Table S1. General characterization of the study sites.

Ecosystem	Dominant species	Parent material	Soil texture and fertility	Mean annual precipitation (mm)	Average biomass of standing herbaceous (g m^{-2})	Burning success of annual burn treatment (%)
Dry	*Colophospermum mopane* (Kirk ex Benth.) Kirk ex J. Leonard	Basalt	Clayey nutrient rich soils	480	300	29.8
Intermediate	*Combretum collinum* Fresen. *, C. zeyheri* Sond. and *C. apiculatum* Sond.	Granite	Sandy nutrient poor soils	650	347	75.8
Wet	*Terminalia sericea* Burch. ex DC. and *Dichrostachys cinerea* (L.) Wight & Arn.	Granite	Sandy nutrient poor soils	740	412	70.0

- Average standing biomass is the averaged for 10 years of monitoring (Smith et al., 2013)
- Mean annual precipitation calculated for a 30 years average (Fick & Hijmans, 2017)

Table S2. Raw variables used in this study to describe savanna structure, function and taxonomic diversity.

	Description	Unit
Structure variables		
Dens. woody plants	Density of woody plants (≥0.5m height)	n ha^{-1}
Max. crown area	Maximum crown area of tall woody plants (≥0.5m height)	m^2
M crown area	Maximum crown area of tall woody plants (≥0.5m height)	m^2
Cov. woody veg.	Cover of woody vegetation in the entire ecosystem	%
Cov. herb. veg.	Cover of herbaceous vegetation in the entire ecosystem	%
Cov. litter	Cover of litter	%
Max canopy h	Maximum canopy height of tall woody plants (≥0.5m height)	m
M canopy h	Mean canopy height of tall woody plants (≥0.5m height)	m
Max cbh	Maximum canopy base height of tall woody plants (≥0.5m height)	m
M cbh	Mean canopy base height of tall woody plants (≥0.5m height)	m
Function variables		
S forms	Richness of vascular plant forms (i.e., number of different forms) in the entire ecosystem	Unitless
H forms woody	Shannon diversity index of forms for tall woody vegetation (≥0.5m height)	Unitless
H forms ground	Shannon diversity index of forms in the ground vegetation (<0.5m height)	Unitless
Woody veg. C	Carbon storaged in the woody vegetation (≥0.5m height)	Mg ha^{-1}
Ground veg. C	Carbon storaged in the ground vegetation (<0.5m height)	Mg ha^{-1}
Litter C	Carbon storaged in litter and plant debris	Mg ha^{-1}
BGB C	Carbon storaged in the belowground biomass of the ground vegetation (<0.5m height)	Mg ha^{-1}
Topsoil OC	Organic C storaged in the uppermost 5cm of the mineral soil	Mg ha^{-1}
CN ratio	Ratio between the soil organic carbon and soil total nitrogen	Unitless
NH_4+ plus NO_3^-	Concentration of ammonia nitrates in the uppermost 5cm of the mineral soil	mg kg^{-1}
Extractable P	Concentration of extractable phosphorus in the uppermost 5cm of the mineral soil	mg kg^{-1}
Extractable K	Concentration of extractable potassium in the uppermost 5cm of the mineral soil	mg kg^{-1}
Taxonomic α- and γ-diversity variables		
S sp.	Richness of vascular plant species in the entire ecosystem	Unitless
S fam.	Richness of vascular plant families in the entire ecosystem	Unitless
S sp. woody	Richness of vascular plant species in the woody vegetation (≥0.5m height)	Unitless
S fam. woody	Richness of vascular plant families in the woody vegetation (≥0.5m height)	Unitless
H sp. woody	Shannon diversity index for the vascular plant species in the woody vegetation (≥0.5m height)	Unitless
H fam. woody	Shannon diversity index for the vascular plant families in the woody vegetation (≥0.5m height)	Unitless
S sp. ground	Richness of vascular plant species in the ground vegetation (<0.5m height)	Unitless
S fam. ground	Richness of vascular plant families in the ground vegetation (<0.5m height)	Unitless
H sp. ground	Shannon diversity index for the vascular plant species in the ground vegetation (<0.5m height)	Unitless
H fam. ground	Shannon diversity index for the vascular plant families in the ground vegetation (<0.5m height)	Unitless
		Unitless
Taxonomic β-diversity variables		
JD sp.	Turnover based on Jaccard distance over species presence-absence in the entire ecosystem	Unitless

JD fam.	Turnover based on Jaccard distance over families presence-absence in the entire ecosystem	Unitless
JD sp. woody	Turnover based on Jaccard distance over species presence-absence in the woody vegetation (≥0.5m height)	Unitless
JD fam. woody	Turnover based on Jaccard distance over families presence-absence in the woody vegetation (≥0.5m height)	Unitless
BC sp. woody	Turnover based on Bray-Curtis dissimilarities over species relative cover in the woody vegetation (≥0.5m height)	Unitless
BC fam. woody	Turnover based on Bray-Curtis dissimilarities over families relative cover in the woody vegetation (≥0.5m height)	Unitless
JD sp. ground	Turnover based on Jaccard distance over species presence-absence in the ground vegetation (<0.5m height)	Unitless
JD fam. ground	Turnover based on Jaccard distance over families presence-absence in the ground vegetation (<0.5m height)	Unitless
BC sp. ground	Turnover based on Bray-Curtis dissimilarities over species relative cover in the ground vegetation (<0.5m height)	Unitless
BC fam. ground	Turnover based on Bray-Curtis dissimilarities over families relative cover in the ground vegetation (<0.5m height)	Unitless

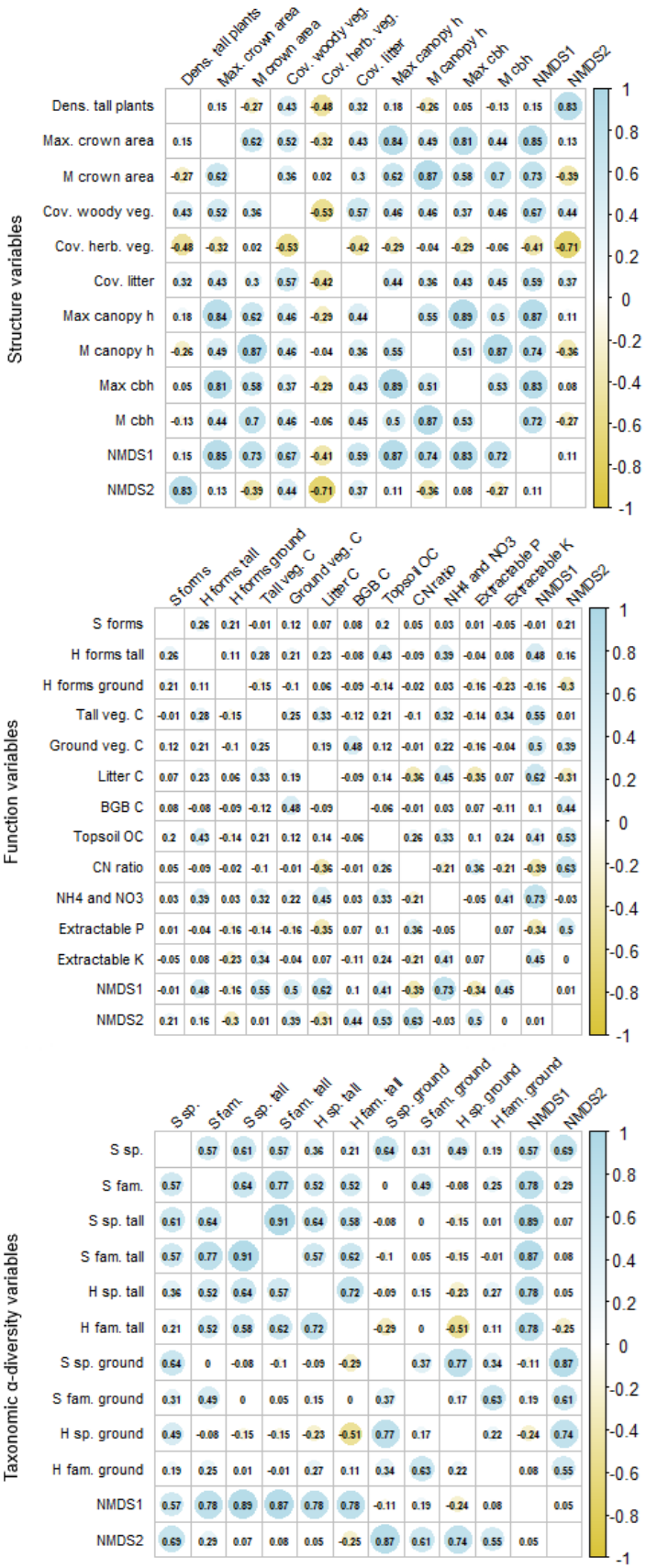

Fig. S1. Matrixes showing the Spearman's coefficients of the correlations between the studied structural (top), function (center) and taxonomic α-diversity variables. NMDS1 and NMDS2 represent the axis of the corresponding ordinations (see Fig. 2a, 2d, 2g).

Table S3. Spearman correlation coefficients between fire frequency and the two axis of the non-metric multidimensional scaling ordinations performed for ecosystem structure, function and taxonomic α-diversity metrics.

	Axis	Correlation coefficient (ρ)	P
Structure	1	-0.53	**0.000**
	2	-0.06	0.661
Function	1	-0.67	**0.000**
	2	0.23	0.116
Taxonomic α-diversity	1	-0.47	**0.001**
	2	0.02	0.883

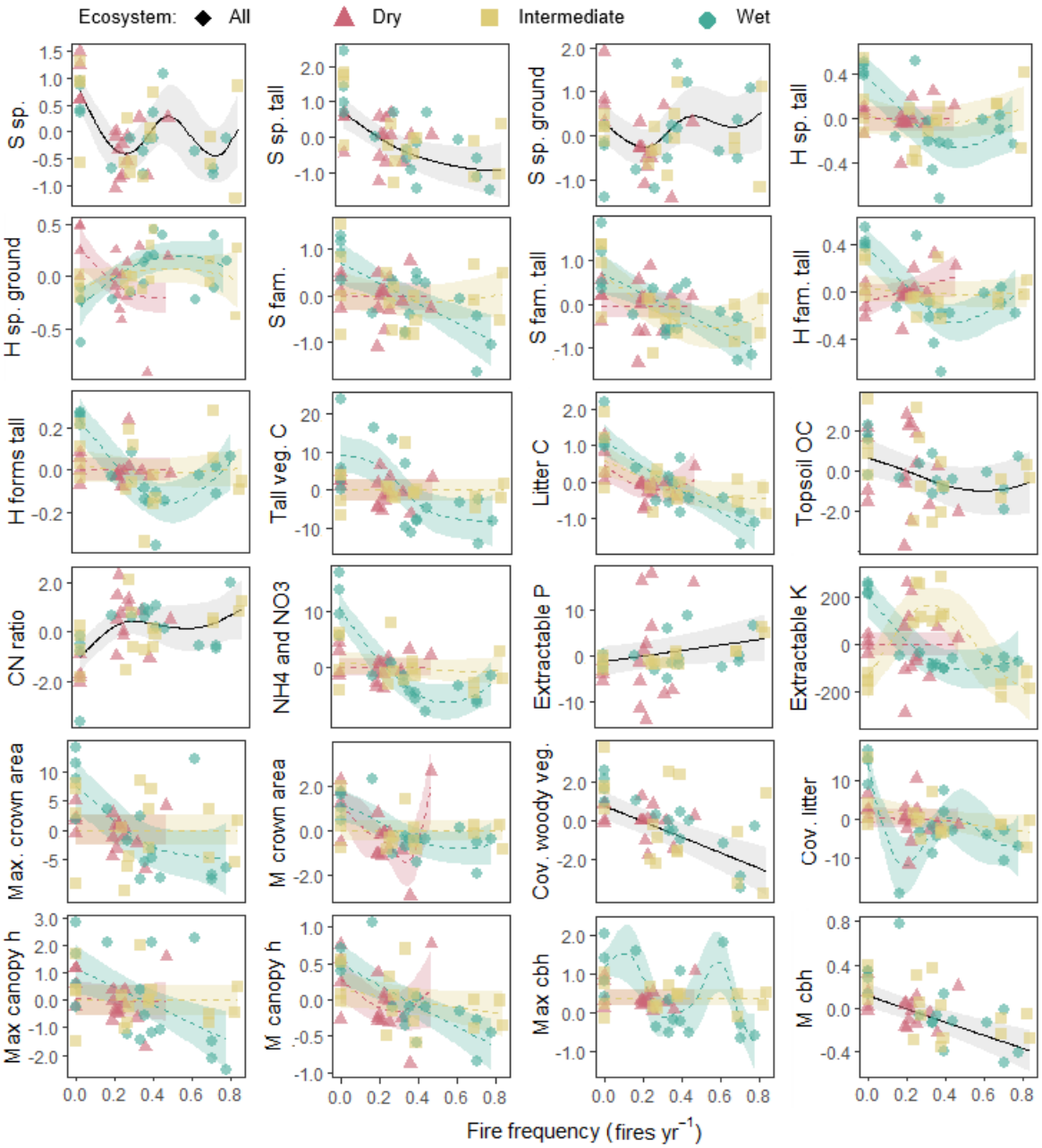

Fig. S2. Mean (± 95% confidence interval) predicted values for each of the studied variables (residualized by string) in response to frequency. The interaction was retained in the generalized additive models only when significantly improved the model performance (P <0.05). Variables not significantly affected by fire frequency (P <0.05) are not shown in the panel. S: richness, H: Shannon diversity index, sp.: species, fam: families, OC: organic carbon, Max.: maximum, M: mean, Cov: cover, h: height, cbh: canopy base height. Variable units are available in Table S1.

Table. S4. Results of the permutational analysis of variance (PERMANOVA) exploring the effects of fire frequency on plant community composition. Species (sp.) and families presence-absence data were compared using Jaccard Distance (JD) matrices, and relative covers using Bray Curtis (BC) dissimilarity matrices. Analyses were performed for the entire community, for the tall stratum (woody vegetation ≥ 0.5m) and ground vegetation (vegetation < 0.5m).

Response distance matrix	Predictor	R^2	F	P
JD sp.	Fire frequency	0.04	3.17	**0.002**
	Fire frequency : ecosystem	0.04	1.38	0.062
JD fam.	Fire frequency	0.03	2.17	**0.029**
	Fire frequency : ecosystem	0.02	0.81	0.695
JD sp. woody	Fire frequency	0.05	3.52	**0.001**
	Fire frequency : ecosystem	0.03	0.99	0.464
JD fam. woody	Fire frequency	0.03	2.39	**0.021**
	Fire frequency : ecosystem	0.02	0.89	0.563
BC sp. woody	Fire frequency	0.06	6.41	**0.001**
	Fire frequency : ecosystem	0.04	1.80	0.069
BC fam. woody	Fire frequency	0.07	6.85	**0.001**
	Fire frequency : ecosystem	0.04	2.00	0.061
JD sp. ground	Fire frequency	0.04	2.88	**0.002**
	Fire frequency : ecosystem	0.04	1.31	0.108
JD fam. ground	Fire frequency	0.02	0.99	0.433
	Fire frequency : ecosystem	0.02	0.53	0.961
BC sp. ground	Fire frequency	0.06	5.03	**0.001**
	Fire frequency : ecosystem	0.05	2.01	**0.008**
BC fam. ground	Fire frequency	0.02	0.76	0.560
	Fire frequency : ecosystem	0.02	1.55	0.776

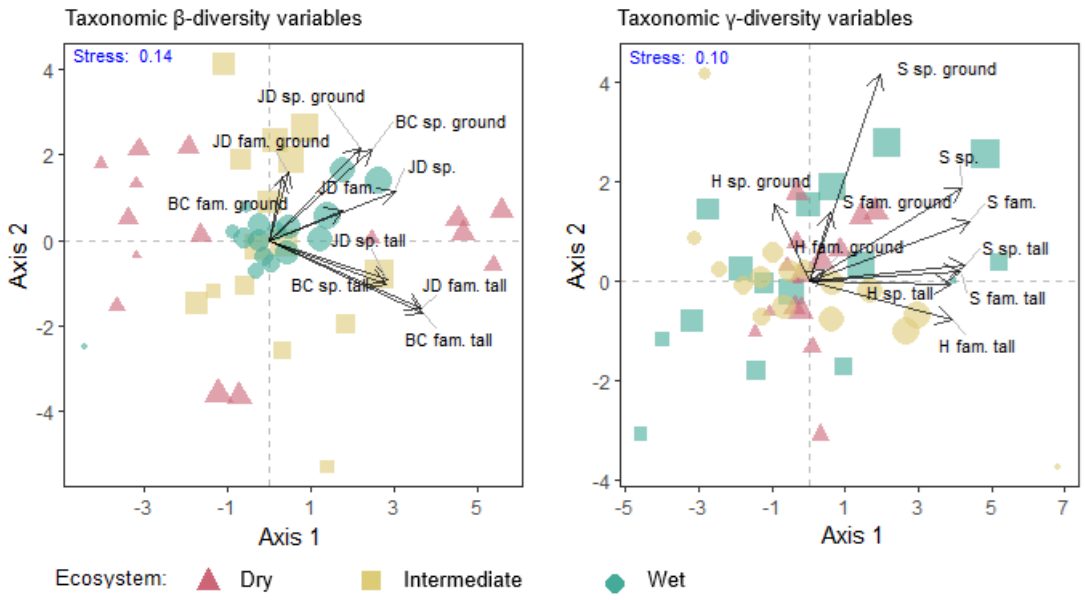

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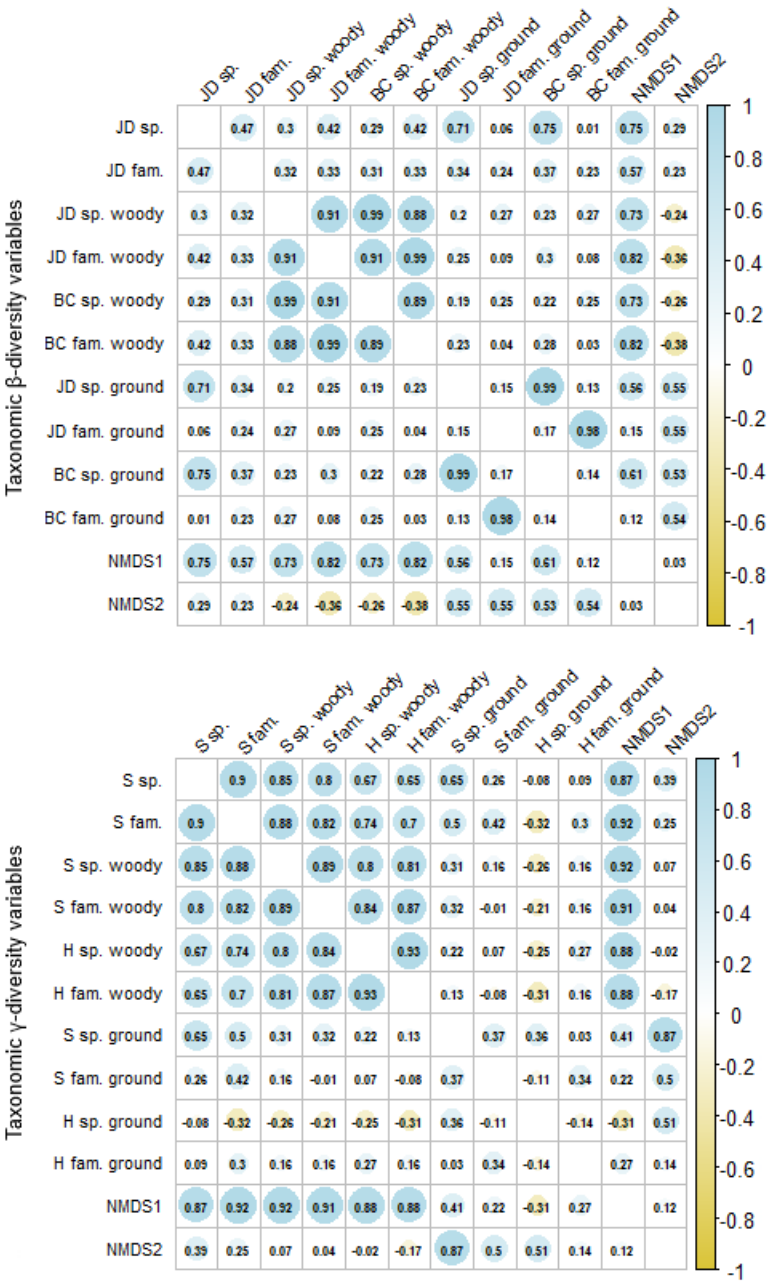
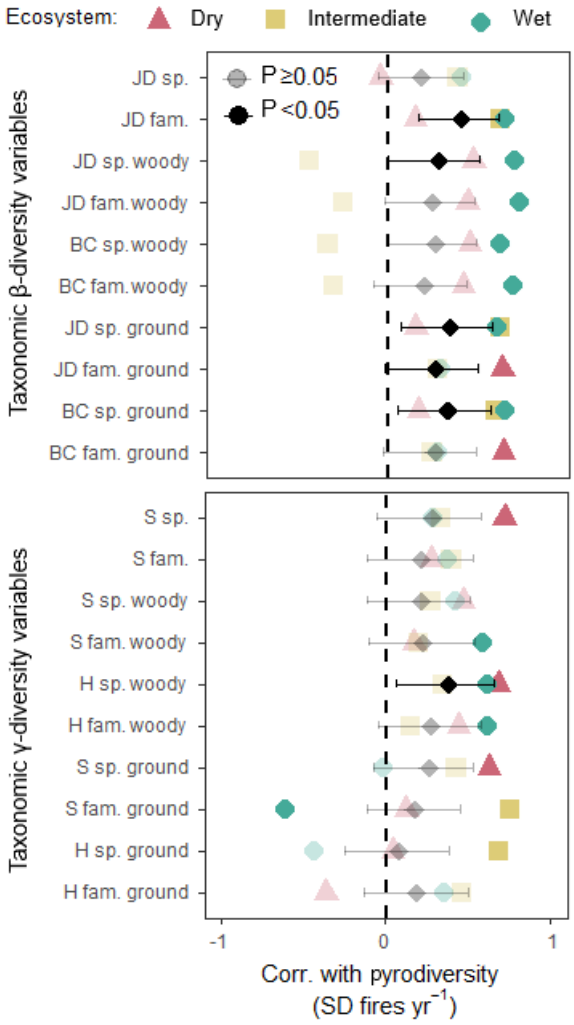
Fig. S3. Non-metric multidimensional scaling ordinations for β-diversity variables (left) and γ-diversity variables (right). Arrows indicate the direction and strength (length of the arrow) of the Spearman correlation of each variable with the two main ordination axes, and the size of the dots is proportional to pyrodiversity.



35 **Fig. S4.** Matrixes showing the Spearman's coefficients of the correlations between the studied β-diversity (top), and γ-diversity variables. NMDS1 and NMDS2 represent the axis of the corresponding ordinations (see Fig. S3).



40 **Fig. S5.** Spearman correlation coefficients (± 95% confidence intervals) and significance of the correlations between fire frequency and each of the taxonomic β-diversity and taxonomic γ-diversity raw variables. JC: Jaccard Distance, BC: Bray-Curtis dissimilarity, sp.: species, fam.: families, S: richness, H: Shannon diversity index.

Table S5. Spearman correlation coefficients between fire frequency and the axis of the non-metric multidimensional scaling ordinations performed for ecosystem taxonomic β-diversity and Taxonomic γ-diversity. Ordinations are available in Fig. S3.

	Axis	Correlation coefficient (ρ)	P
Taxonomic β-diversity	1	0.44	0.003
	2	0.25	0.094
Taxonomic γ-diversity	1	0.31	0.034
	2	0.25	0.085

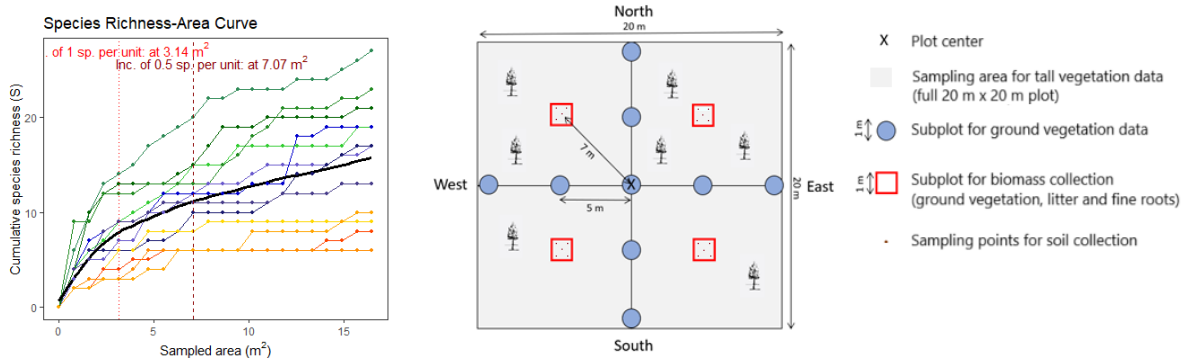


Fig. S6. The panel over the left shows the species richness-area curves obtained in one string per ecosystem. Each string is represented by a different color, with blue tones being the wet savanna, green tones the intermediate and yellow tones the dry savanna. The dotted lines in this panel show areas at which increases in one sampling unit ($1m^2$ subplot) led to increases in one and 0.5 species, respectively according to the loess curve fitting all the data (black line). The more conservative threshold (increases of less than 0.5 species per new subplot) was used to fix the size of the field sampling plots to 20 × 20 m, as shown in the panel over the right.