October, 8

How to increase species diversity in phytostabilization strategies near Lubumbashi (Katanga – D.R.C.) ?

Sylvain Boisson, Julien Collignon, Soizig Le Stradic, Arnaud Monty, Grégory Mahy & Mylor Ngoy Shutcha

Context

- Lubumbashi (Katanga – D.R. Congo)

Context

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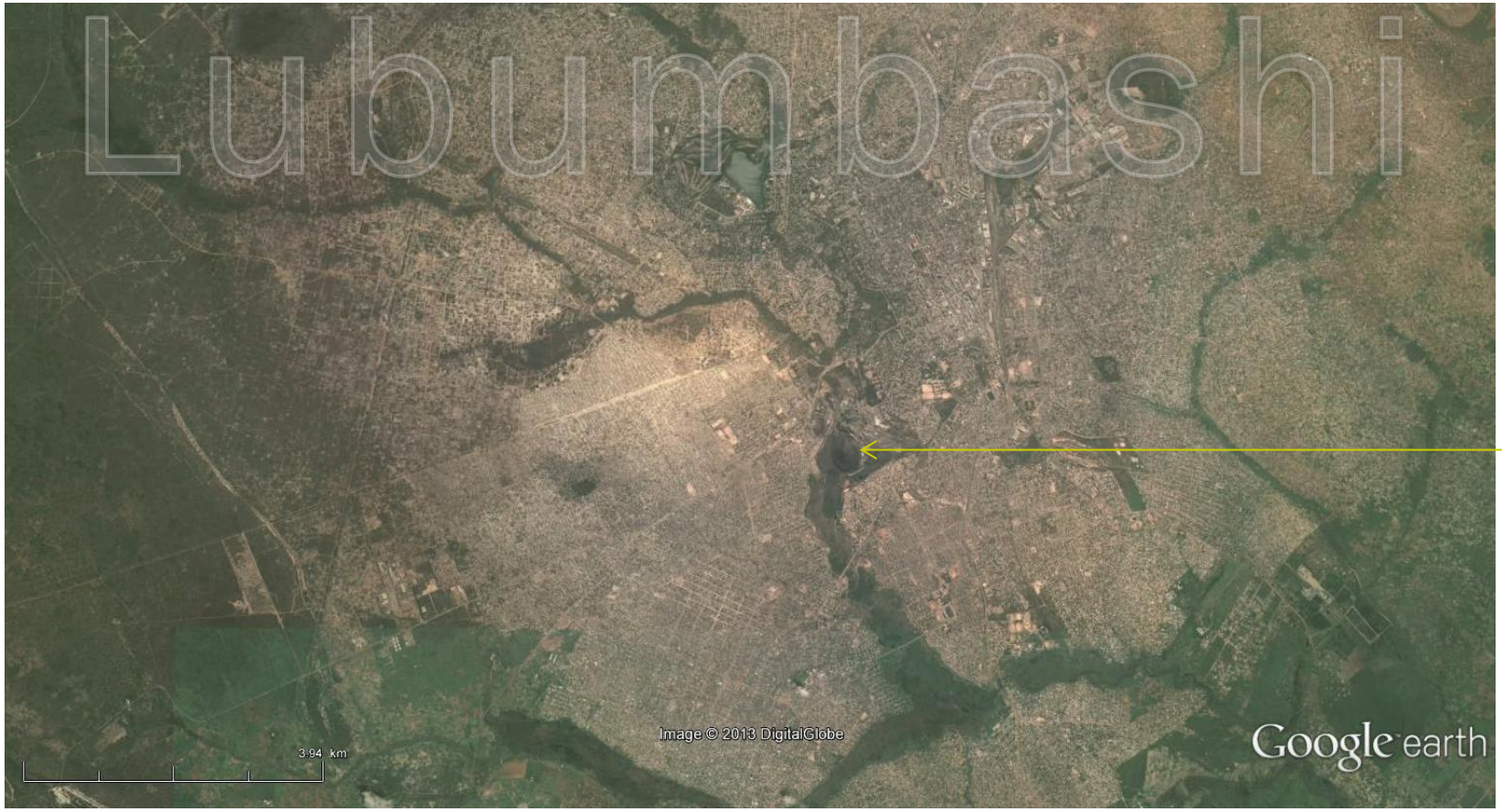
Environmental contamination by metals (Cu, Co, …)
More than 10 000 mg $Cu.kg^{-1}$

Environmental pollution

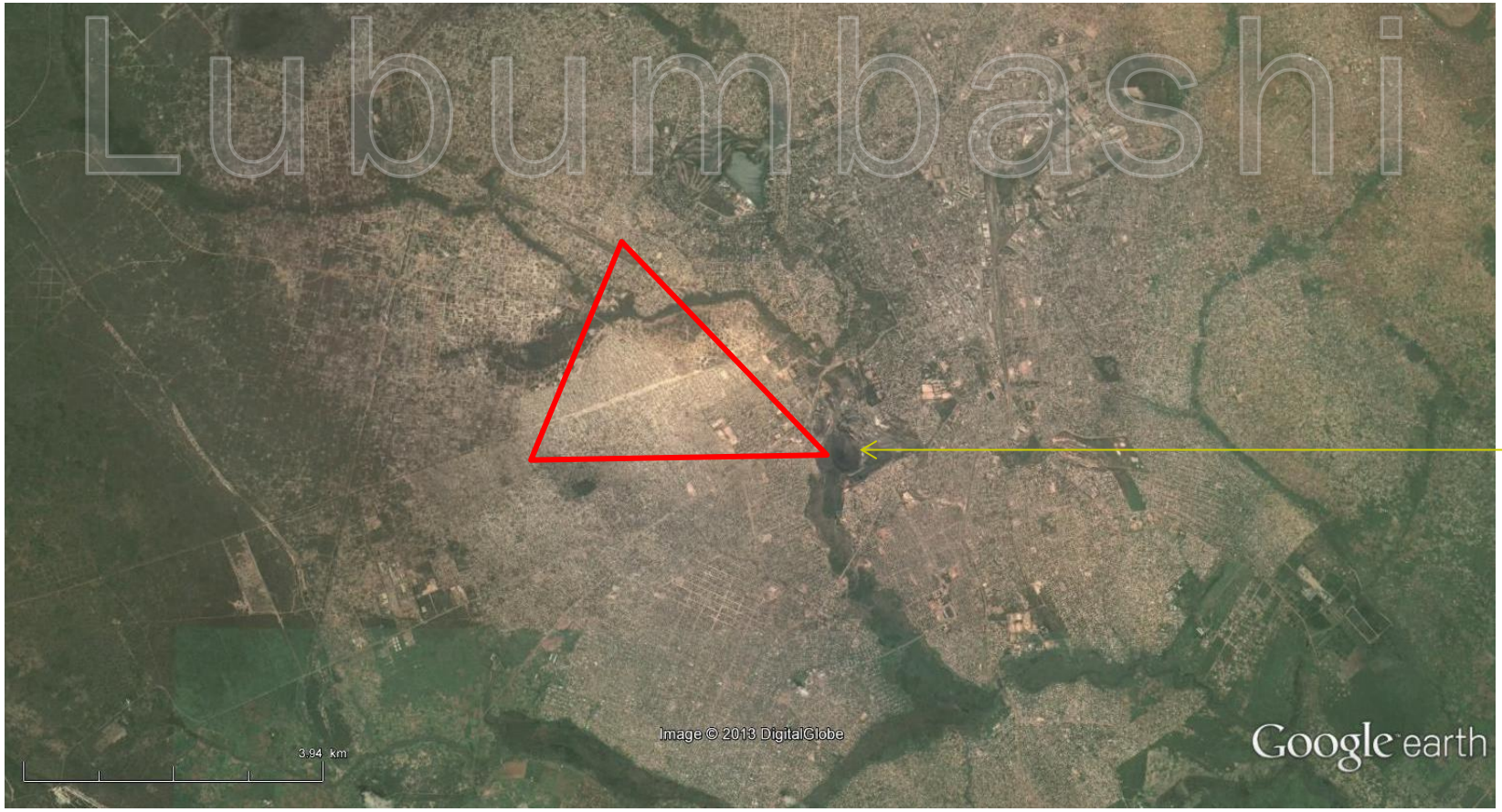
- Polluted area by atmospheric particles



Atmospheric emissions

Environmental pollution

- Polluted area by atmospheric particles

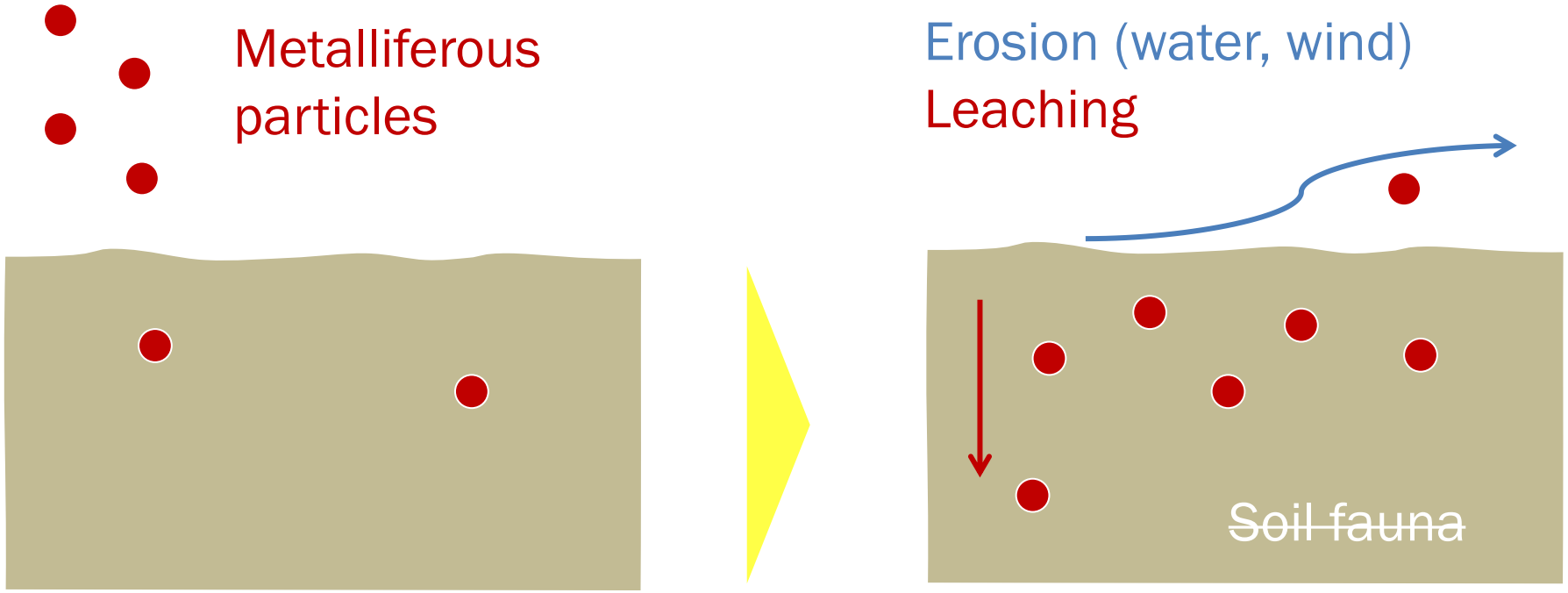


Atmospheric emissions

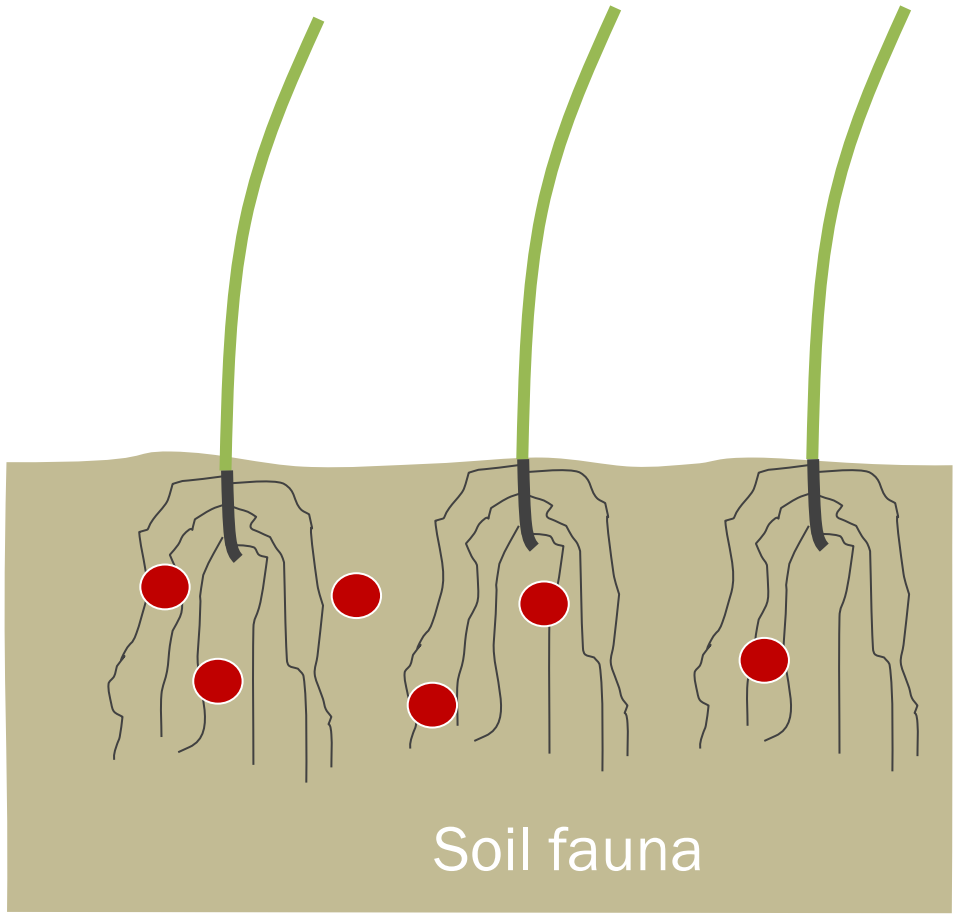
Environmental pollution

- Impact on public health (Banza et al., 2009)

Atmospheric pollution



Phytostabilization

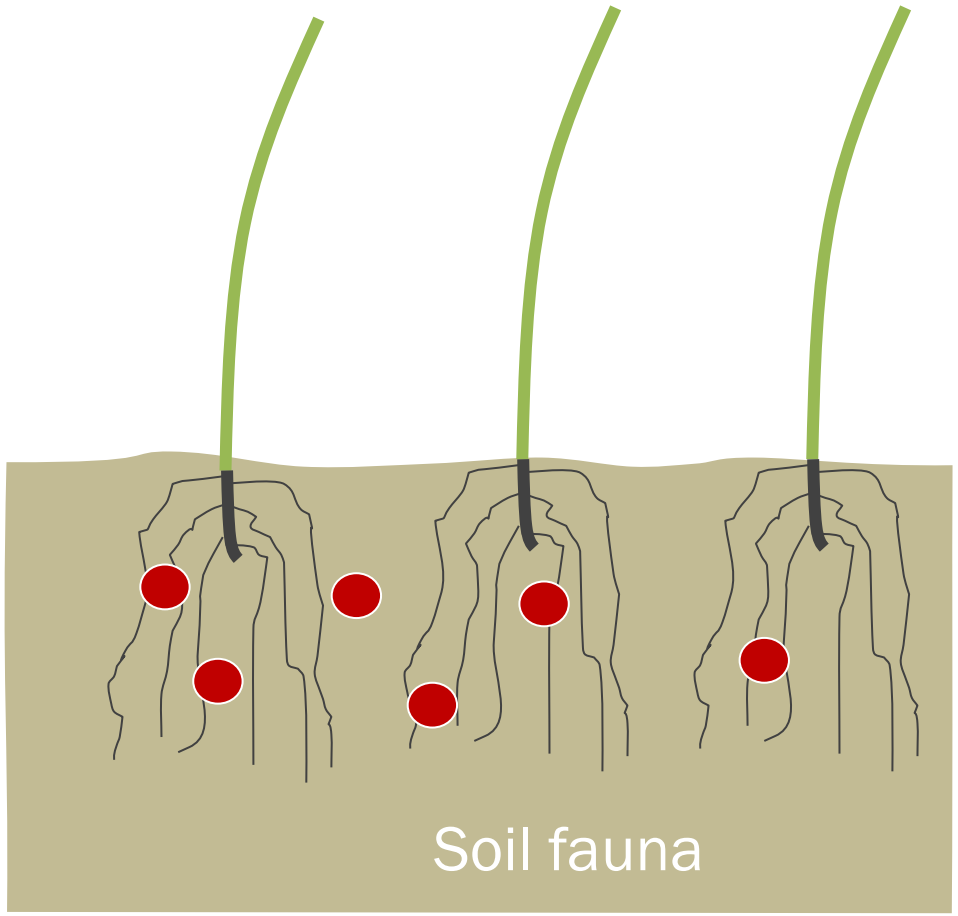


Immobilization by

- Adsorption
- Precipitation

Berti & Cunningham, 2009

Phytostabilization



Advantages

- Economic
- Sustainable
- Low maintenance

Mendez, MO. 2008.

Species selection

- Long fruiting time
- High seed production
- High germination rate
- Fast growing
- High soil covering
- Broad ranges of metal concentrations
- Interest for conservation

Tests

- *Microchloa altera* *(Shutcha et al., 2010)*

phytostabilized area

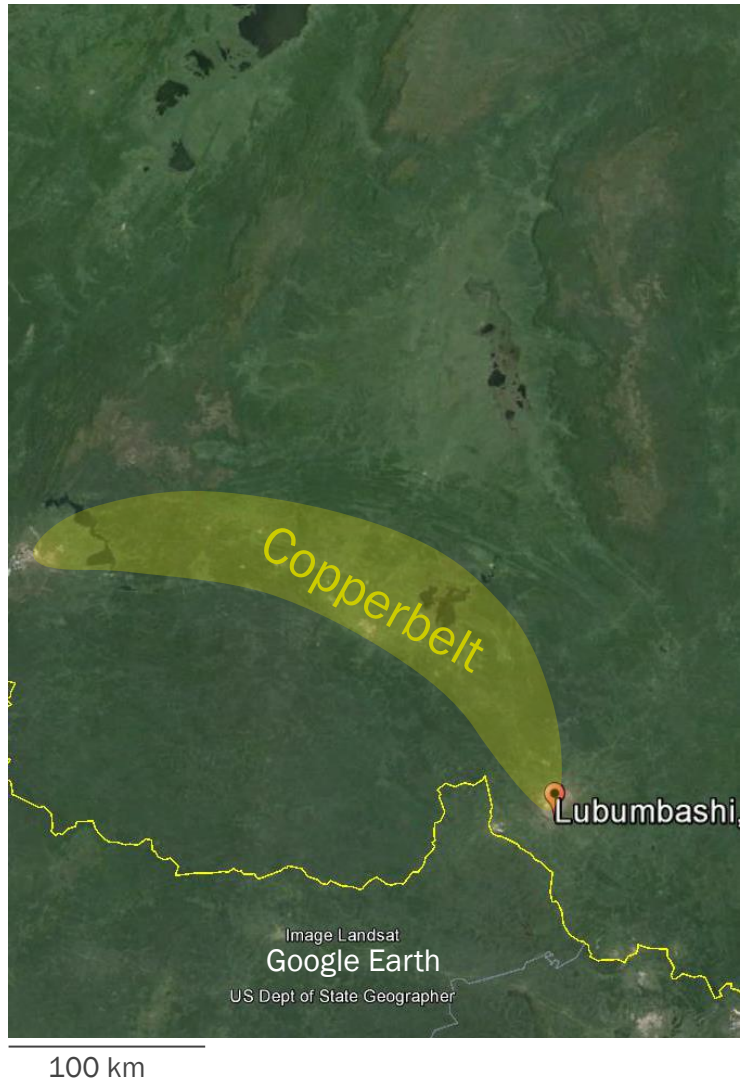
Microchloa altera (Poaceae)

- Copper tolerant species

Shutcha et al., 2010

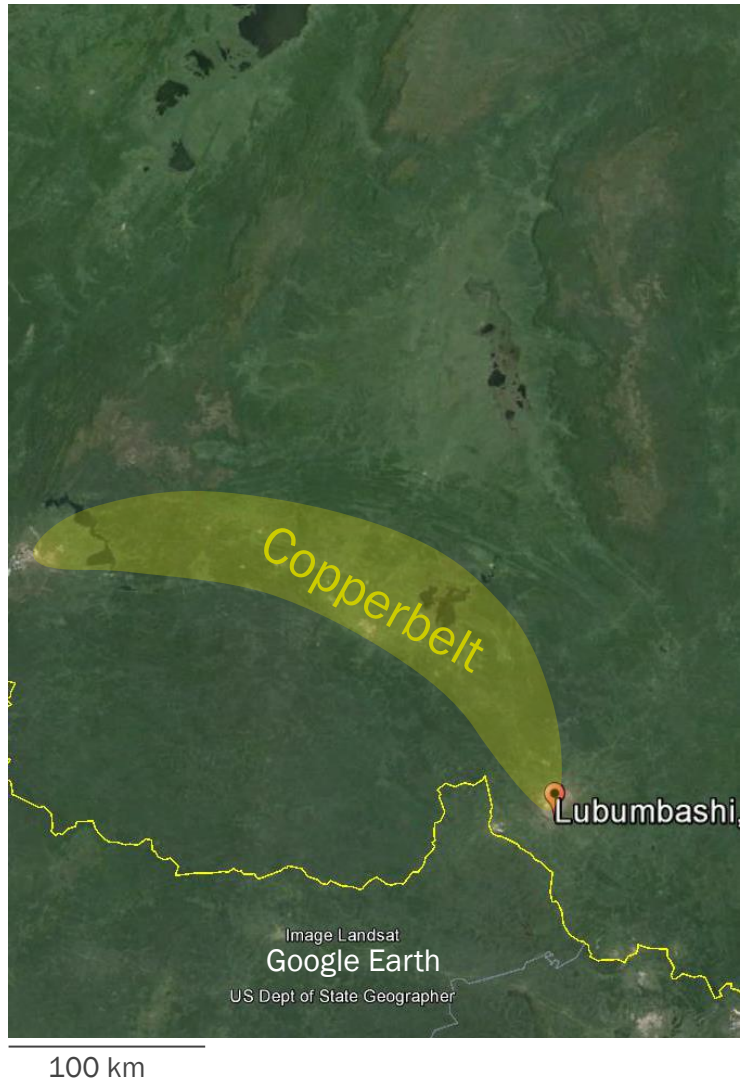
Microchloa altera

- Copper tolerant species
- Katangan copperbelt



Microchloa altera

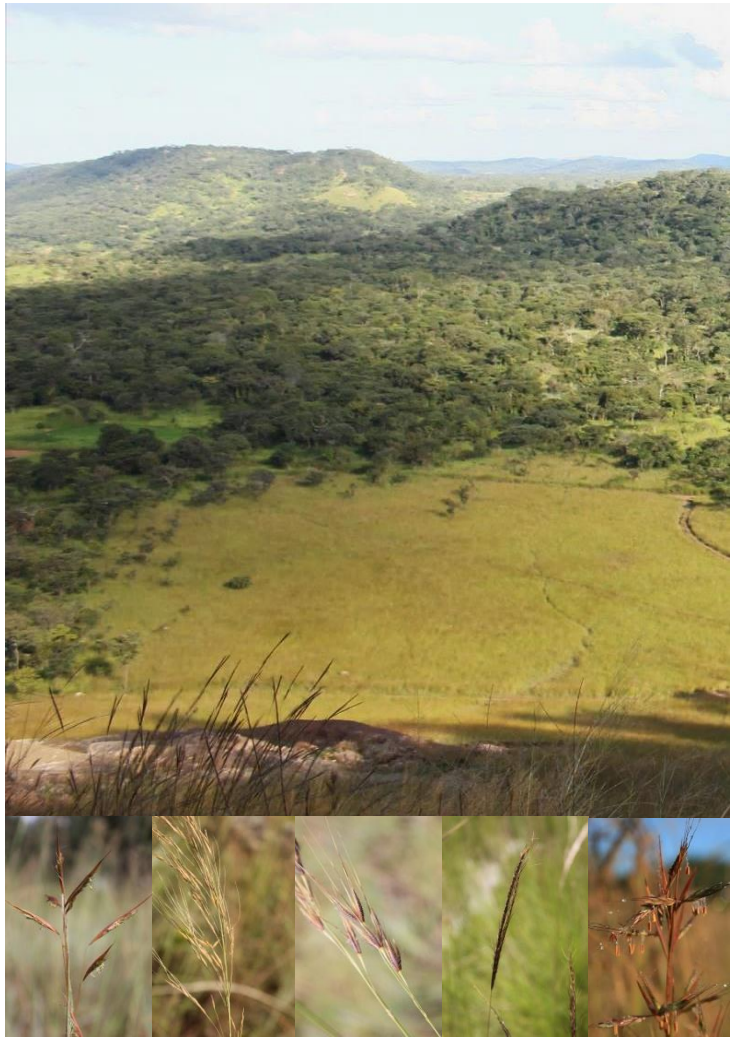
- Copper tolerant species
- Katangan copperbelt
- Phytostabilization
  - Fast growing
  - High covering
  - Long fruiting time



Microchloa altera

- Copper tolerant species
- Katangan copperbelt
- Phytostabilization

More than 140 grass species compose the flora



Objective

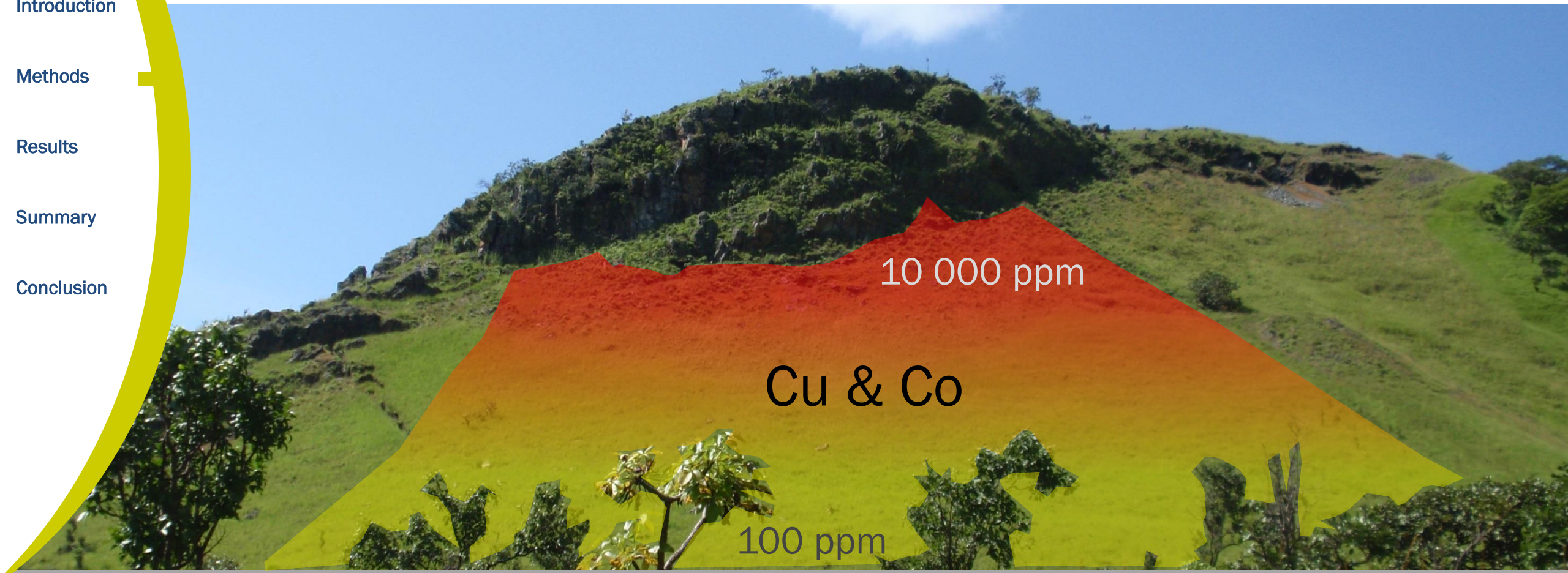
- To identify candidate species for phytostabilization strategies near Lubumbashi among 7 dominant grasses living on copper hills
  - Analyzing 5 criterions based on reproductive success
  - Comparison with *M. altera*

Study site

Katangan copperbelt

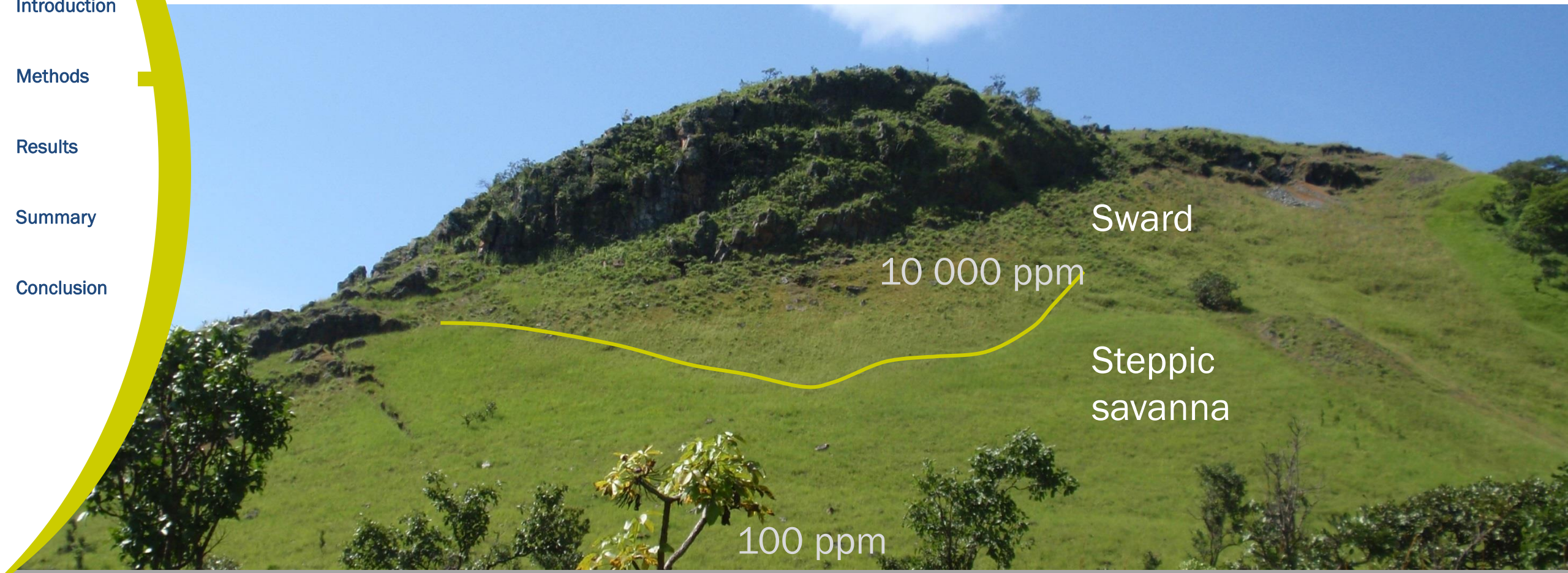
Original flora

Natural contamination (Cu-Co outcrops)



Original flora

2 vegetation units



Study species

Monocymbium ceresiiforme

Perennial, culms solitary, or caespitose

Inflorescence: raceme

Study species

Tristachya bequaertii

Perennial, caespitose

Inflorescence: panicle

Study species

Loudetia simplex

Perennial, caespitose

Inflorescence: panicle

Study species

Hyparrhenia diplandra

Perennial, caespitose

Inflorescence: raceme

Study species

Andropogon schirensis

Perennial, caespitose

Inflorescence: panicle

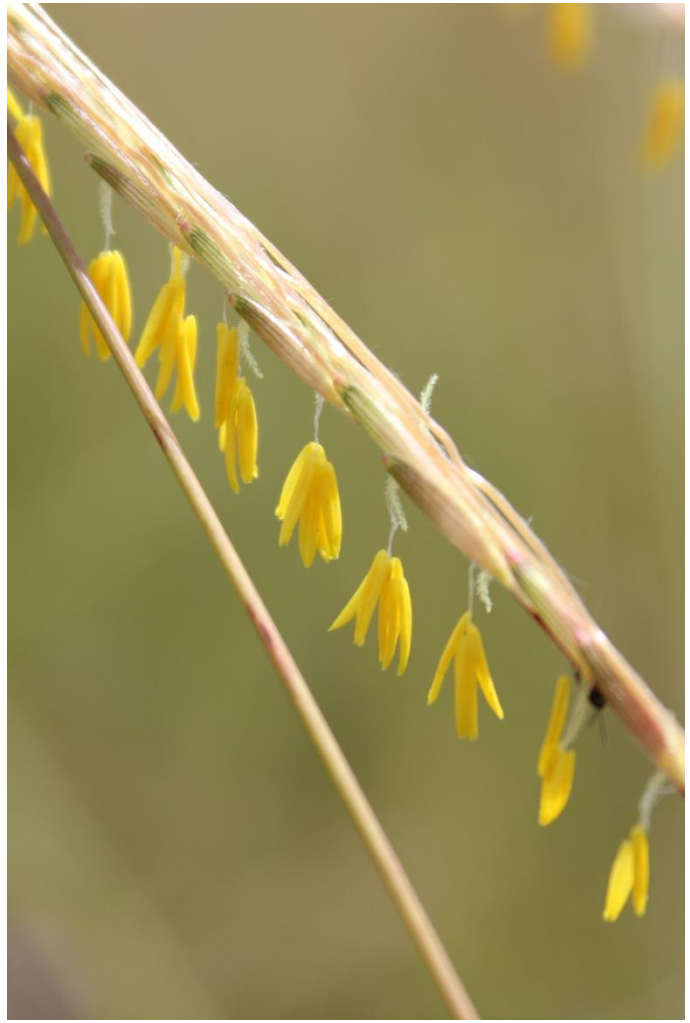
Study species

Eragrostis racemosa

Perennial, caespitose

Inflorescence: panicle

Study species



Trachypogon spicatus

Perennial, caespitose

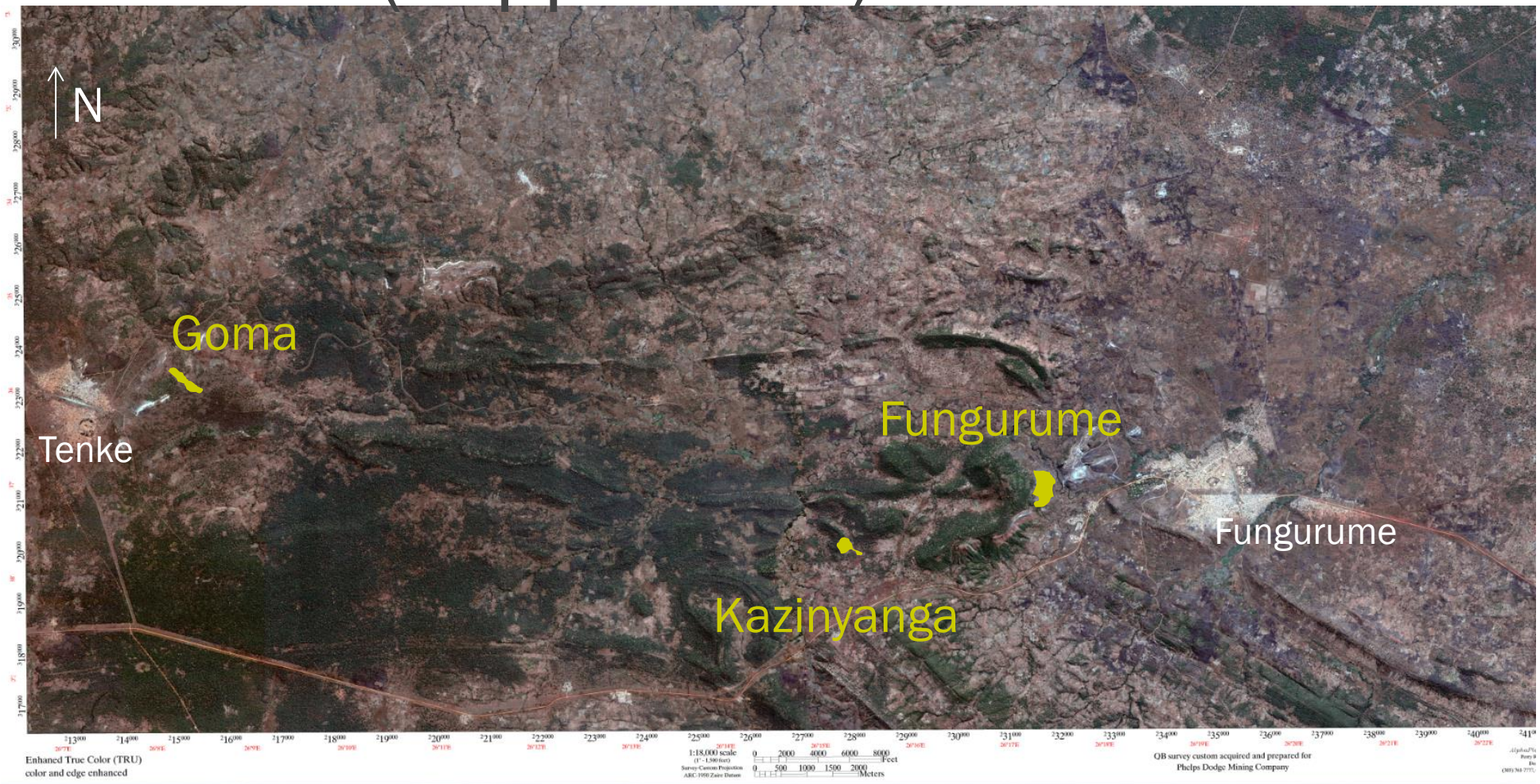
Inflorescence: raceme

Sampling

- Katanga (Congo, RDC)

Sampling

- 3 Sites (copper hills)



Sampling

- Random

GOMA HILL

Sampling

- 3 sites
- Random sampling
- 68 permanent quadrats (F21, K20, G29)
  - Min 8 quadrats/sp and site

Sampling

- 3 sites
- Random sampling
- 68 permanent quadrats (F21, K20, G29)
- 2 periods (1 month interval)
  - April
  - May

Measures

- By quadrat and species
  - Number of inflorescences
  - 3 collected inflorescences
- By 3 inflorescences
  - Number of fertile spikelets
  - Number of seeds

Measures

- Germination rate
  - 5 replicates of 30 seeds
  - Tested by species
  - Not for *T. bequaertii*

Data analysis

- One way ANOVA
- HSD Test

Species repartition

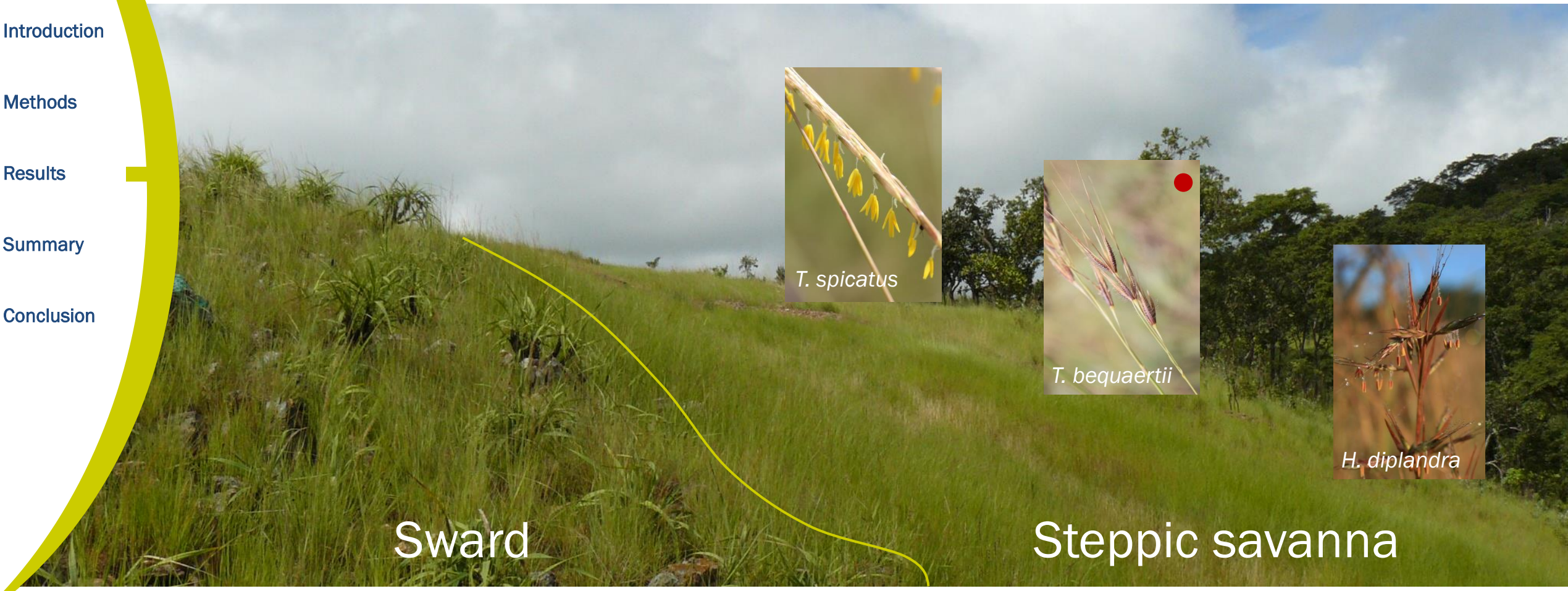
Species repartition

E. racemosa

Sward

Steppic savanna

Species repartition



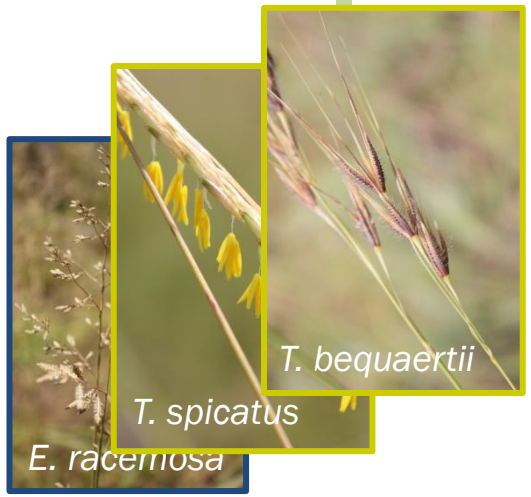
Species repartition

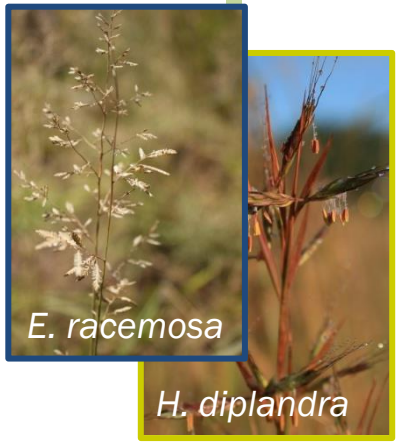
Fruiting time

Species in two vegetation units

April

May





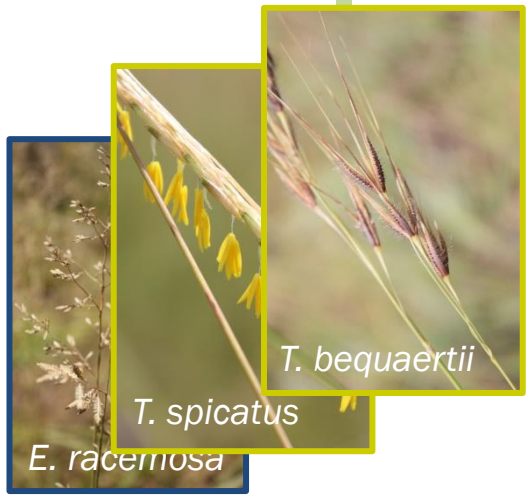
Species in sward or steppic savanna

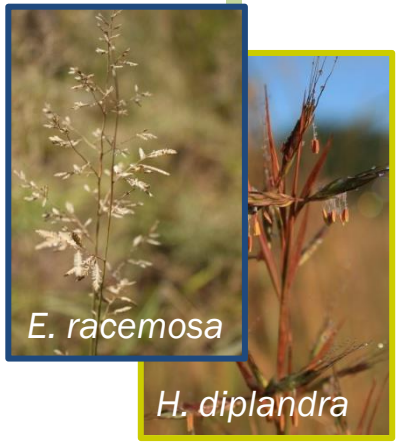
Fruiting time

Species in two vegetation units

April

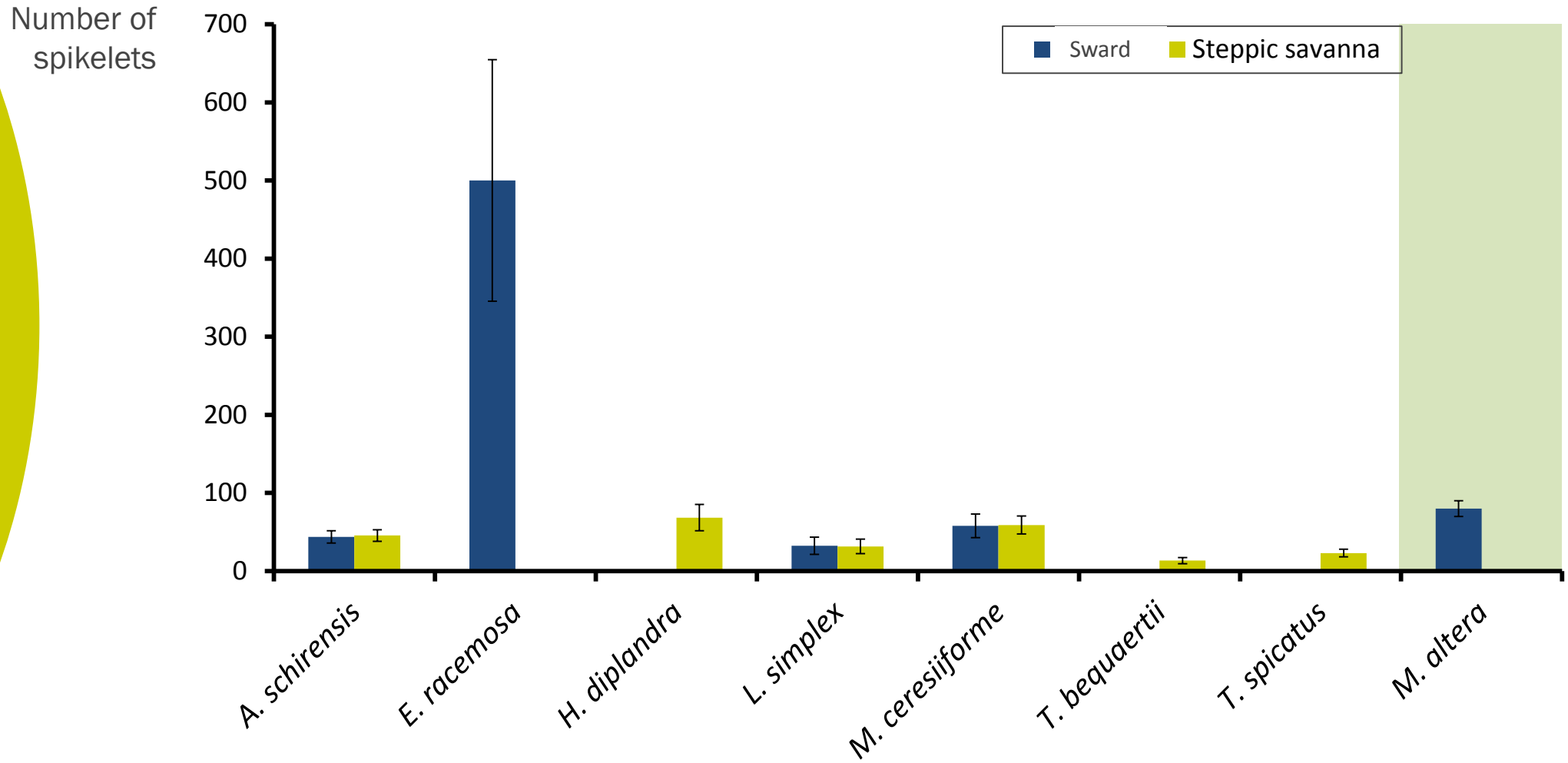
May





Species in sward or steppic savanna

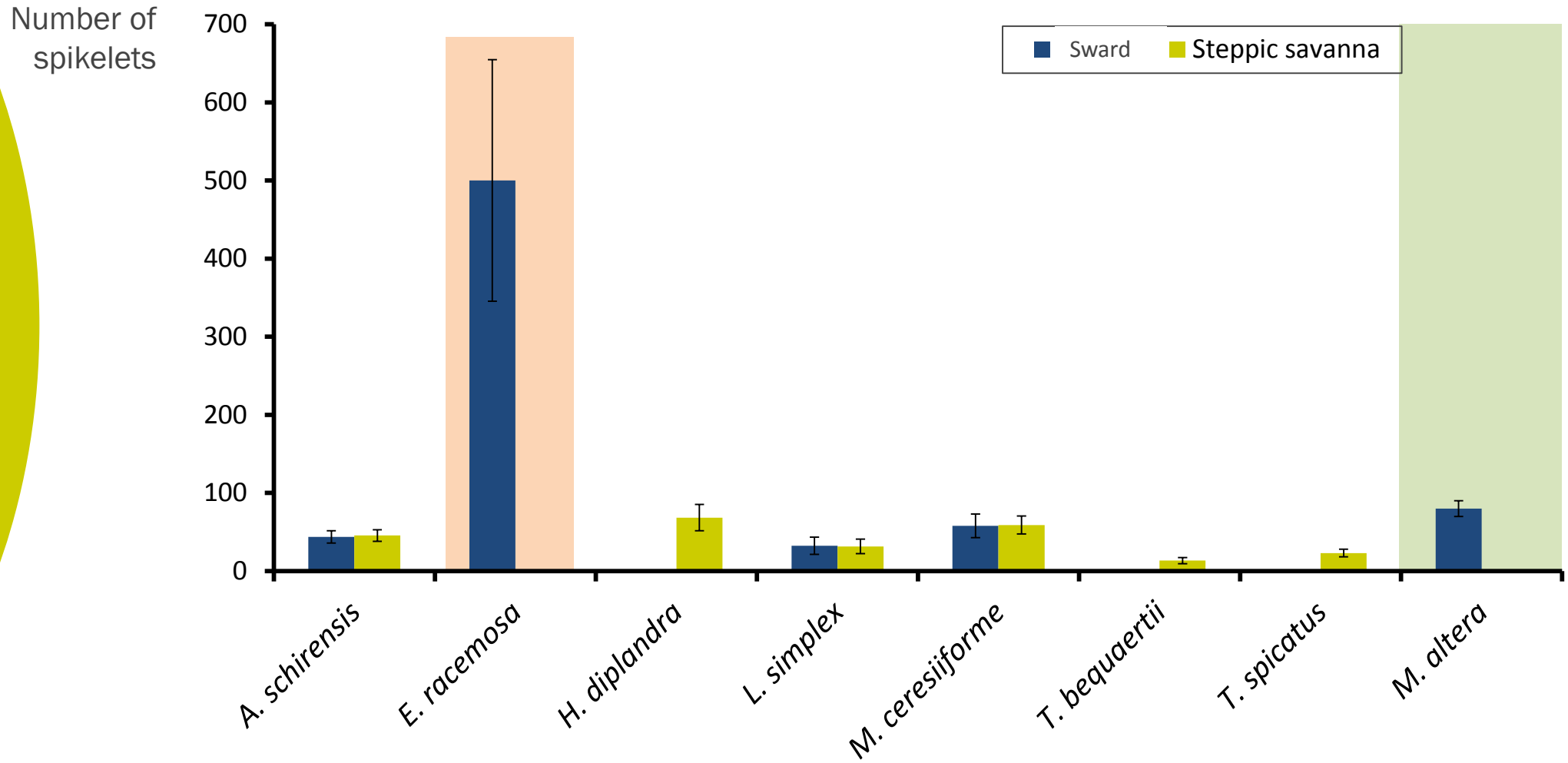
Fertile spikelets/inflorescence



No significant differences between vegetation units

Data from Shutcha, 2013

Fertile spikelets/inflorescence



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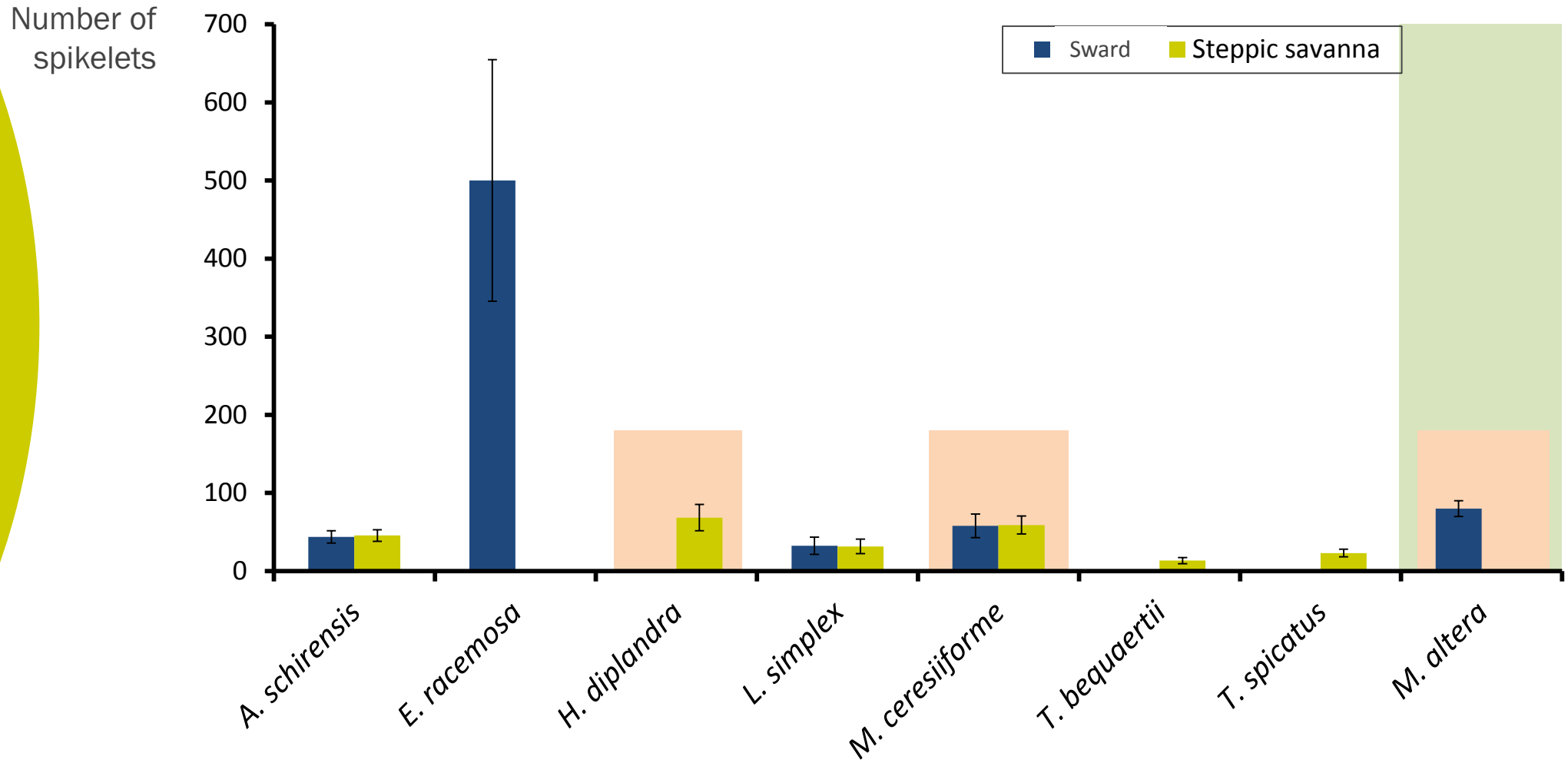

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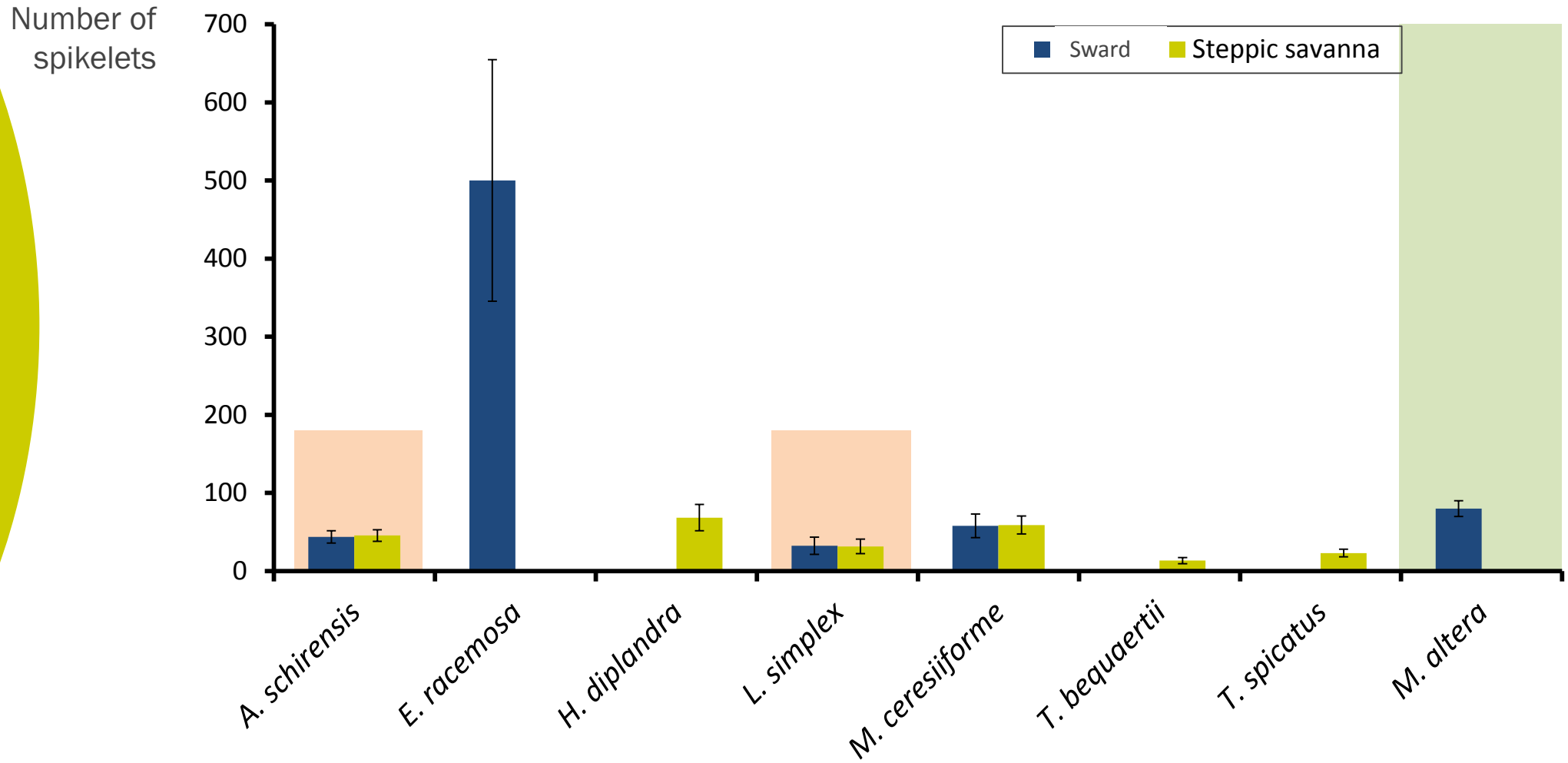

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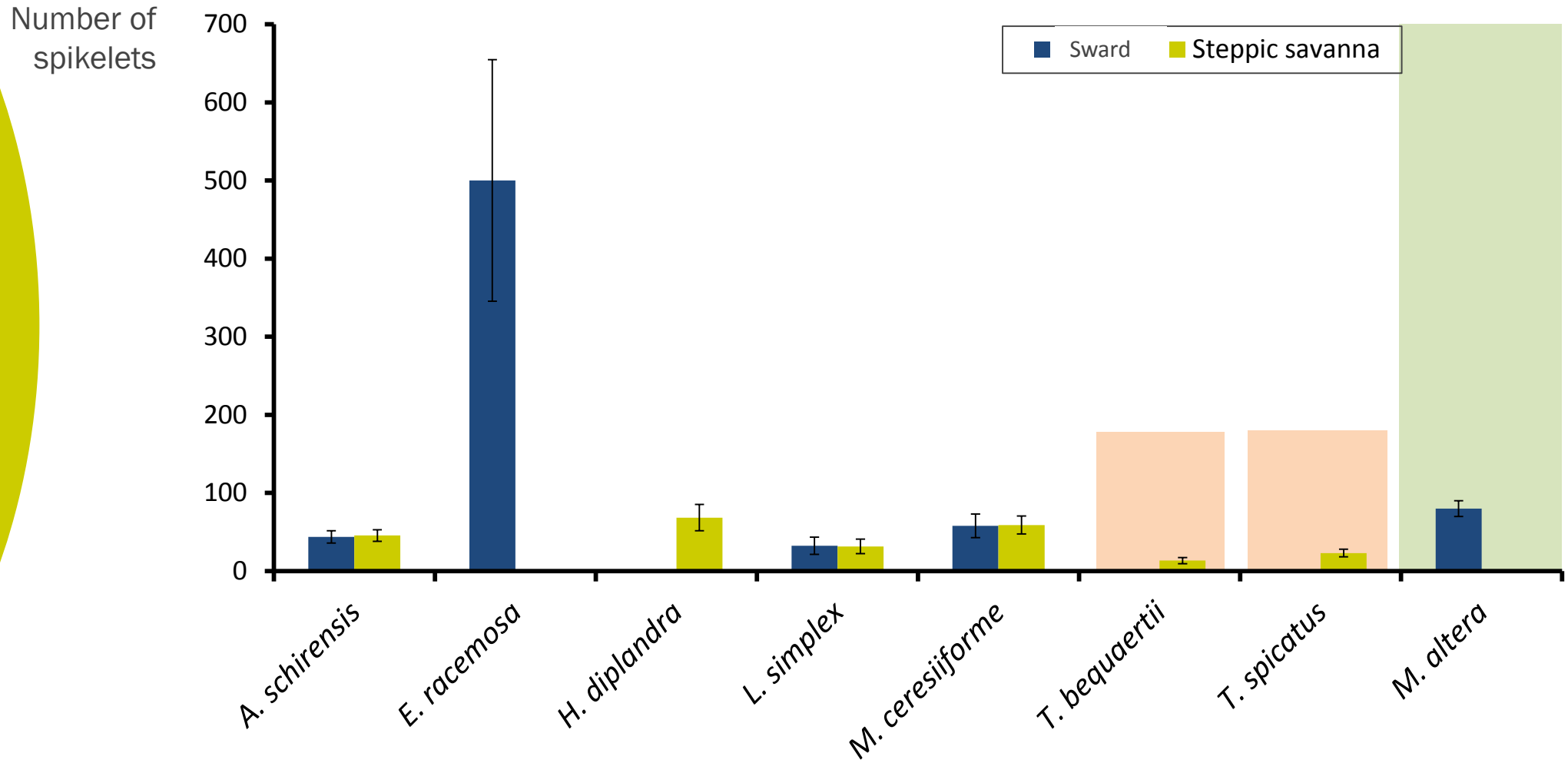

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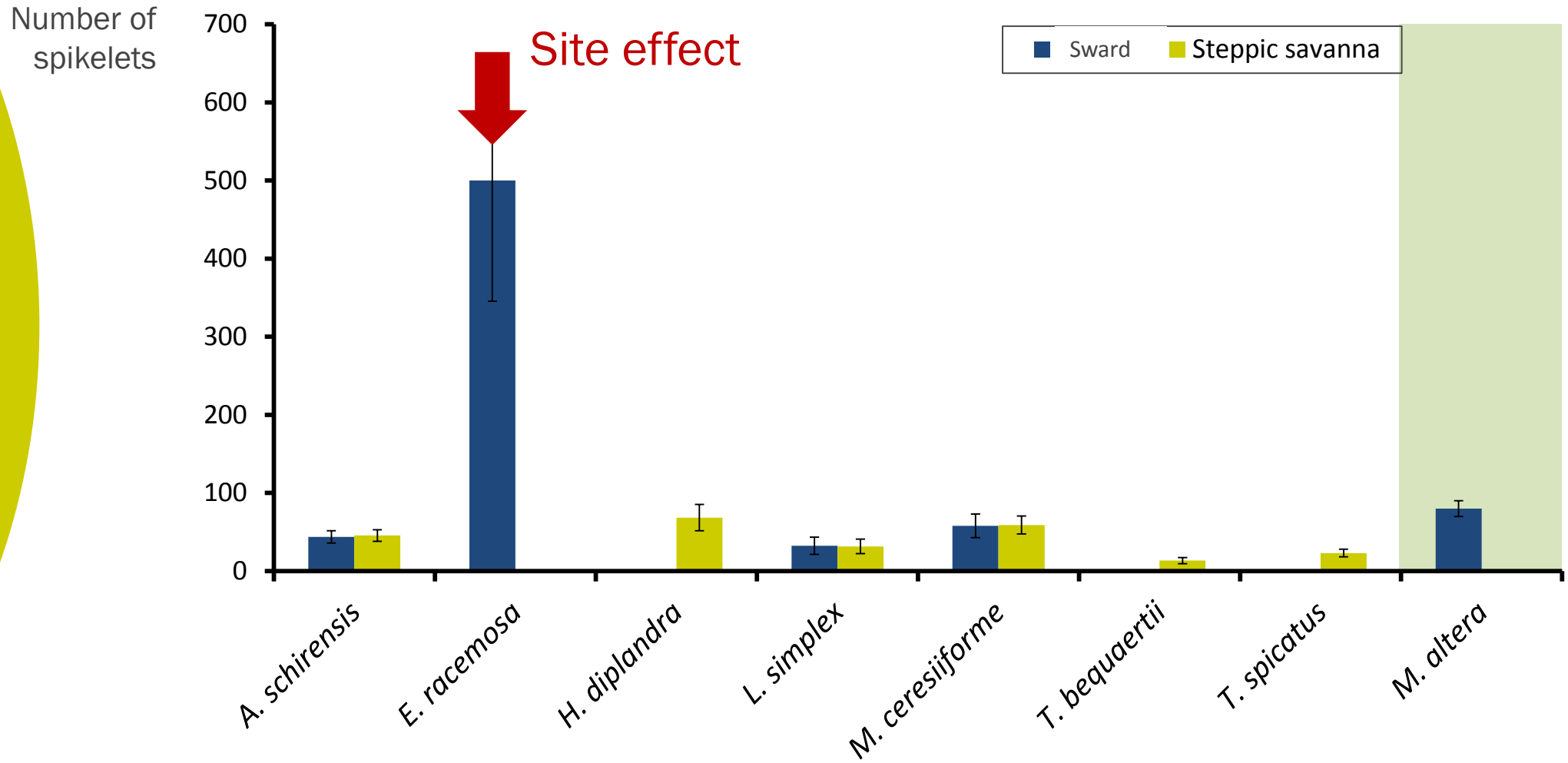

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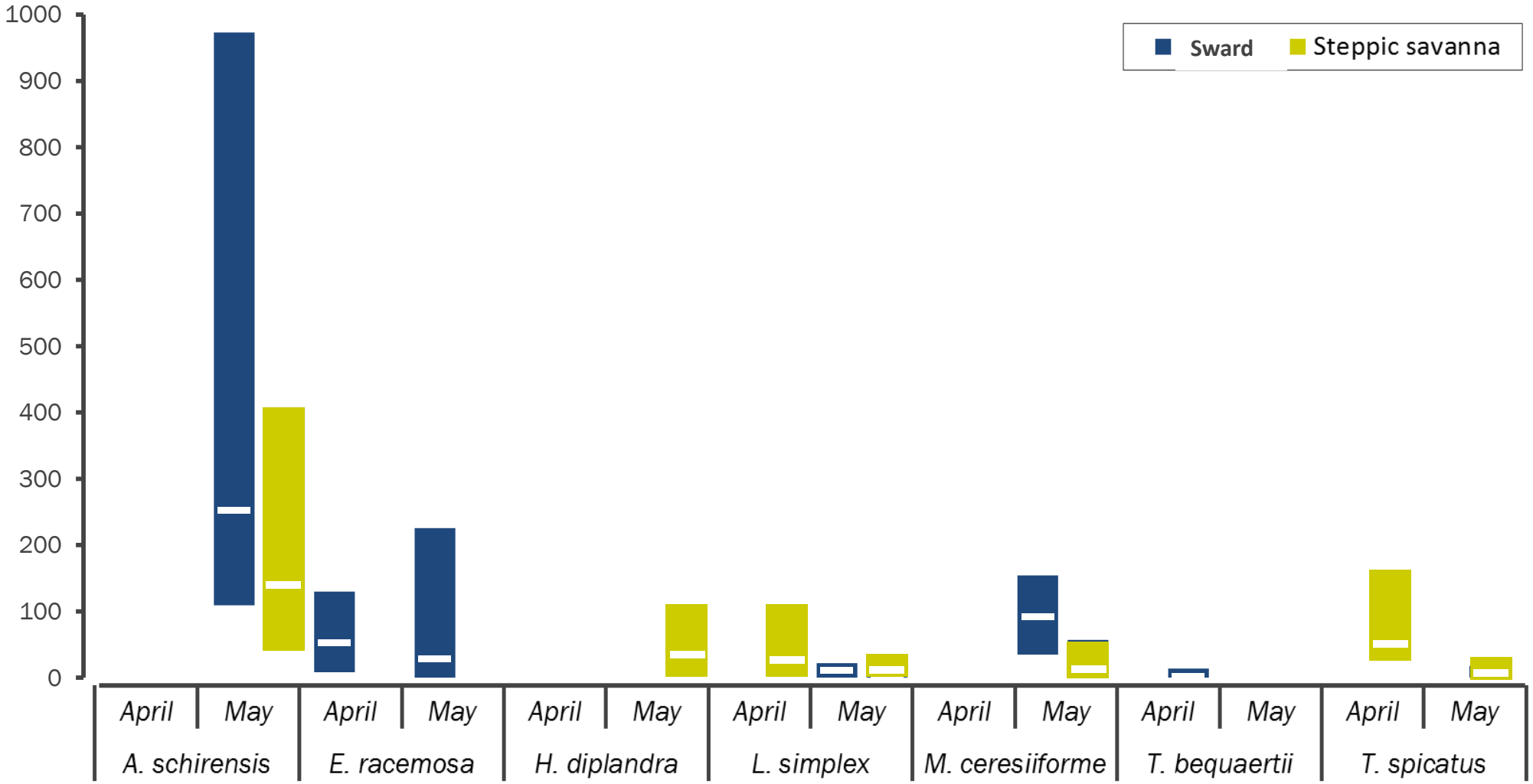
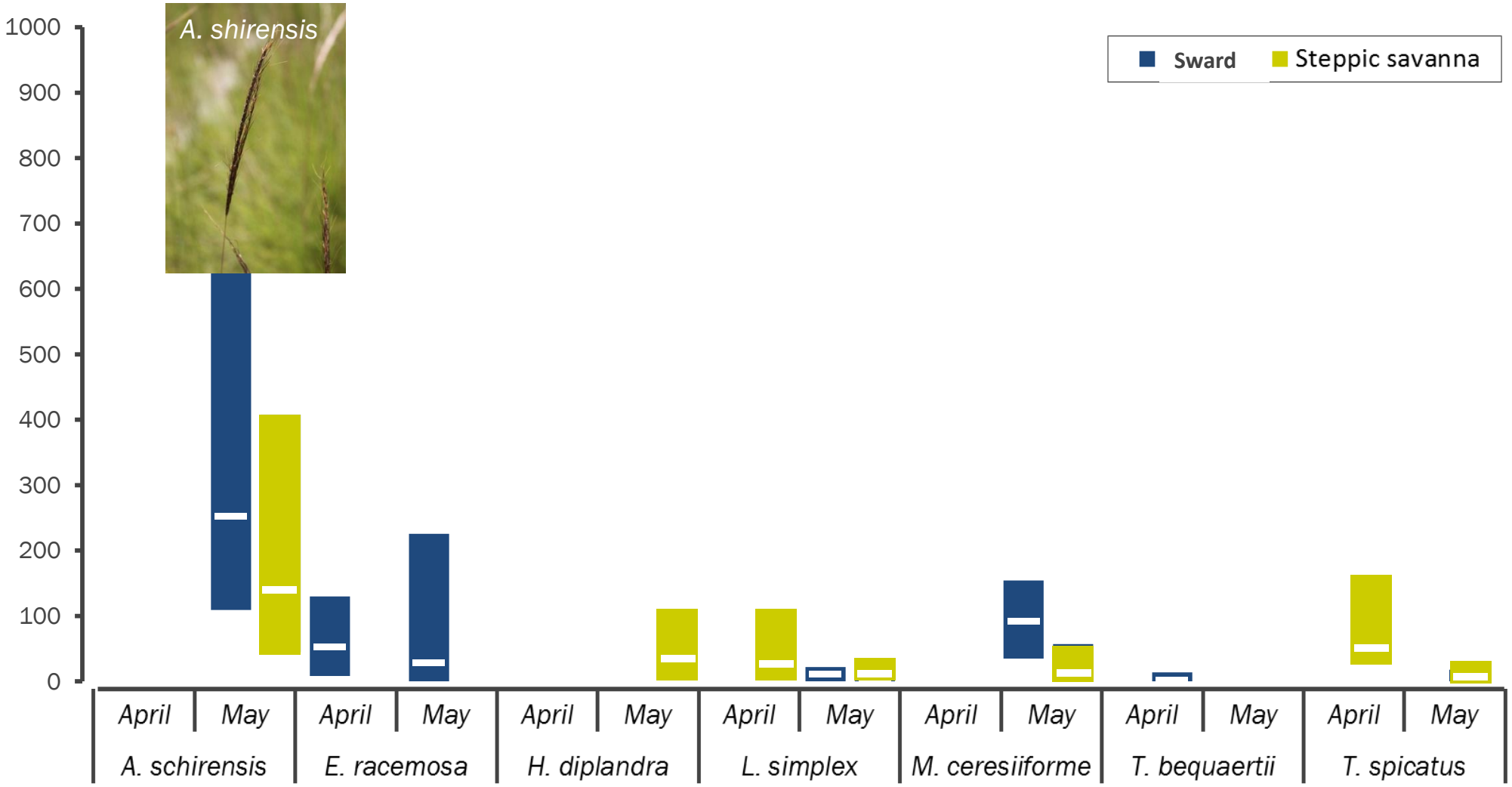
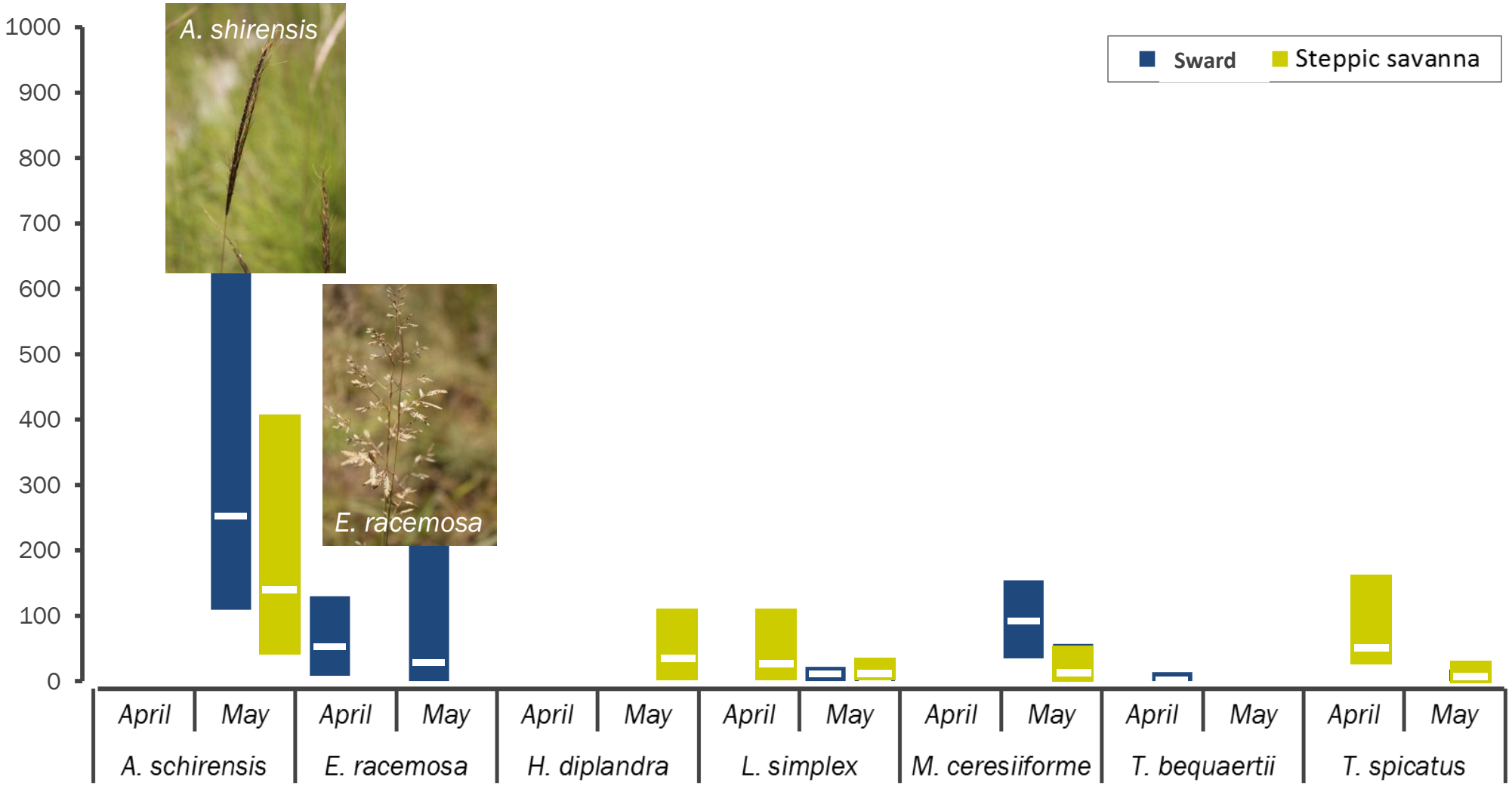
Seeds estimation/m²



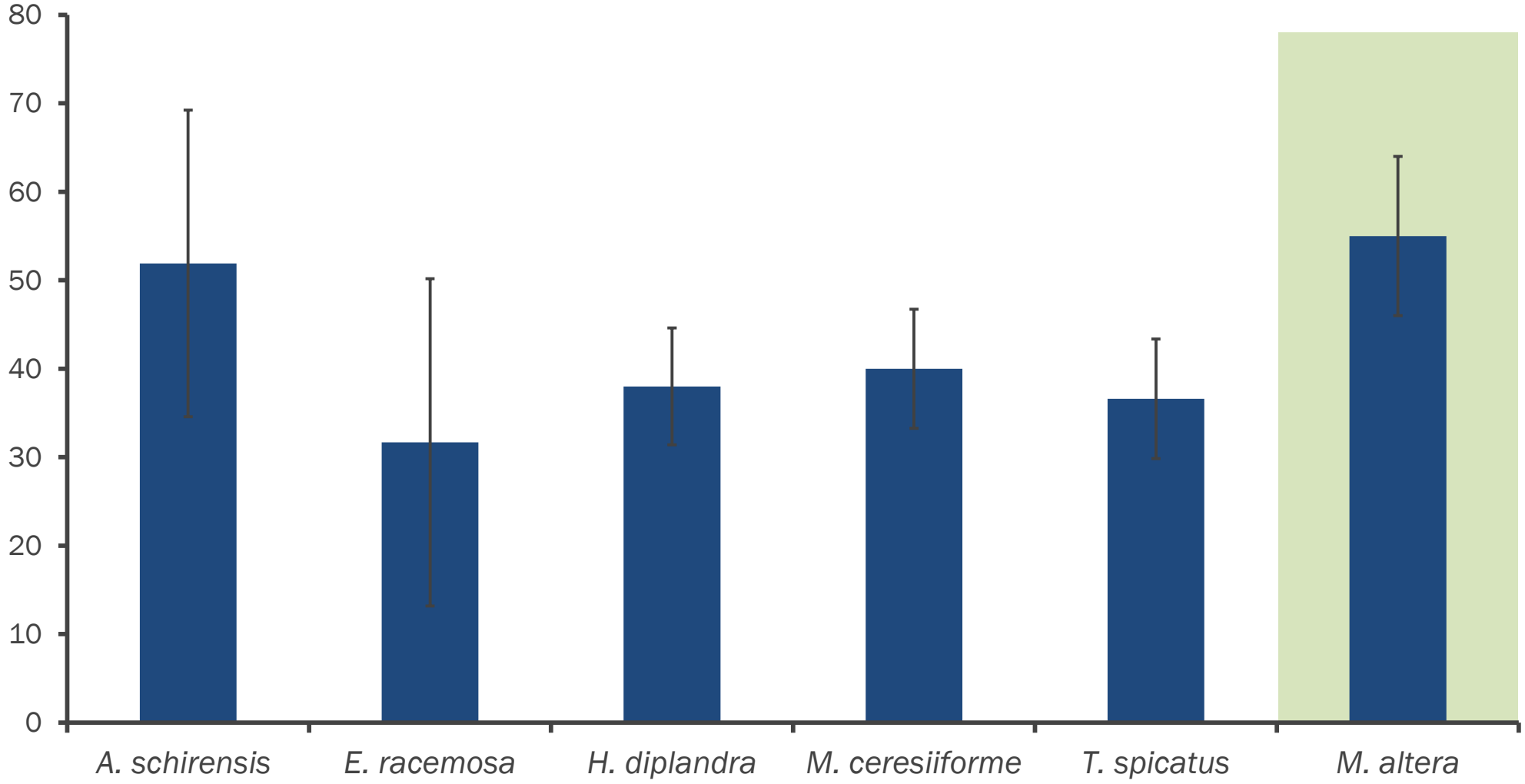
Seeds estimation/m²



Seeds estimation/m²



Germination rate



Data from NBGB & Shutcha, 2013

Interest for phytostabilization

	Fruiting time	Seed production		Vegetation unit	Germination rate	Soil covering	Cu-range (ppm)[1]	Interest in conservation	
		By inflo	By sq.m						
A. schirensis	🟠	🟢	🔵	🟢	🔵	🟠	3000 – 10 000	–	
E. racemosa	🔵	🔴	🔵	🔵	🟠	🟠	6000 – 10 000	Hyperaccumulator	
H. diplandra	🟠	🔴	🟠	🔵	🟠	🔴	0 - 5000	–	
L. simplex	🔵	🟠	🟠	🟢	🟠	🟢	0 - 5000	–	
M. ceresiiforme	🟠	🟠	🟠	🟢	🟠	🔴	2000 - 9000	–	
T. bequaerti	🟠	🔴	🔴	🔵	ND	🔴	0 - 1500	–	
T. spicatus	🔵	🔵	🟠	🔵	🟠	🔴	0 - 4000	–	
M. altera	0	0	ND	0	0	0	3000 - 6000	Hyperaccumulator	

Legend 0 : Reference 🔵 Equal to the R 🟢 More than the R 🟠 Less than the R 🔴 2X less than the R

1 Cu-extractable (min – max)

Conclusion

- Each species has specificities
- 4 candidate species
- For copper species
  - Several criterions
  - Depend on polluted sites

Perspectives

- Candidates species
  - Measures in other sites ? Site effects ?
  - Sowing in polluted areas ?
- Dicotyledons ?

October, 8

Thank you for your attention !

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More informations : **copperflora.org**

Sampling

- Quadrat by species

	Number of quadrats
A. schirensis	60
E. racemosa	24
H. diplandra	24
L. simplex	52
M. ceresiiforme	53
T. bequaerti	18
T. spicatus	33

Absent in one site

Seeds/inflorescence

Introduction

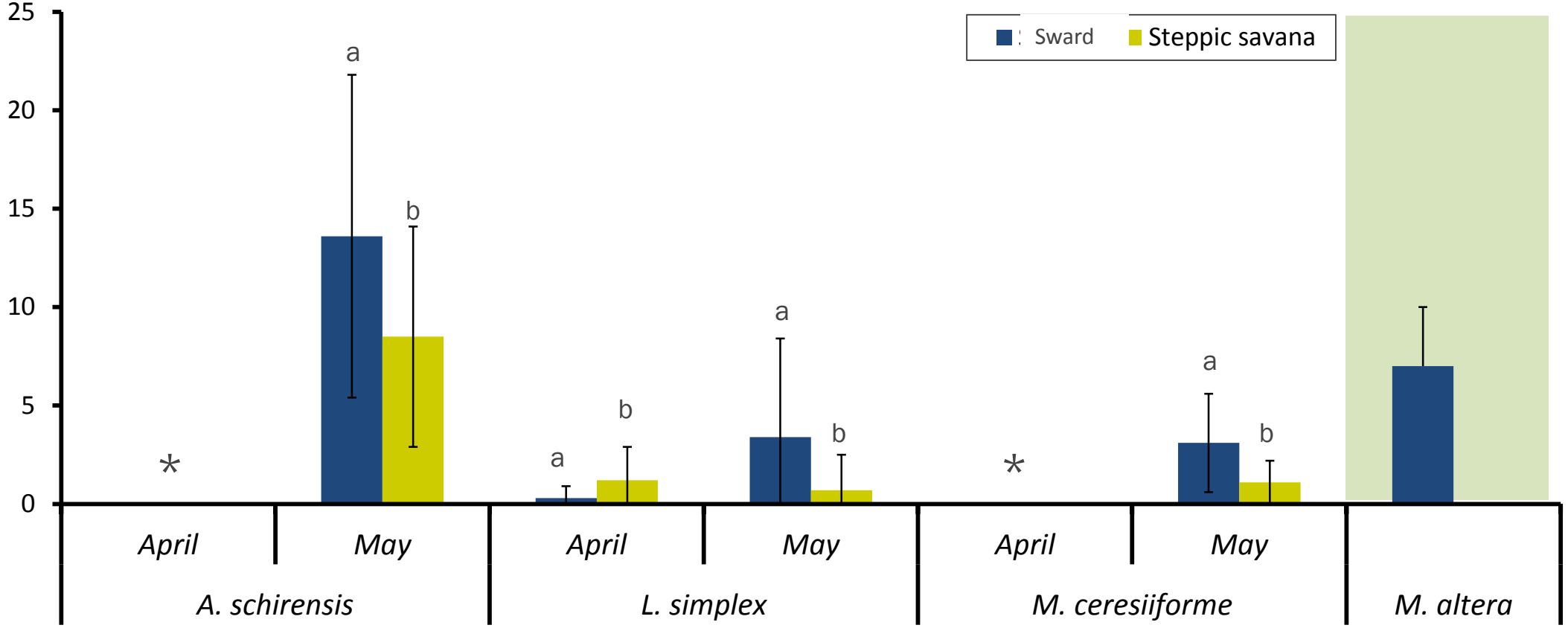
Methods

Results

Summary

Conclusion

Species in two vegetation units



Significant differences between vegetation units

Data from Shutcha, 2013