

Do reserves protect riparian biodiversity?



Karen Kotschy and Kevin Rogers

Centre for Water in the Environment
University of the Witwatersrand



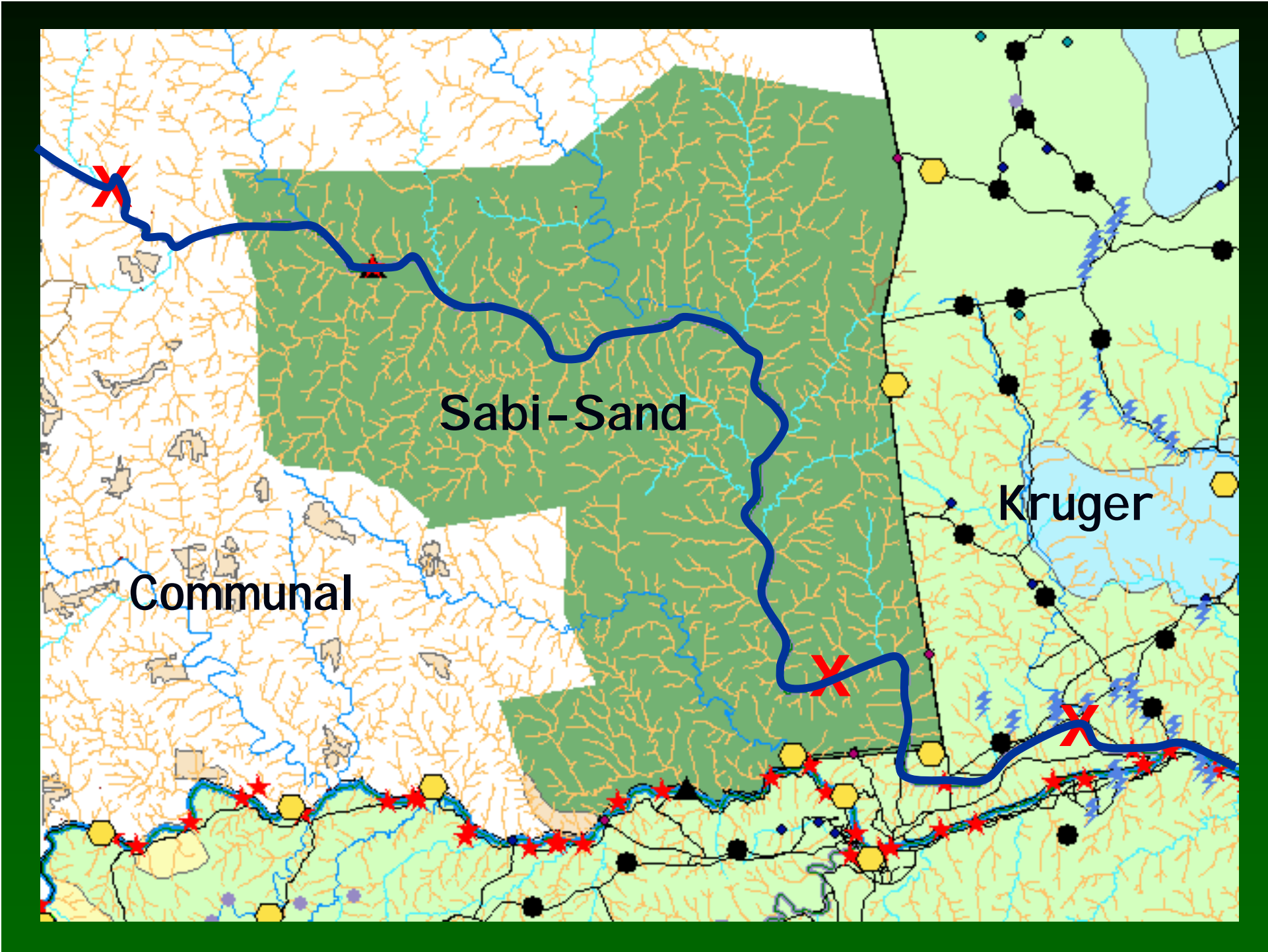
Importance of riparian zones

- Riparian zones in savanna landscapes provide important ecosystem services
 - shade, cover, nesting sites, dry-season forage, nutrient cycling, erosion control, carbon storage...
- Much of this functioning is underpinned by the biodiversity of riparian plants



Effects of land management practices on riparian vegetation

- Riparian ecosystems are strongly influenced by land management practices in the surrounding catchment
- How different practices impact on riparian biodiversity is poorly understood
- Communal lands such as the areas to the west of Kruger are commonly viewed as “degraded”
- BUT several studies have found that communal lands often have higher species richness than areas protected from human influence, and also high resilience
- What about riparian zones?







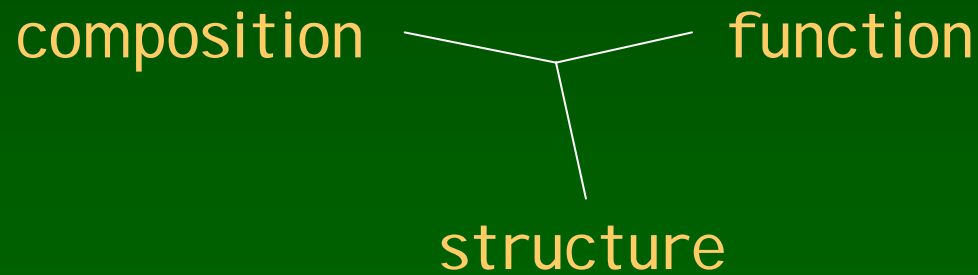




Measuring biodiversity

Three components of diversity (Stirling 2007)

- Variety: how many types of thing?
- Balance: how many of each type of thing?
- Disparity: how different are the types of thing?



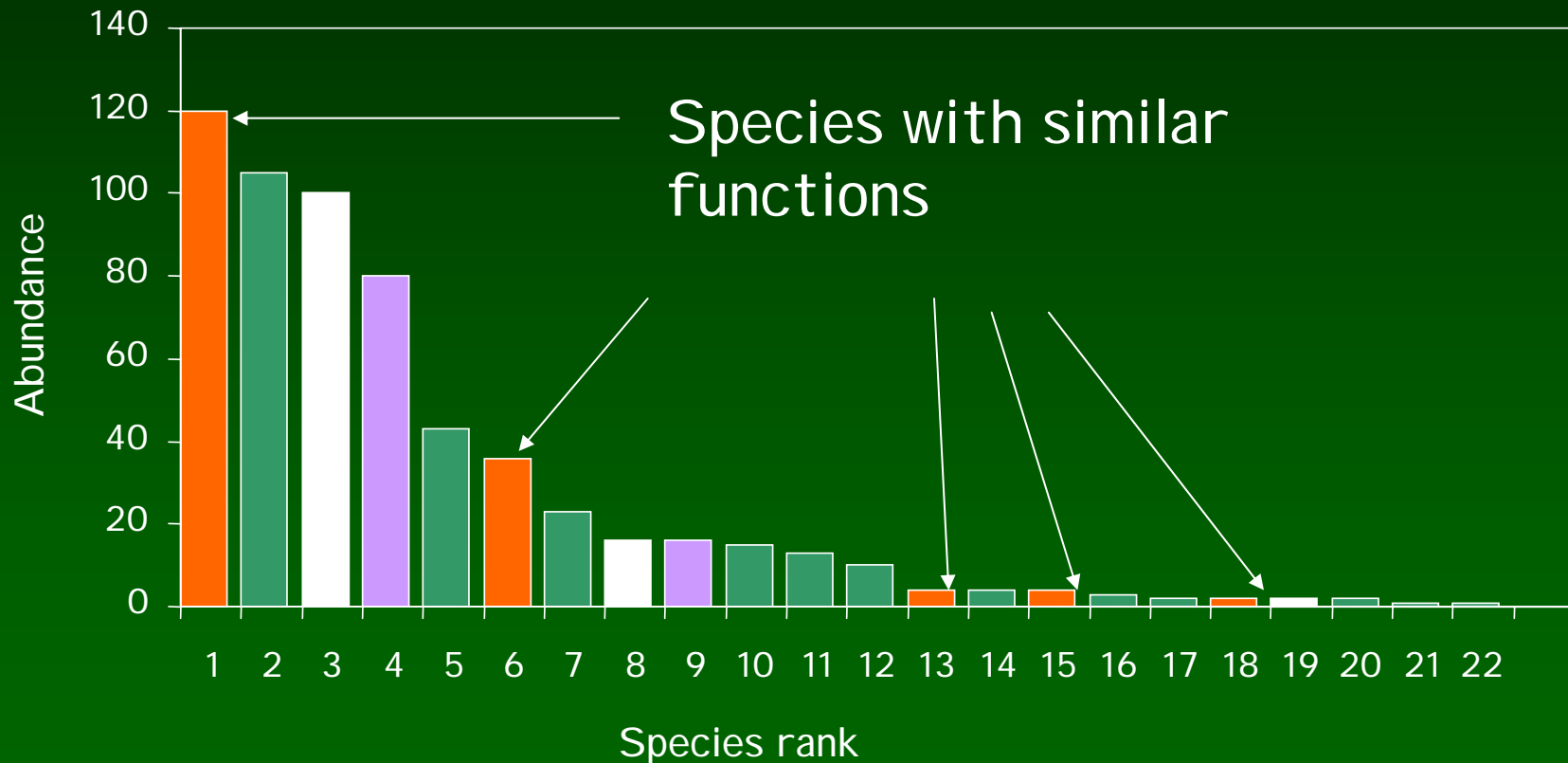
Functional diversity and resilience

Functional diversity

Range and value of functions and functional combinations present

Functional redundancy

Degree of similarity between species with respect to a particular function



Walker (1992) *Cons. Biol.* 6:18-23; Walker et al. (1999) *Ecosystems* 2:95-113

Compositional diversity

Taxonomic disparity
+
Relative abundance

Functional diversity

Functional disparity
+
Relative abundance

Variety, balance and disparity

Rao's Quadratic Entropy

Plant species composition and abundance



Collection of functional trait data



Plant trait data collected

Obtained from the literature

Growth form

Life span

Leaf phenology

Spinescence

Presence/absence of clonality

Sprouting ability

Woodiness

Riparian affinity

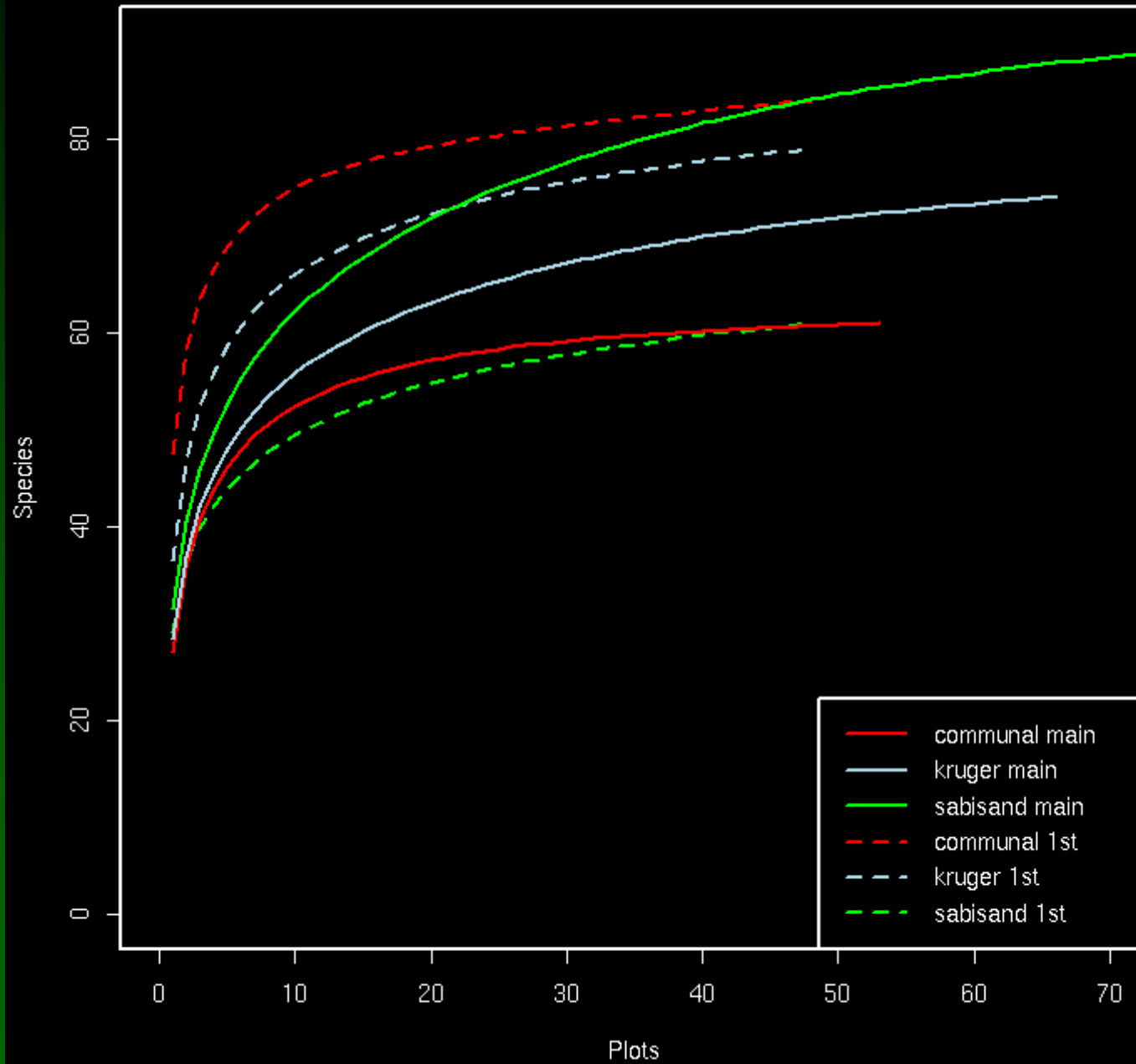
Potential height

Measured in the field

Specific leaf area (SLA)

Leaf tensile strength

Species accumulation curves



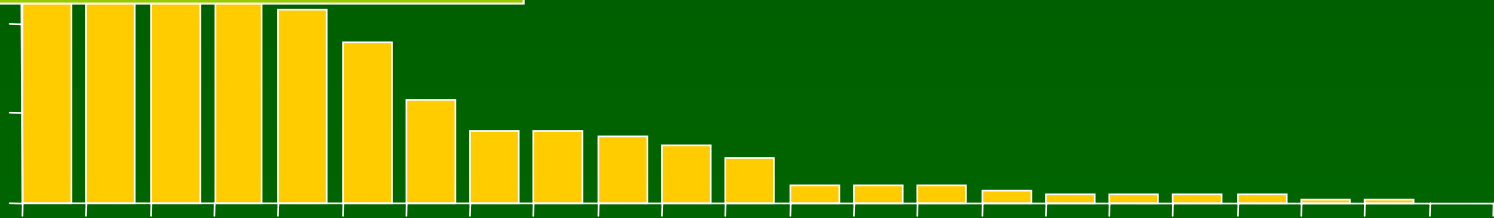
Main river

50% of abundance (3-5 spp)

1% of abundance (17-35 spp)

Communal
Kruger
Sabi-Sand
<i>Ficus capreifolia</i>
<i>Gymnosporia senegalensis</i>
<i>Fluggea virosa</i>
<i>Lantana camara</i>
<i>Jasminum fluminense</i>

<i>Sclerocarya birrea</i>
<i>Dombeya rotundifolia</i>
<i>Berchemia zeyheri</i>
<i>Lanea schweinfurthii</i>
<i>Ochna natalitia</i>



Species rank

First order streams

50% of abundance (4-11 spp)

1% of abundance (20-21 spp)



















Communal
Kruger
Sabi-Sand
Combretum apiculatum
Strychnos spinosa
Acacia exuvialis
Acacia welwitschii
Dalbergia melanoxylon
Dichrostachys cinerea
Combretum apiculatum
Combretum hereroense
Combretum apiculatum

Schotia capitata
Ximenia caffra
Zanthoxylum capense

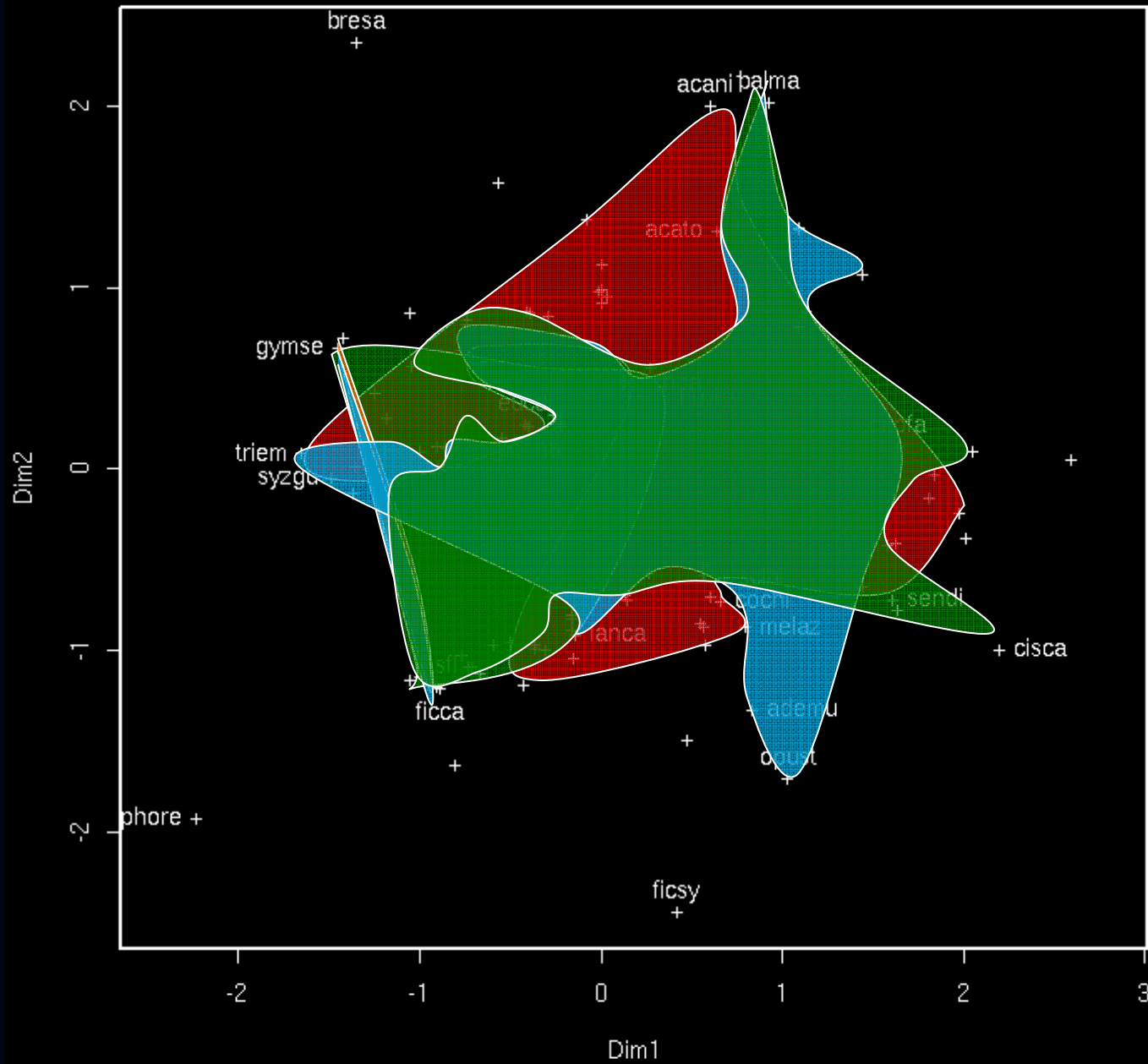


Species rank

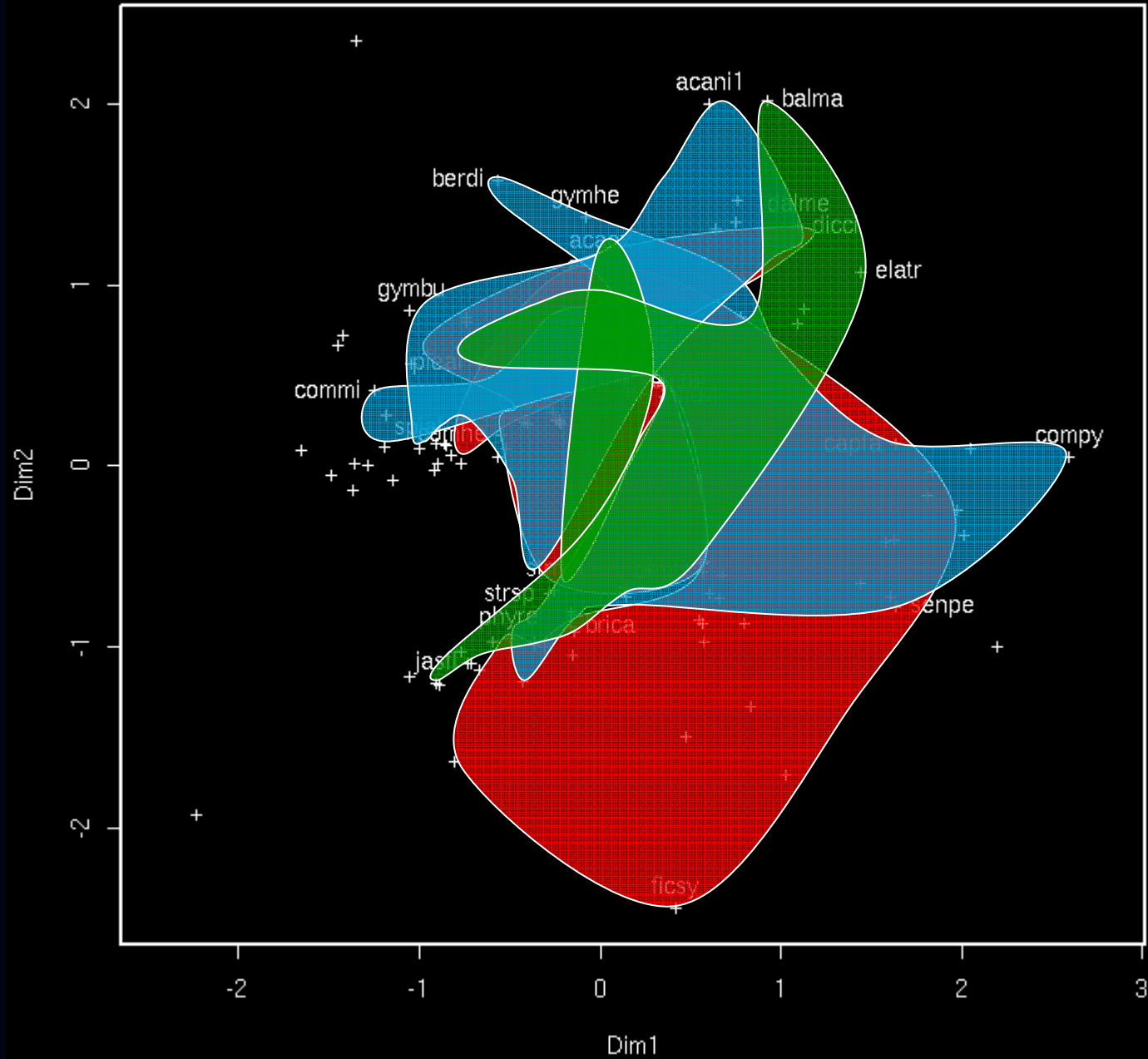
Compositional diversity

	Variety (rarefied sp. richness)	Balance (Pielou's evenness)	Disparity (Warwick & Clarke's tax distinctness)	Combined (Rao's QE)	Renyi (Generalised Shannon)
comm.main				low	low
kruger.main				medium	medium
ss.main				high	high
comm.1st				high	high
kruger.1st				medium	medium
ss.1st				low	low

Functional spectrum: main river



Functional spectrum: first order streams



Functional diversity

	Disparity (Warwick & Clarke)	Combined (Rao)	Compositional diversity
comm.main	high	high	low
kruger.main	medium	low	medium
ss.main	low	low	high
comm.1st	high	high	high
kruger.1st	medium	medium	medium
ss.1st	low	low	low

Conclusions

- Do reserves protect biodiversity?
 - Along main river: yes, but functional diversity has not been lost outside the reserves
 - Along small streams: no
- Reserves do not necessarily protect compositional or functional diversity of riparian vegetation better than adjacent communally-managed areas
- Riparian vegetation in this area can probably handle a lot more disturbance than we think it can!
- This study will help us to set criteria for defining desired states for riparian ecosystems

Acknowledgements

CWE members, Scientific Services staff, Jonathan Swart and landowners from Sabi-Sand, all our assistants and game guards

Andrew W. Mellon Foundation for funding

