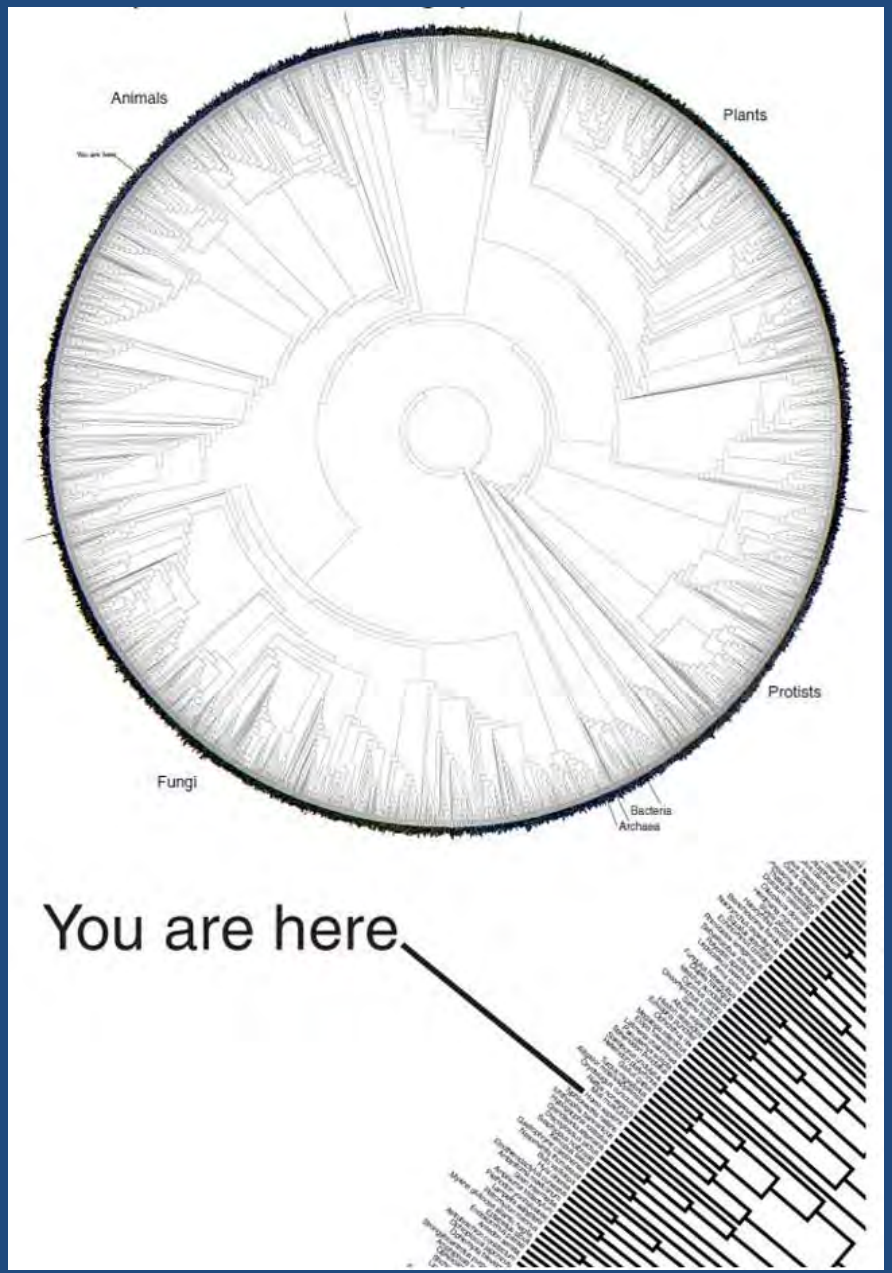
1. Woody plants, minimum height of 2 m
2. Permanent trunk
3. Habits: tree, shrub, palm, cycad, tree fern, bamboo, arborescent succulent, climber



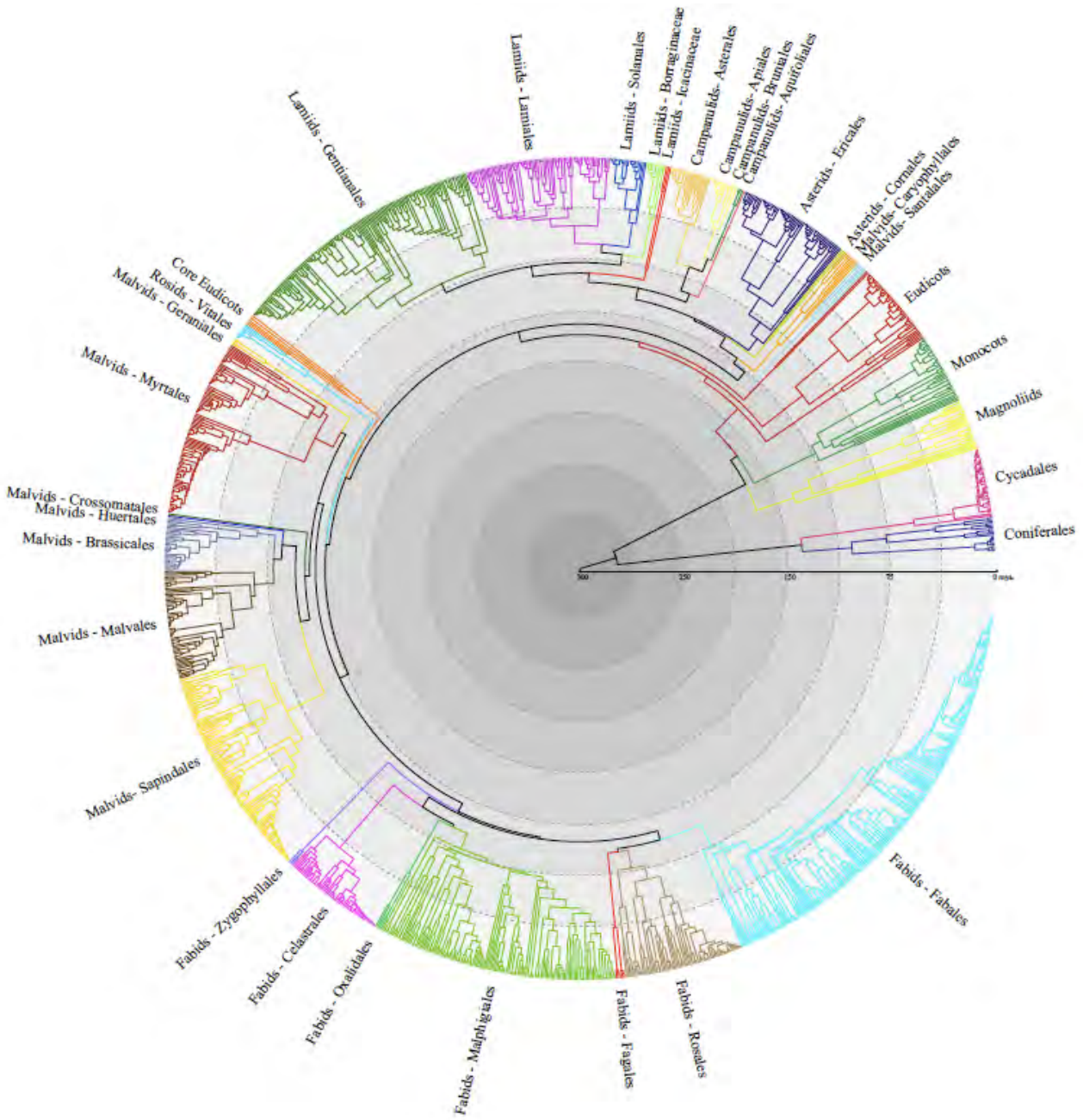



DNA barcoding the Trees of Africa



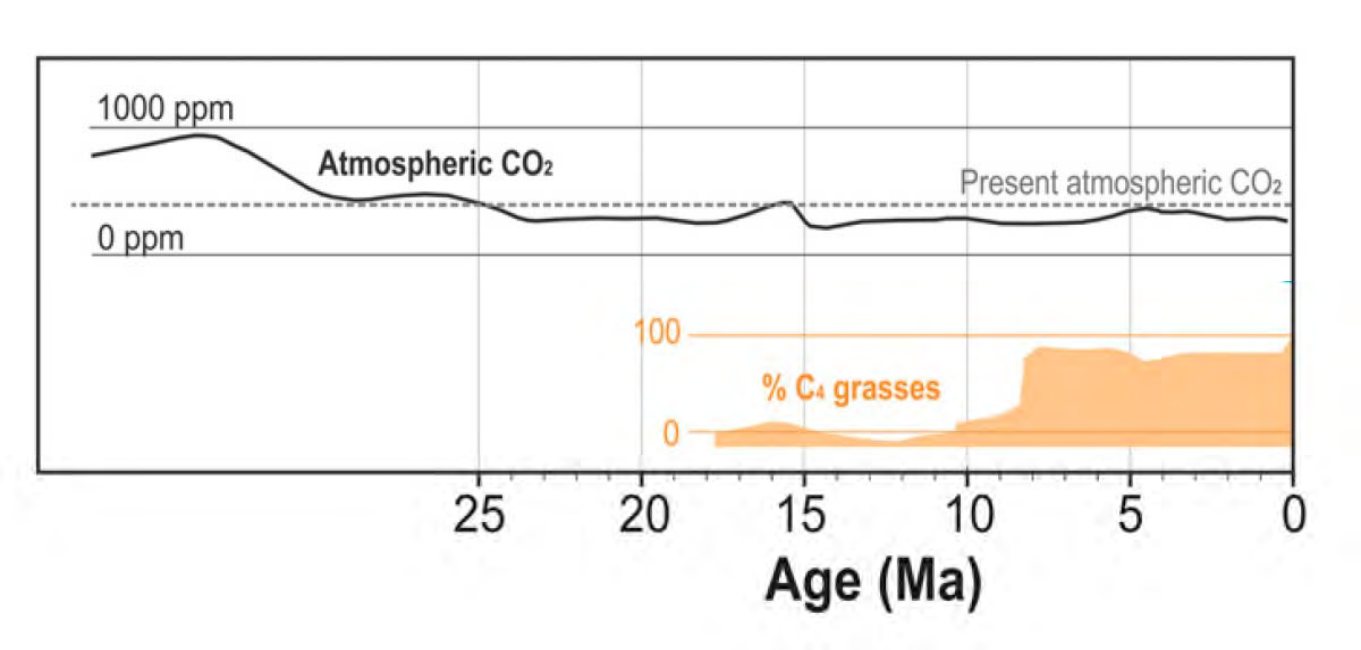


DNA barcoding the Trees of Africa



African savanna

Origins of savanna



Climate the usual explanation for changing vegetation – but does not match to time of savanna spread.

African savanna

Pushing back the forest

‘underground trees’

Geoxylic growth form evolved in response to frequent fires and high precipitation. As such, geoxyles may be markers of fire-maintained savannas

Underground forests

AFRICAN CENTRE FOR DNA BARCODING

Cussonia arborea

south-central Africa

Cussonia corbisieri

Zambia-DRC

Elephantorrhiza goetzei

south-central Africa

Elephantorrhiza elephantina

southern Africa

Erythrina abyssinica

south-central Africa

Erythrina acanthocarpa

Eastern Cape

Gardenia ternifolia

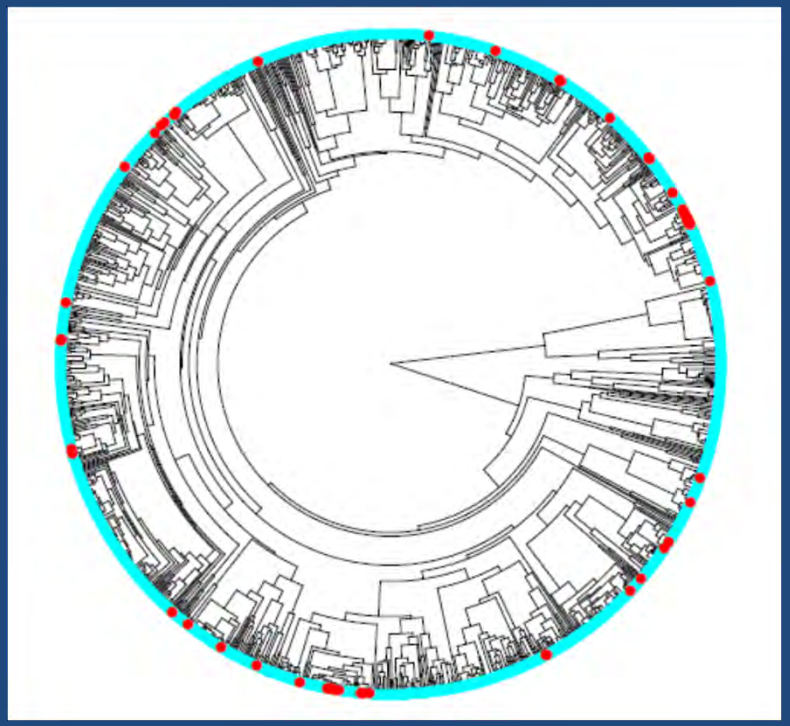
southern Africa

Gardenia subacaulis

Zambia-DRC

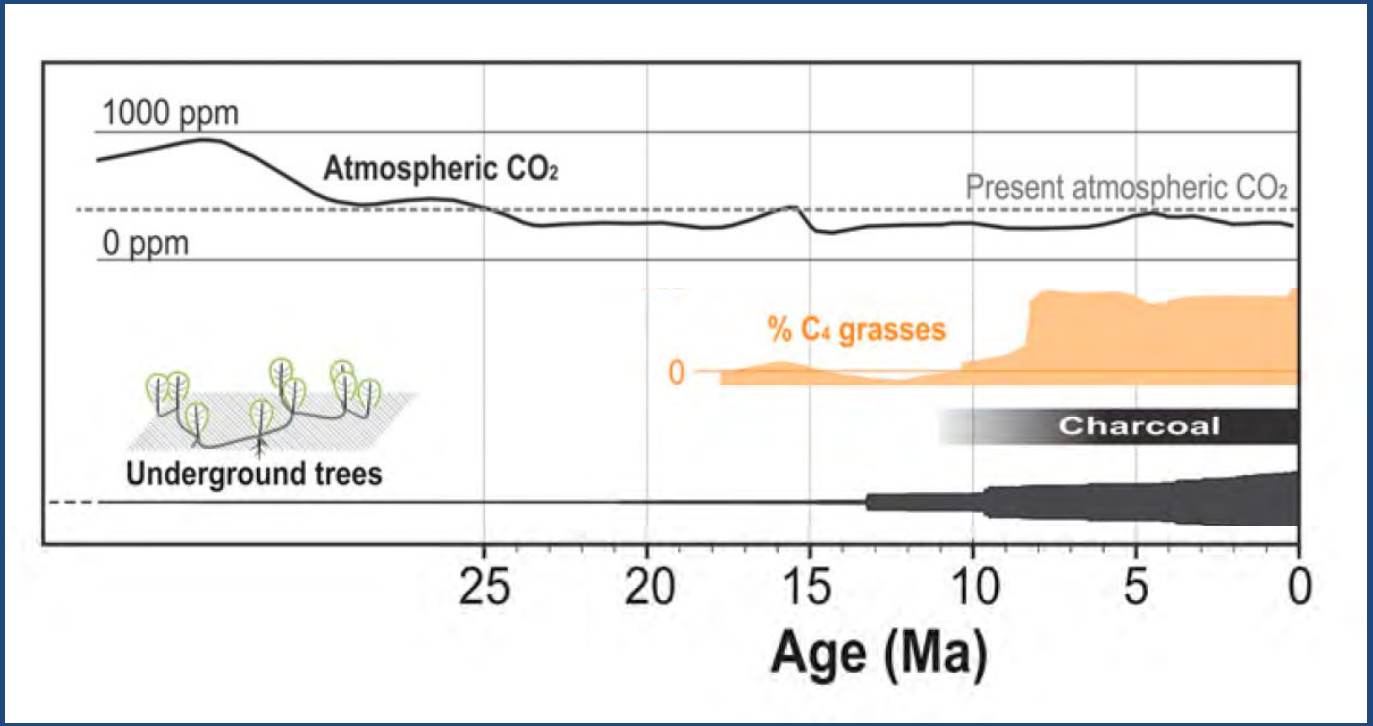
Underground forests

Pushing back the forest



‘underground trees’ geoxyles as markers of fire-maintained savannas

Underground forests

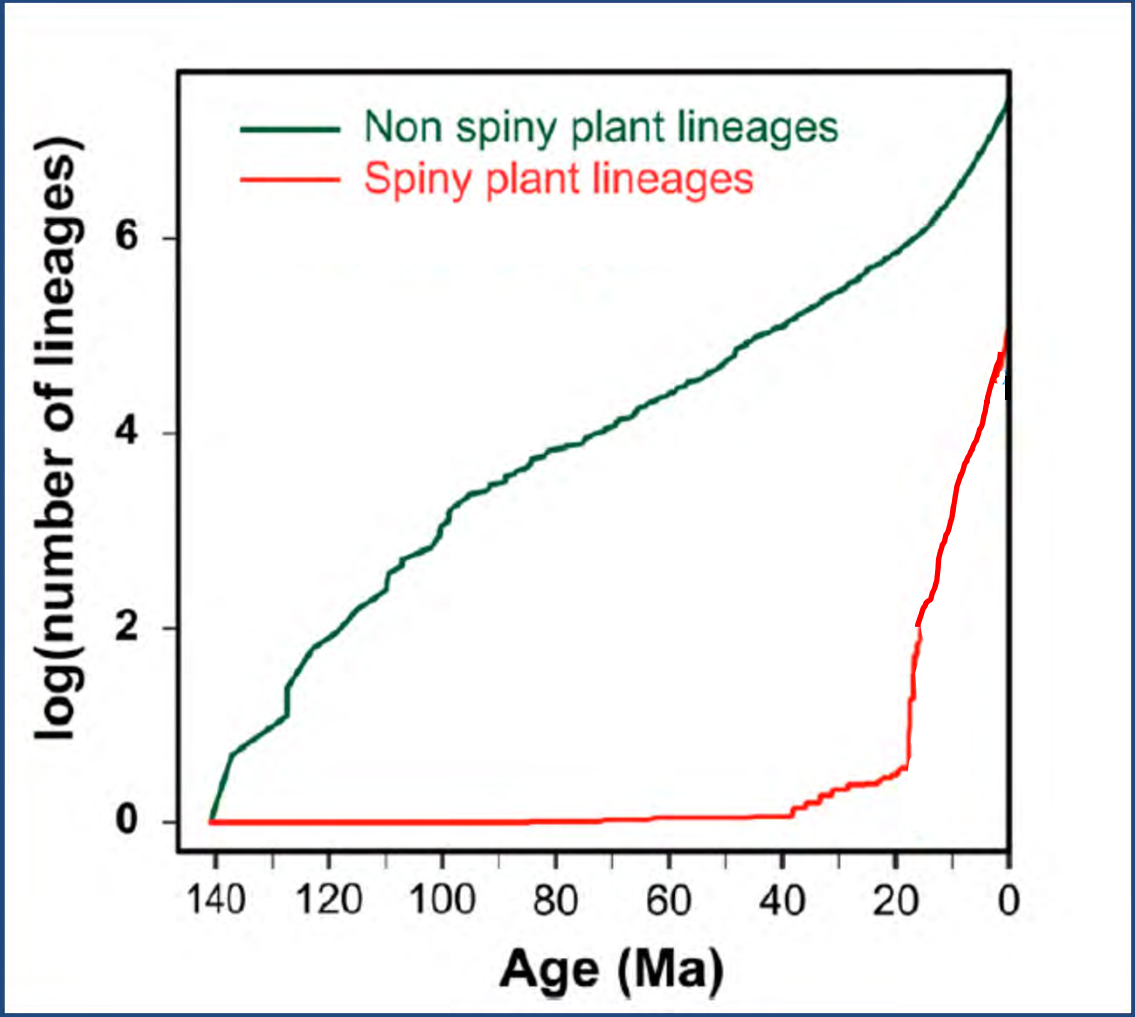


'underground trees' geoxyles as markers of fire-maintained savannas – evolved around 2-10 million years ago

African savanna

Pushing back the forest

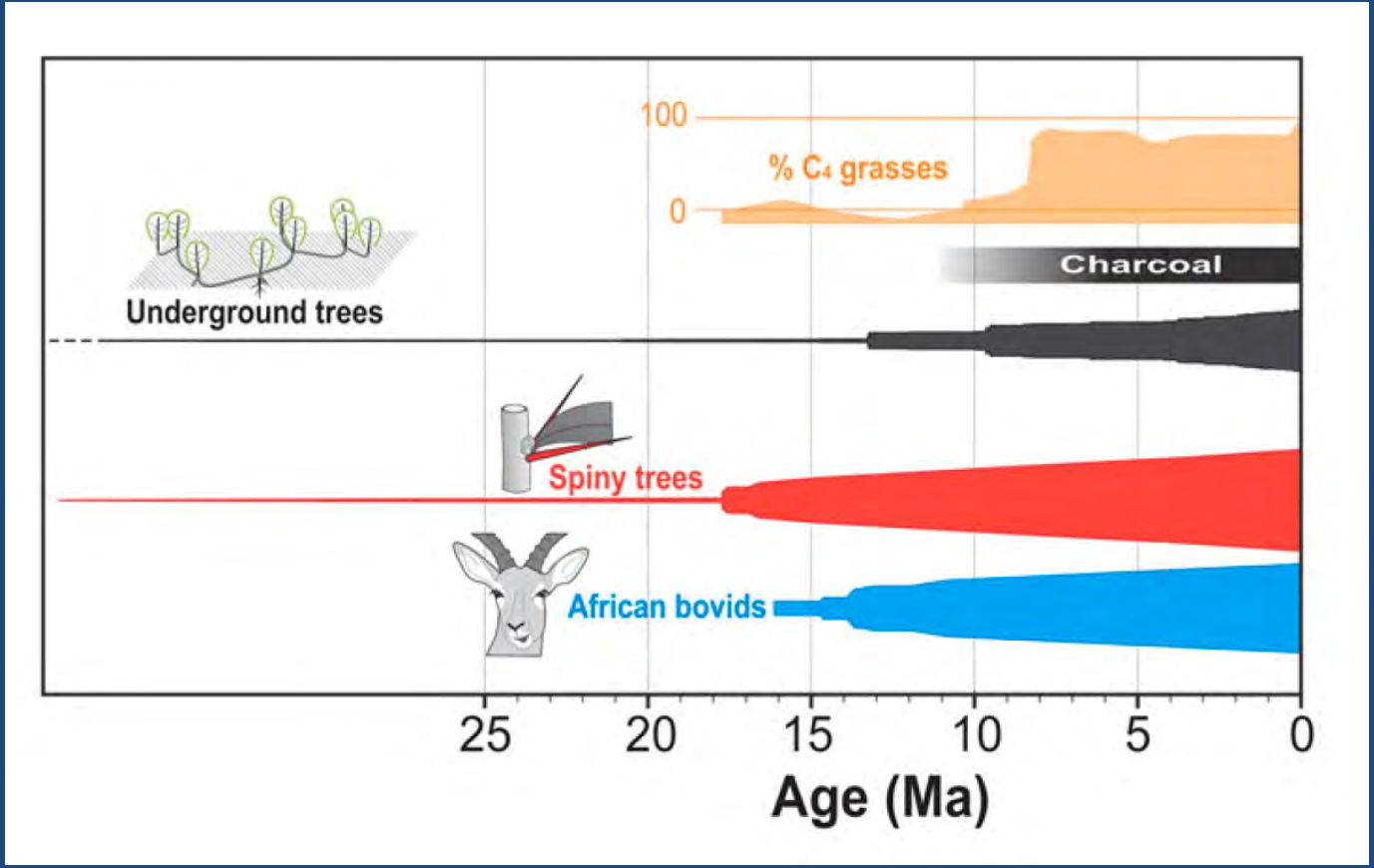
African savanna



Number of spiny plants started increasing 10-20 million years ago

Charles-Dominique, Davies et al. 2016

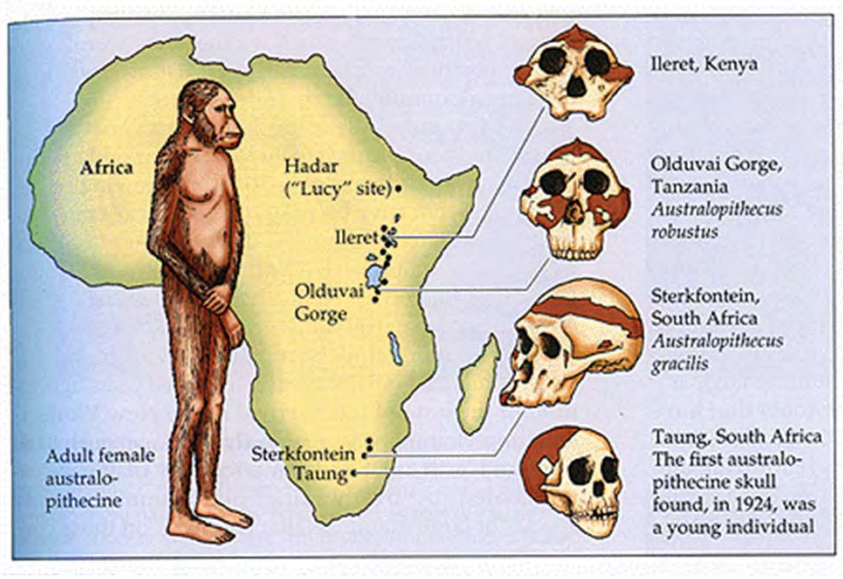
African savanna



herbivore-adapted savannas evolved several million years before fire-maintained savannas, and probably in different environmental conditions.

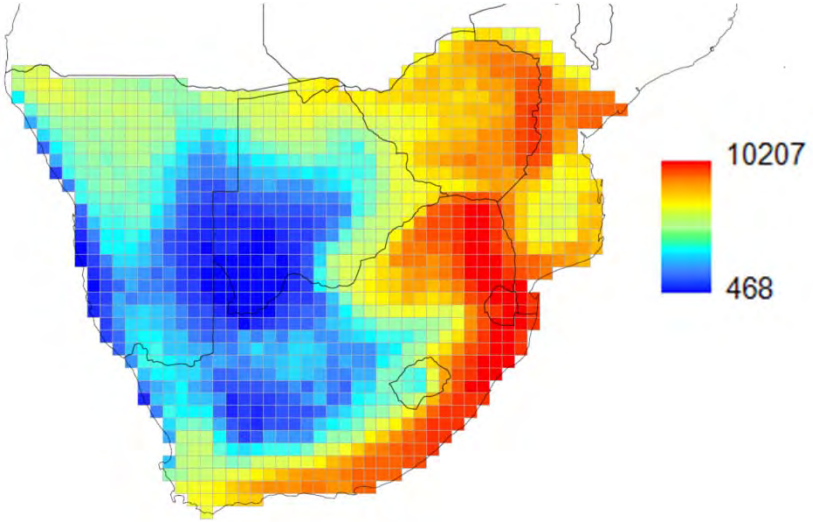
Trees and people

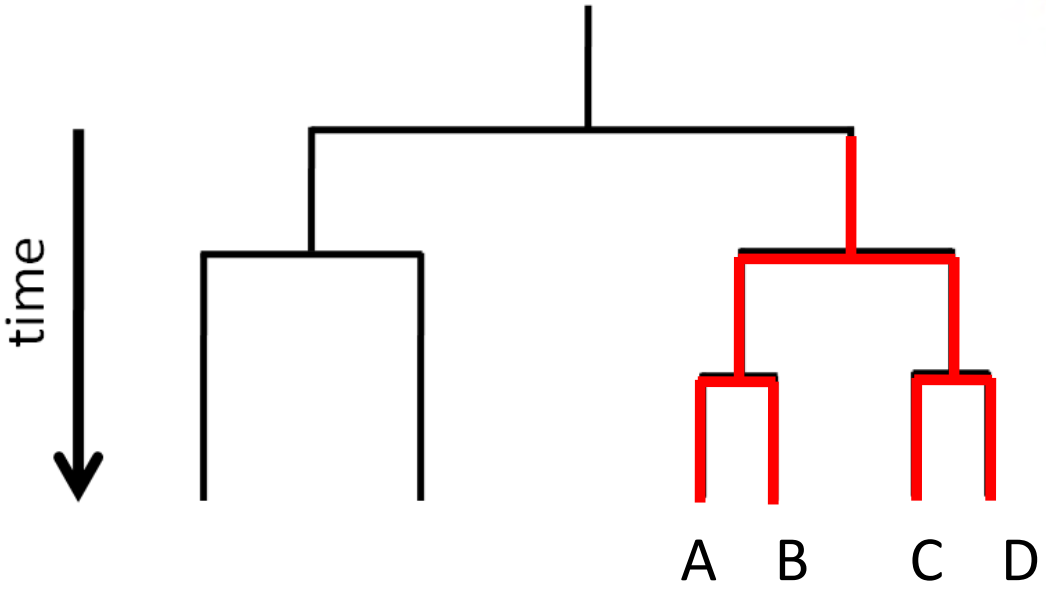
Our results suggest that savannas first appeared in the tropics and extended more recently to lower latitudes.



Trees and people

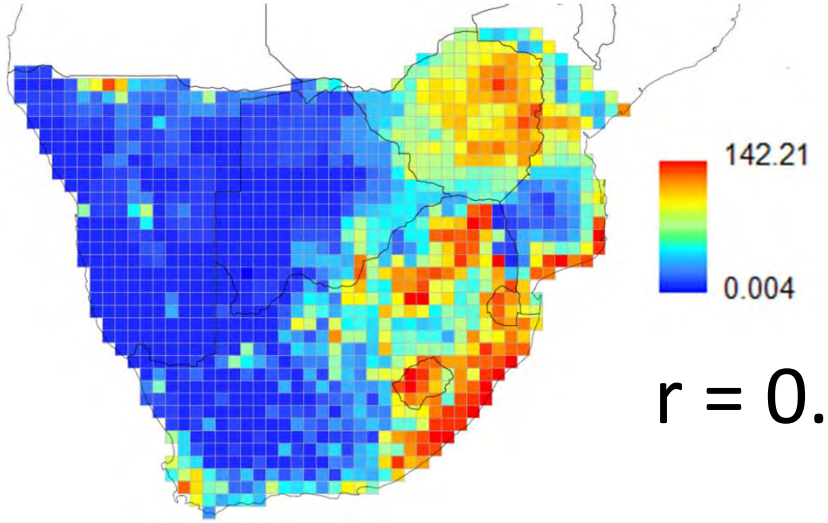
Tree phylogenetic diversity





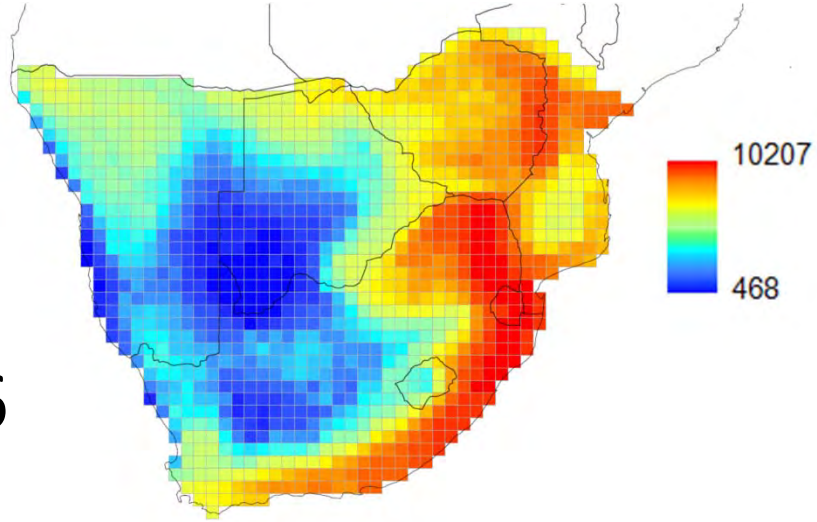
Trees and people

Human population density



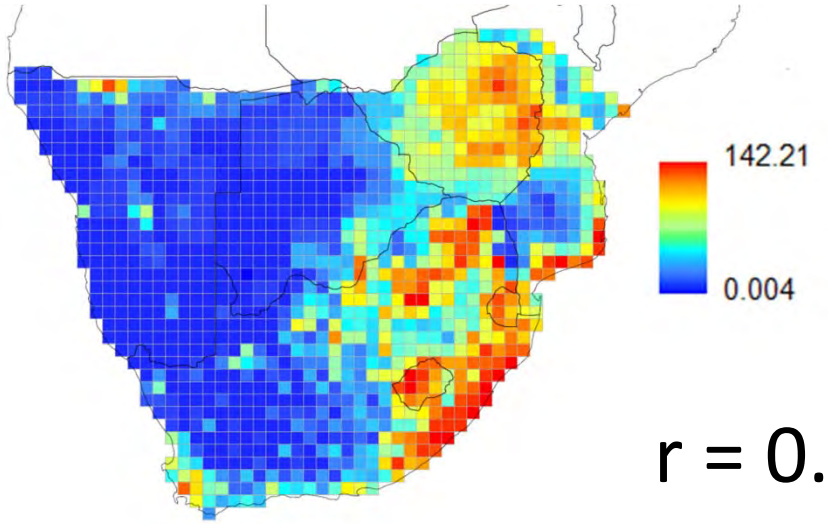
r = 0.76

Tree phylogenetic diversity

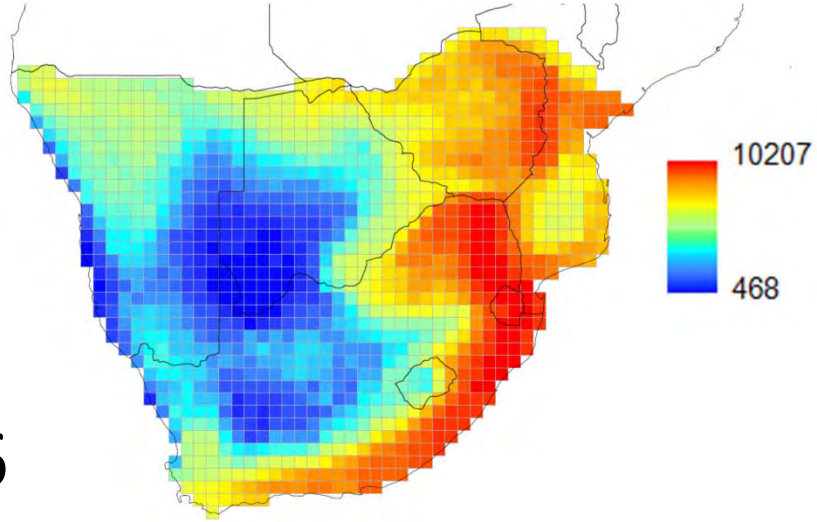


Trees and people

Human population density



Tree phylogenetic diversity



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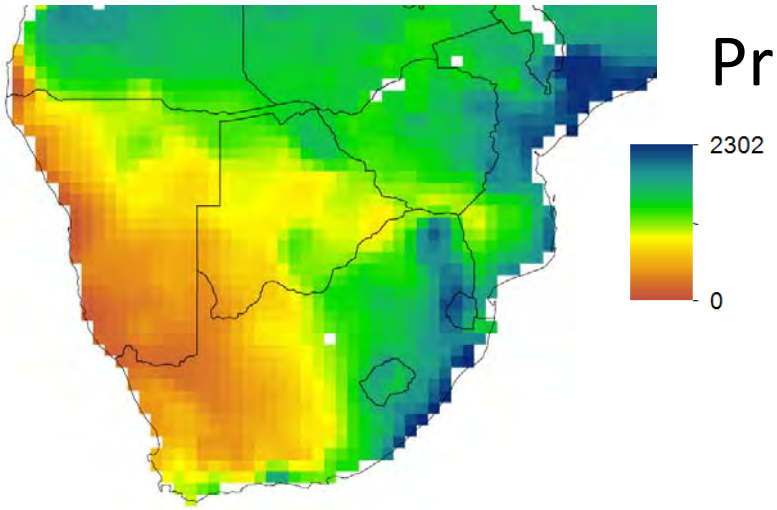
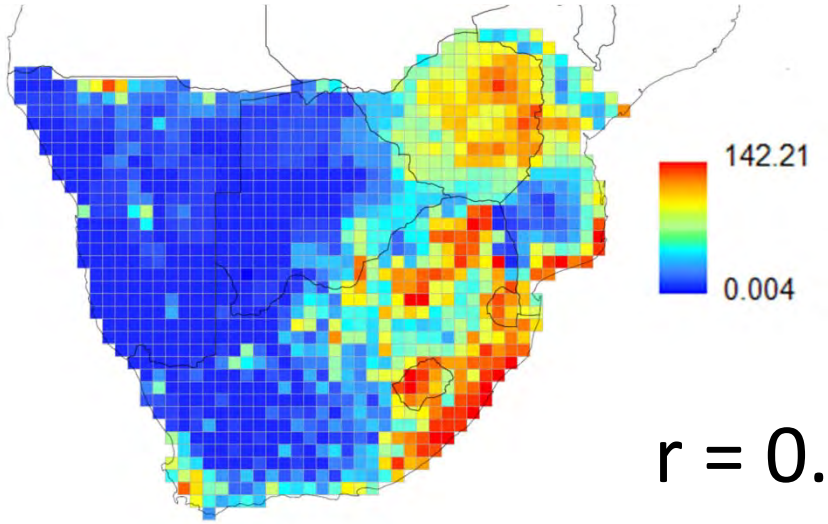


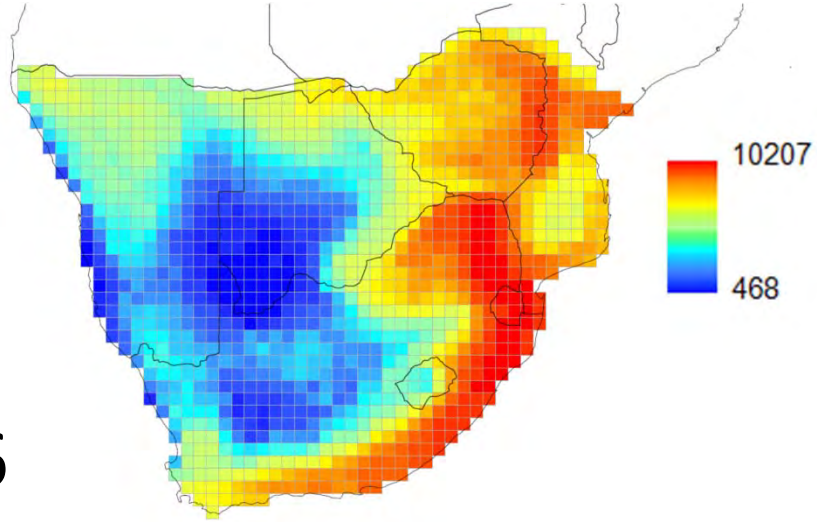
Primary productivity

Trees and people

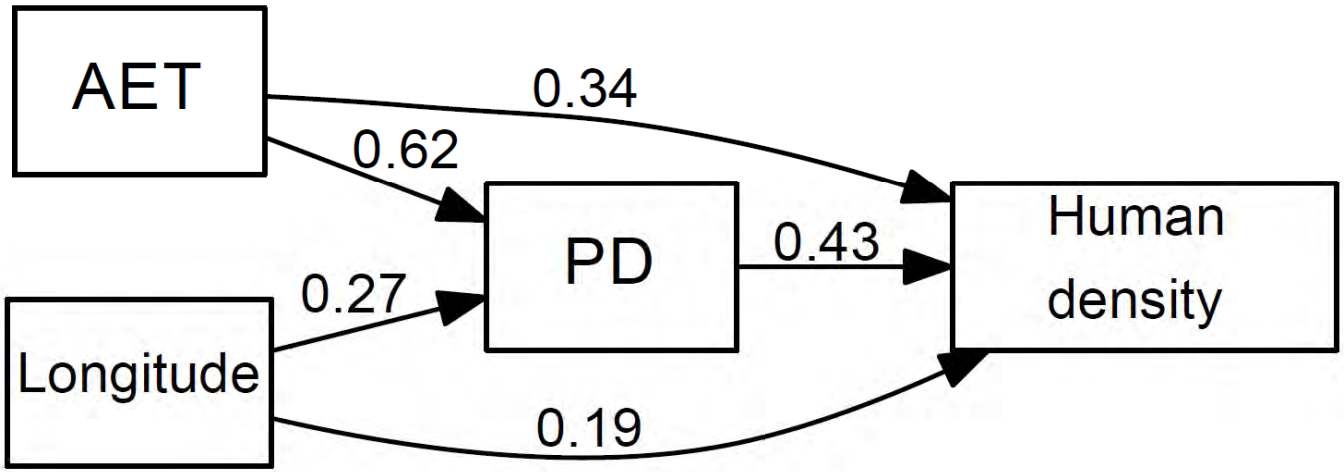
Human population density



Tree phylogenetic diversity

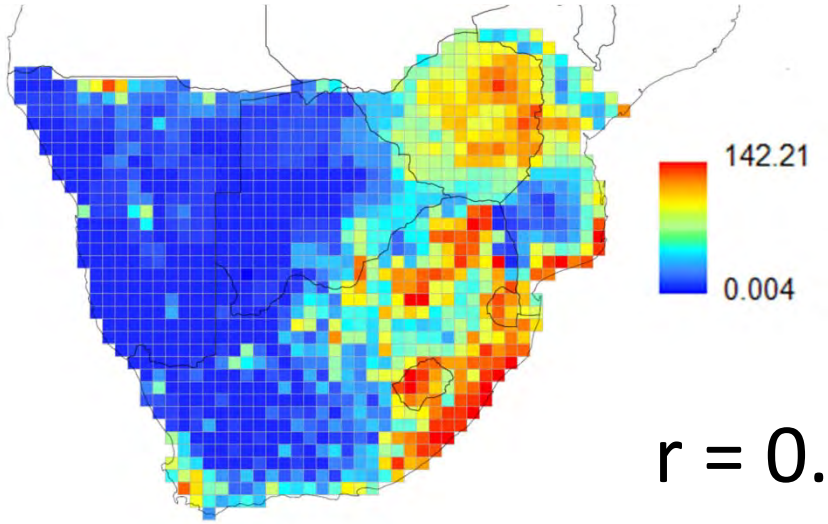


r = 0.76

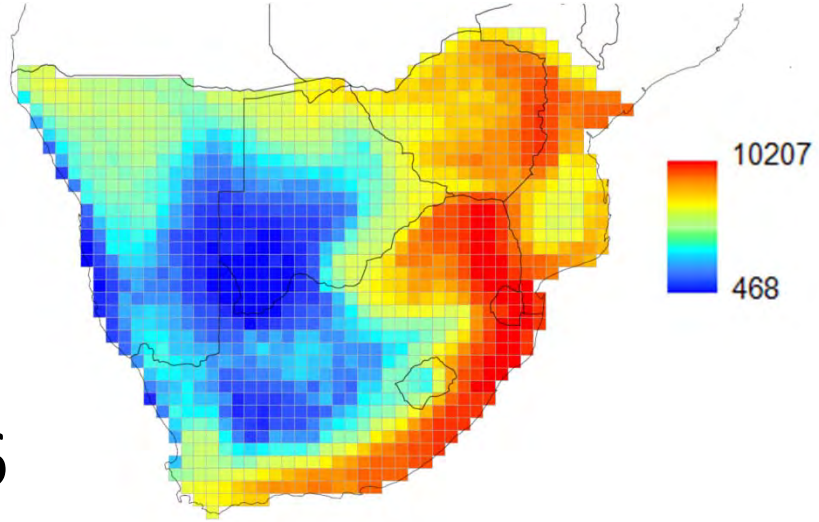


Trees and people

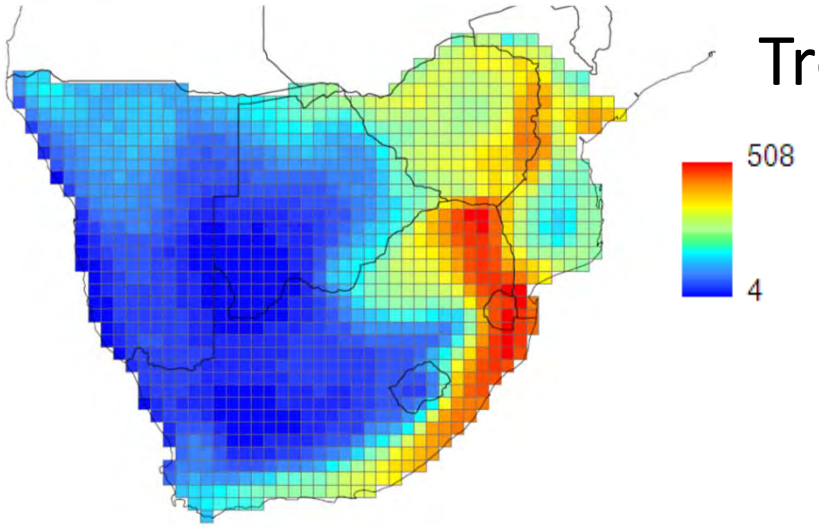
Human population density



Tree phylogenetic diversity



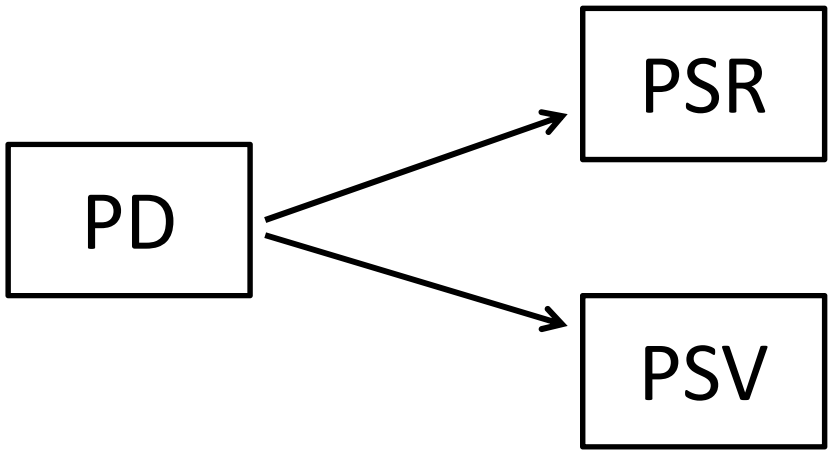
r = 0.76



Tree species richness

r = 0.72

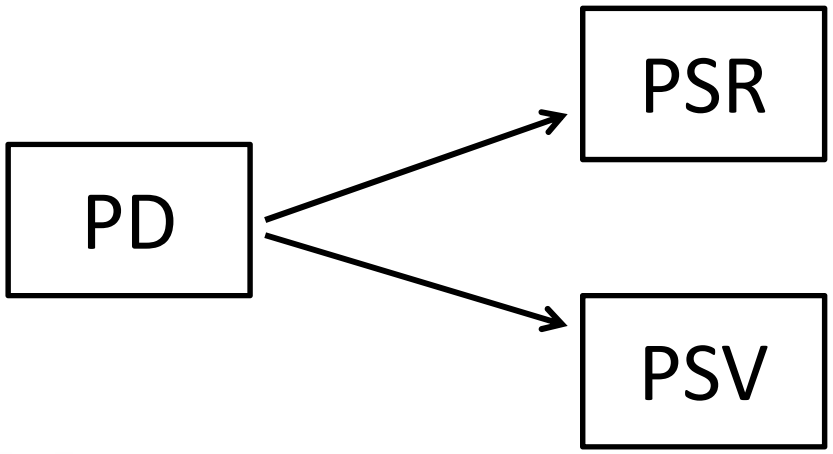
Trees and people



measure of richness discounted for species phylogenetic relatedness

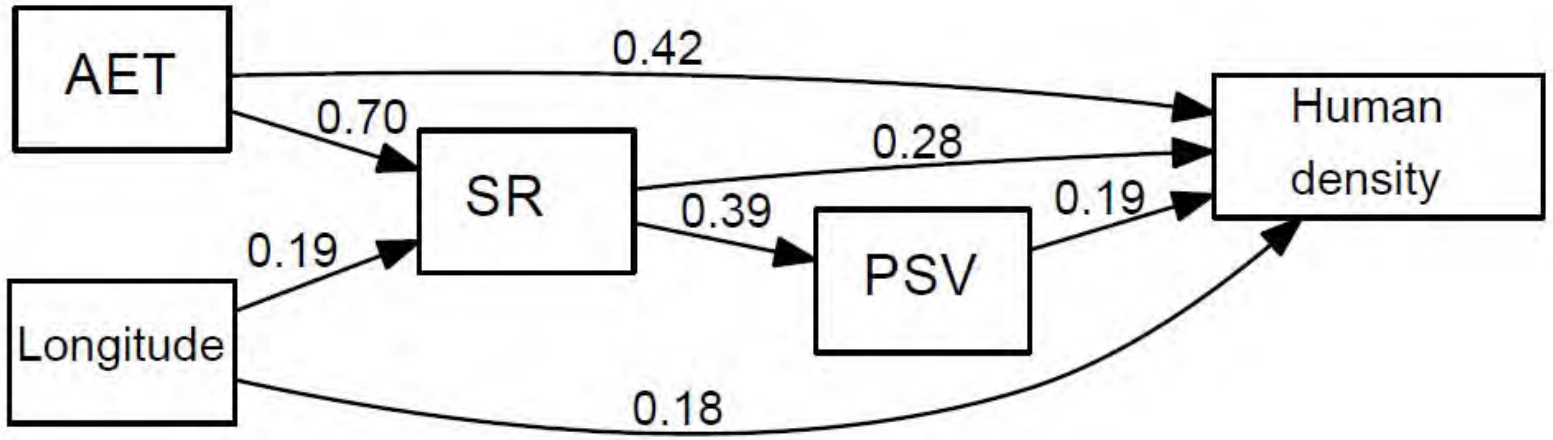
richness independent measure of evolutionary disparity

Trees and people



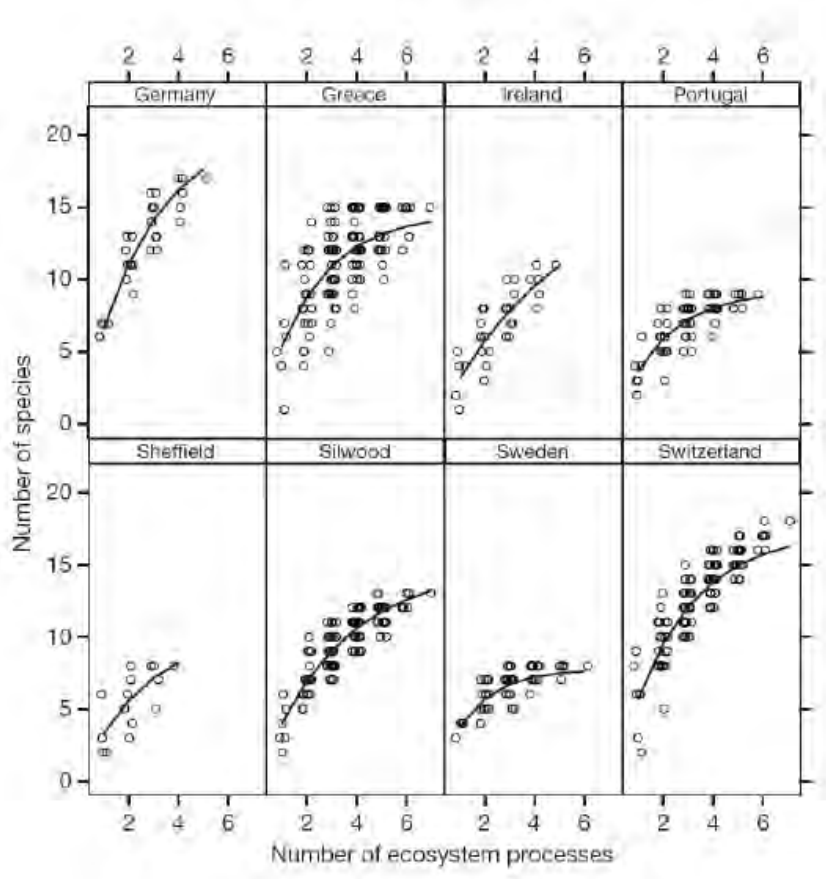
measure of richness discounted for species phylogenetic relatedness

richness independent measure of evolutionary disparity



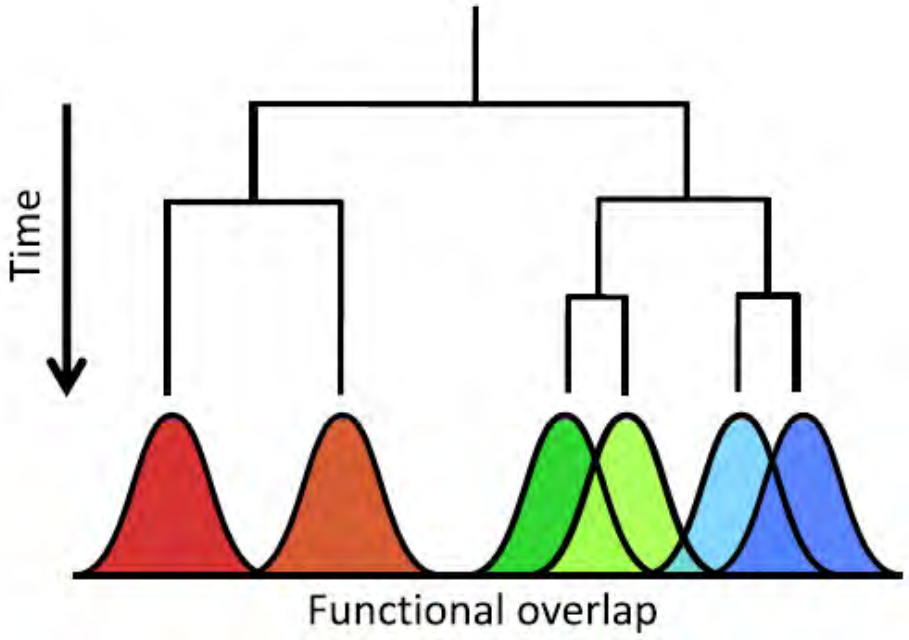
Trees and people

More species more functions



Hector & Bagchi 2007

More phylogenetic diversity more functions



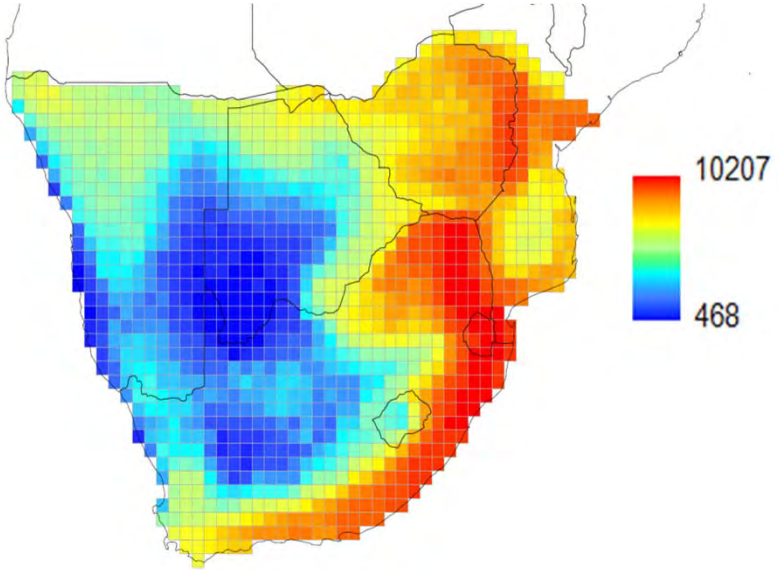
Trees and people

firewood and charcoal, carving, building and structural, spiritual, cultural, food (for humans), ornamental, forage and fodder, shade, chemical compounds, and medicinal

Scientific name	APG Family	IUCN	Firewood & Charcoal	Building structural	Carving	Cultural	Spiritual	Food (humans)	Forage & Fodder	Ornamental	Shade	Chemical Compounds	Medicinal
Abutilon angulatum	Malvaceae	LC	0	1	0	1	0	1	0	0	0	0	1
Abutilon sonneratium	Malvaceae	LC	0	0	0	0	0	0	1	0	0	1	0
Acacia adenocalyx	Fabaceae	NE	0	1	0	0	0	0	0	0	0	0	1
Acacia amythethophylla	Fabaceae	NE	0	1	0	0	0	1	1	1	0	1	1
Acacia arenaria	Fabaceae	NE	0	1	0	1	0	0	1	1	0	0	1
Acacia ataxacantha	Fabaceae	LC	0	1	1	1	1	0	1	1	0	0	1

Trees and people

Tree phylogenetic diversity



Coefficient	Estimate (s.e.)	t-value	P-value
PSR	0.10 (0.002)	55.79	<0.001
PSV	-16.15 (2.75)	2.75	<0.001

Model P-value <0.001,
$r^2_{adjusted}$ = 0.74

Trees and people

- Human population density correlates with tree species diversity in sub-Saharan Africa.

- However, it is not just the number of species that is important, but also how evolutionarily distinct they are from one another.

- A greater phylogenetic diversity of trees provides a greater diversity of ecosystem goods.

Trees and people

- The correlation between human population and plant species richness generates a conflict between humans and biodiversity conservation.

CONSORTIUM FOR THE BARCODE OF LIFE

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