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Supplementary Information Appendix A: Supplementary figures (Figs. S1-S5)

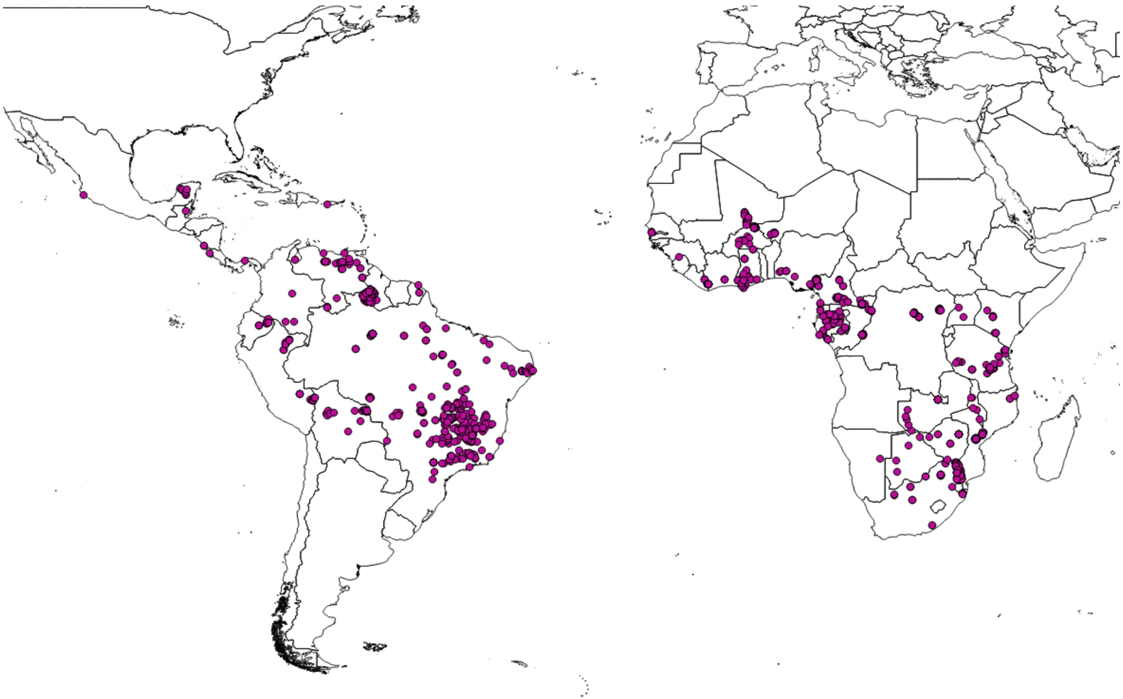

Fig. S1: Location of the 1,125 plots included in this study.

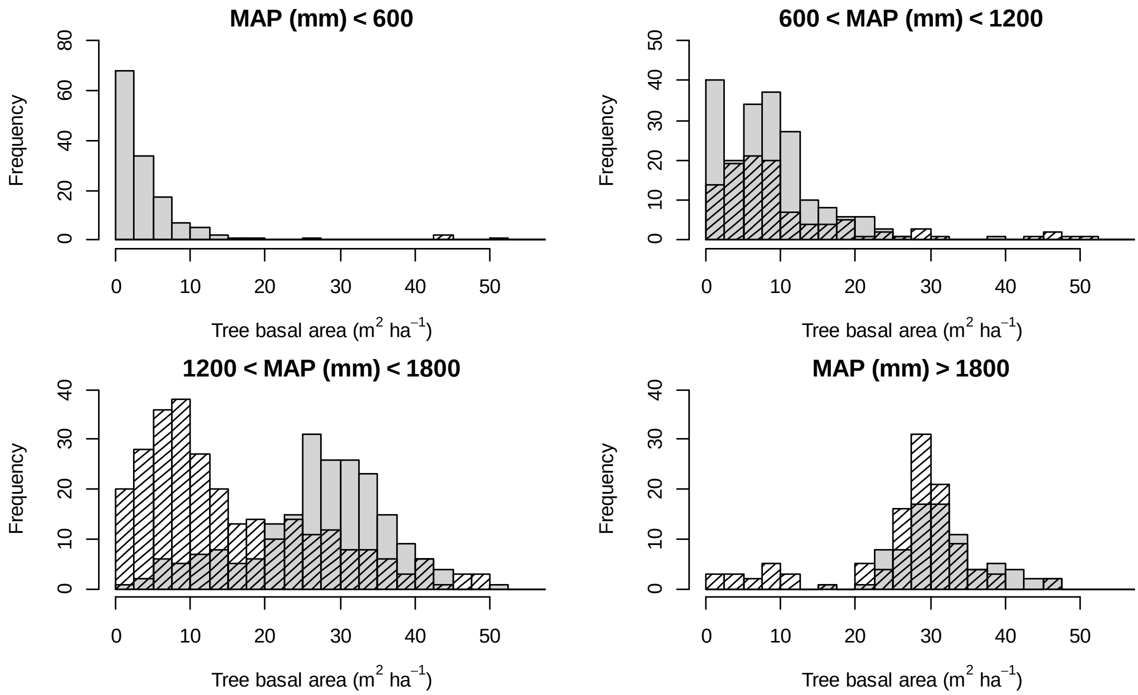

Fig S2: Frequency distribution of tree basal area within different mean annual precipitation (MAP) ranges for Afrotropical (grey bars) and Neotropical (hatched bars) communities. Below 600 mm, there is only one peak associated with wooded grasslands (WG) in Africa. Between 600 and 1200 mm, WG still occur but savannas emerge in both continents. Between 1200 and 1800 mm, the stability of savannas drops in the Afrotropics while that of forest highly increases; WG practically disappears. In contrast, the stability of both savannas and forests increase in the Neotropics, but that of savanna increases proportionally faster. Finally, above 1800 mm, savannas disappear from the Afrotropics while still persisting in the Neotropics.

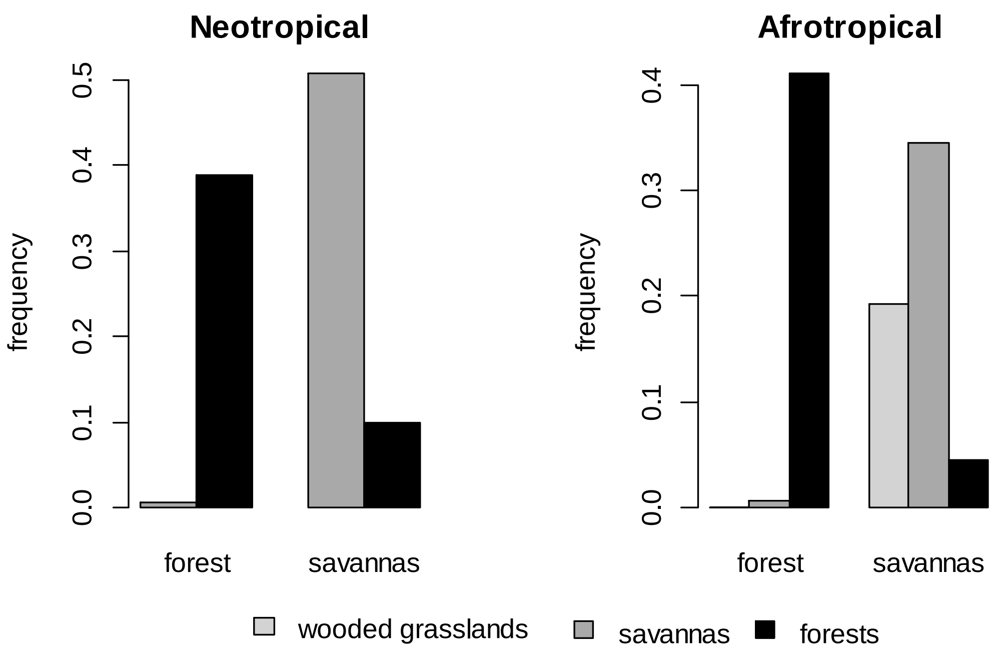

Fig. S3: Frequency of coincidence between field-based classification (between forest and savanna) and the results of the state detection analysis (SDA). SDA was performed using hierarchical clustering for parameterized Gaussian mixture models on tree basal area data, classifying communities into: wooded grasslands (light grey), savannas (dark grey) and forests (black). Field-based classifications were obtained from the articles from which the data were compiled. Although field-based studies have a strong floristic bias, the classifications matched in most cases.

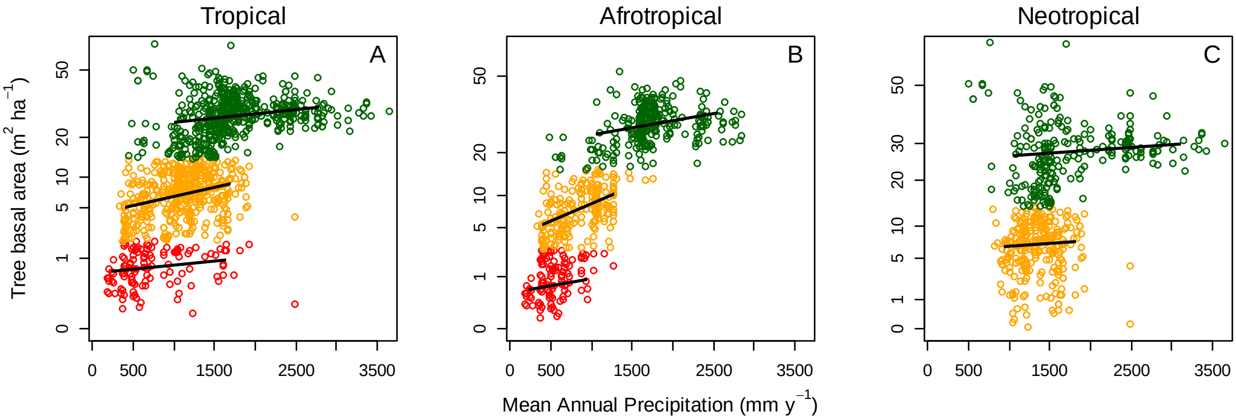

Figure S4: Split regression modelling (ANCOVA) results for tree basal area against mean annual precipitation. The y-axes were power transformed using the boxcox method. The split is based in the state regression analysis result (Fig. 1A-C; Table S1 and S2). Red: wooded grasslands; Orange: savannas; Green: forests.

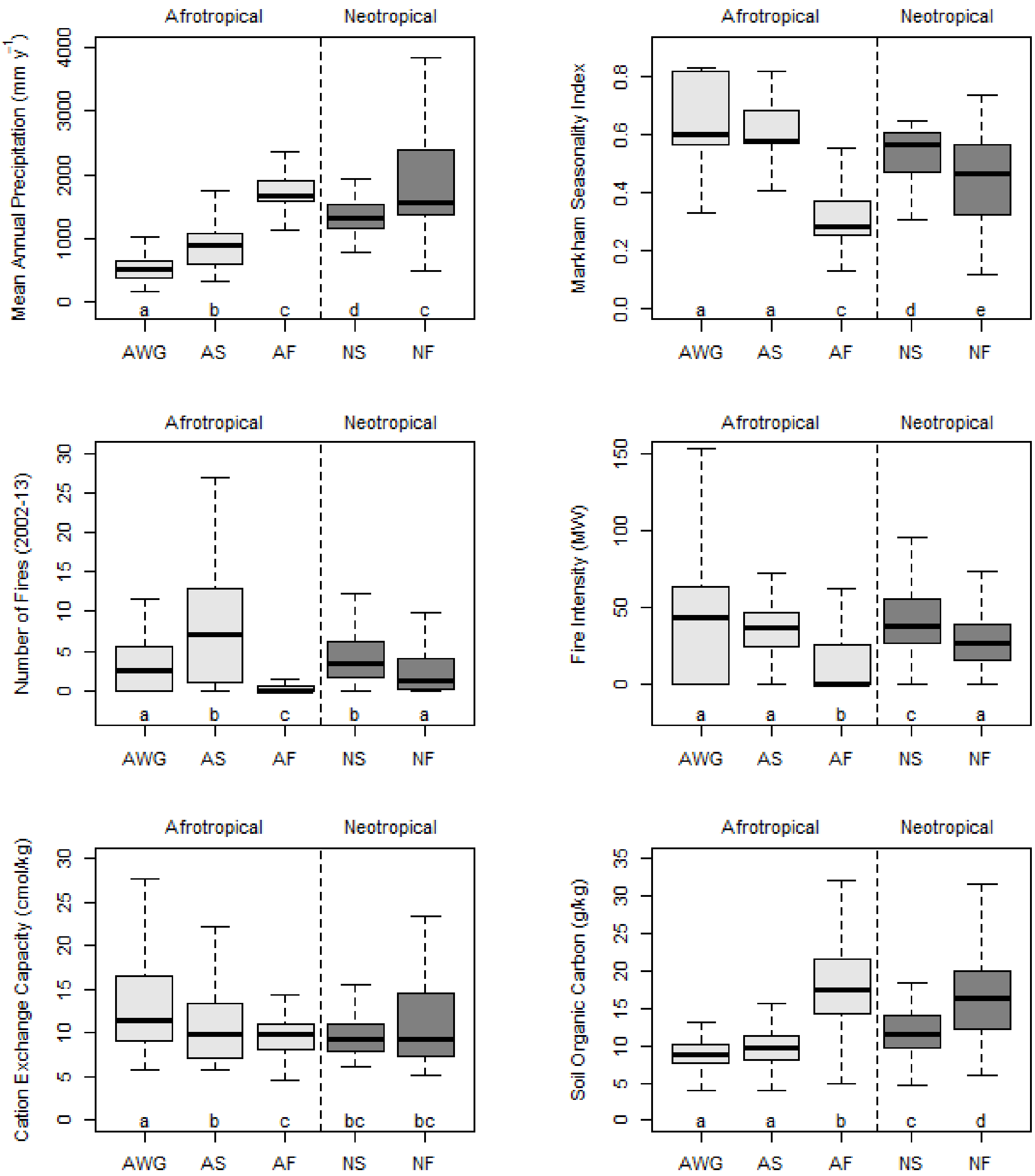

Figure S5: Boxplots showing differences in environmental and disturbance conditions among Afrotropical (light grey) and Neotropical (dark grey) biome states. Different letter indicate significant differences in Tuckey's pairwise comparison. Detailed results are shown in Table S6. Outliers are not shown. AWG: Afrotropical wooded grasslands; AS: Afrotropical savannas; AF: Afrotropical forests; NS: Neotropical savannas; NF: Neotropical forests.

Supplementary Information Appendix B: Supplementary Materials and Methods
Supplementary Materials and Methods

Tree Basal Area data

The tree basal area data used in this study was compiled from 74 published studies. Specifically, whereas data for tropical America was obtained from 73 studies (Campbell *et al.* 1986; Korning, Thomsen & Ollgaard 1991; Smith & Killeen 1995; Felfili 1995; Coomes & Grubb 1996; Oliveira-filho *et al.* 1998; Kellman, Tackaberry & Rigg 1998; Killeen *et al.* 1998; Berg & Oliveira-Filho 2000; Sampaio, Walter & Felfili 2000; Bertani *et al.* 2001; Oliveira-Filho *et al.* 2001, 2004, 2007; Botrel *et al.* 2002; Marimon, Felfili & Lima 2002; Moreno, Nascimento & Kurtz 2003; Moreno, Schiavini & Haridasan 2008; Nunes *et al.* 2003; Quigley & Platt 2003; Silva & Scariot 2003, 2004; Silva *et al.* 2003, 2004, 2005; Silva, Higuchi & van den Berg 2010; Souza *et al.* 2003; Andrade & Rodal 2004; Dalanesi *et al.* 2004; Gomes, Martins & Tamashiro 2004; Nascimento, Felfili & Meirelles 2004; Pereira-Silva *et al.* 2004; White & Hood 2004; Malhi *et al.* 2004; Dezzeo *et al.* 2004; Carvalho, van den Berg & Fernandes 2012; Guarino & Walter 2005; Pinto & Hay 2005; Rocha *et al.* 2005; Veneklaas *et al.* 2005; Carvalho *et al.* 2005, 2007; Ferraz & Rodal 2006; Haugaasen & Peres 2006; Rodal & Nascimento 2006; González-Rivas *et al.* 2006; Fagundes, Carvalho & Berg 2007; Felfili *et al.* 2007; Lopes & Schiavini 2007; Meguro *et al.* 2007; Neri *et al.* 2007; Paiva, Araújo & Pedroni 2007; Costa Junior *et al.* 2008; Guimarães *et al.* 2008; Roitman, Felfili & Rezende 2008; Conceição & Castro 2009; Dias Neto *et al.* 2009; Silva & Araújo 2009; Siqueira *et al.* 2009; Filho *et al.* 2010; Matos & Felfili 2010; Rodrigues *et al.* 2010; Barbosa *et al.* 2011; Fontes & Walter 2011; Franczak *et al.* 2011; Mews *et al.* 2011; Prado Júnior *et al.* 2011; Campos *et al.* 2011; Carvalho & Felfili 2011; Valente *et al.* 2011; Loschi *et al.* 2013; Lehmann *et al.* 2014; Mitchard *et al.* 2014), data for Africa was obtained from two studies (Lewis *et al.* 2013; Lehmann *et al.* 2014). Although most of the studies included trees with trunk diameters equal to or greater than 3 or 5 cm, some of the studies did not include individuals below 10 or, to lesser extent, below 15 or 20 cm. Although small trees should make a very minor contribution to TBA, these different sampling schemes could potentially result in an underestimation of TBA values in some plots with low TBA. To ensure that there were no biases in the data, we calculated an adjusted tree basal area index based on tropical studies applying a range of inclusion criteria for the same sampling. These studies included for Neotropical studies (Botrel *et al.* 2002; Cummings *et al.* 2002; Dezzeo & Chacón 2006; Carvalho, Bernacci & Coelho 2013) and one study from India (Swamy *et al.* 2000). This approach consisted in adding an estimated fixed proportion of the TBA value for each five cm increase in the minimal inclusion diameter. This metric was strongly correlated with the raw data ($r = 0.996$; $P < 0.001$) and the results were basically the same as those with the original data. Therefore, only results using the raw data are presented. It is also important to notice that small mismatch in the spatial and temporal scale at which tree basal area and environmental data was recorded is an inherent feature of this type of broad scale study.

Soil Data

Besides gathering soil data from the Soil Grid Dataset (SGD), we also obtained data from the African Soil Grid Dataset (ASGD; 250 m of spatial resolution; http://africasoils.net). The ASGD data was highly correlated with the data from SGD in our plot locations (r = 0. 72-0.84 for the chemical features and 0.63 for texture, all with

$P < 0.001$). Because the ASGD is currently available to Africa only and to allow a better comparison with Neotropical data we did all the statistical analysis using the SGD.

Grazing Data

We used data from (Hempson *et al.* 2014) to see how grazer biomass changed with precipitation and compare the patterns with the precipitation limits of the biome states detected in the state detection analysis (see Fig. 4). Specifically, we extracted grazer biomass data in relation to precipitation from Fig. 2 (Hempson *et al.* 2014) using web plot digitalizer (Rohatgi 2014). Even though these data is a combination of both wild animals and livestock biomasses (Archibald *et al.* 2009), the carrying capacity of savannas is the main factor controlling both wild herbivore and livestock biomasses while management practices have insignificant effects (Fritz & Duncan 1994). Therefore, we assume that this data reflects the way grazer biomass changes with precipitation under natural conditions.

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Supplementary Information Appendix C: Supplementary tables (Tables S1-S6)

Table S1: State detection analysis results using tree basal area data. The number of states was determined using hierarchical clustering for parameterized Gaussian mixture models. Colum numbers represent candidate number of groups (states). The selected models (in bold) are those presenting the lowest Integrated Completed Likelihood criteria (ICL).

	ICL				
	1	2	3	4	5
Tropical	8969.431	8642.78	**8601.08**	9019.72	9149.79
Afrotropical	4948.629	4691.41	**4654.51**	4904.09	4930.69
Neotropical	4030.557	**3934.18**	4096.27	4189.68	4124.66

Table S2: Results of the likelihood-ratio test for bimodality between adjacent detected modes (see Fig. 1A-C and Table S1) in Afrotropical and the Neotropical communities. WG: wooded grasslands; S: savannas; F: forests.

	Tropical		**Afrotropical**		**Neotropical**	
	LR	**P***	**LR**	**P***	**LR**	**P***
WG-S	56.49	<0.001	63.62	<0.001	-	-
S-F	472.71	<0.001	170.57	<0.001	177.31	<0.001

*P ≤ 0.05 indicate a significant bimodality.

Table S3: Model comparison between continuous models (i.e. linearized multiple regression) and split models (i.e. ANCOVA) of tree basal area against the Resource Availability Index. The Resource Availability Indices (RAI) are described in details in Table S4 for each continent. λ and Xtrans refer to the transformation selected to TBA and the RAI axes, respectively, in order to linearize the associations (see methods). The same transformations used in the continuous models are used in the split models. The P values in the last column refer to ANOVA results for continuous vs. split model comparison. ALL: tropical; AFR: Afrotropical; NEO: Neotropical.

			Continuous model				**Split model**				**L vs. S model**		
	λ	**Xtrans**	**R2adj**	**P**	**BIC**	**AICc**	**R2adj**	**P**	**BIC**	**AICc**	**ΔBIC**	**ΔAICc**	**P**
ALL	0.48	none	0.52	<0.001	3429.20	3404.15	0.88	<0.001	1936.04	1871.10	1493.16	1533.06	<0.001
AFR	0.58	none	0.76	<0.001	2062.39	2040.38	0.92	<0.001	1399.47	1342.59	662.92	697.78	<0.001
NEO	0.44	Recip	0.28	<0.001	1492.94	1471.93	0.78	<0.001	907.07	869.42	585.86	602.52	<0.001

Table S4: Results of the principal component analyses used to derive the three axes of the Resource Availability Indices. The variables included in the PCAs of each biogeographic context (tropical, Afrotropical and Neotropical) are those of the multiple regression model (with tree basal area as response) presenting the lowest Akaike Information Criteria (ΔAIC of 5.21, 2.85 and 3.56, respectively). TRO: tropical (both Neotropical and Afrotropical) communities; AFR: Afrotropical communities; NEO: Neotropical communities. PE: proportion explained; PC: significant positive correlates; NC: significant negative correlates. map: mean annual precipitation; msi: Markham Seasonality Index; cec: soil cation exchange capacity; soc: soil organic carbon; maxt: maximum annual temperature; mint: minimal annual precipitation.

		PC1	**PC2**	**PC3**
TRO	**PE**	0.68129	0.18512	0.07695
	PC	map, soc	cec, pH	-
	NC	msi, cec, pH	map, msi	map, msi, cec, soc, pH
AFR	**PE**	0.6258	0.21127	0.07673
	PC	map, soc, mint	Cec	map, msi, soc
	NC	msi, cec, maxt	msi, mint, maxt	cec, mint, maxt
NEO	**PE**	0.5202	0.25635	0.12905
	PC	map, soc, mint	cec, pH, mint	map, cec, soc
	NC	msi, pH	Map	msi, mint

Table S5: Wilcoxon rank sum test results comparing fire regimes between biome states within shared fractions of the resource space. The shared fractions were defined as those in which the Resource Availability Index hypervolume of two biome states overlap (see Fig. 2 and Table 2). NF: Number of active Fire records (2002-13); FI: Fire Intensity (MW); WG: wooded grasslands; S: savannas; F: forests.

Fire	**Afrotropical**						**Neotropical**	
	WG vs. S		**WG vs. F**		**S vs. F**		**S vs. F**	
	W	**P**	**W**	**P**	**W**	**P**	**W**	**P**
NF	5934	<0.001	644	0.002	20906	<0.001	27243	<0.001
FI	10648	0.074	1327	0.156	20173	<0.001	26457	<0.001

Table S6: ANOVA results comparing environment and disturbance predictors among all biome states. Different letter indicate significant differences in Tukey's pairwise comparisons. AWG: Afrotropical wooded grasslands; AS: Afrotropical savannas; AF: Afrotropical forests; NS: Neotropical savannas; NF: neotropical forests. MAP: Mean Annual Precipitation; MSI: Markham Seasonality Index; MinT: minimal annual temperature; MaxT: maximal annual temperature; NF: Number of active Fire records (2002-13); FI: fire intensity; SOC: soil organic carbon; CEC: cation exchange capacity; and Sand: soil sand percentage.

	Vegetation State					ANOVA	
	AWG	**AS**	**AF**	**NS**	**NF**	**F**	**P**
MAP (mm)	549.02±218.37[a]	853.38±297.97[b]	1737.97±423.36[c]	1352.47±276.6[d]	1821.5±664.97[c]	461.0	<0.001
MSI	0.65±0.12[a]	0.60±0.13[a]	0.32±0.14[b]	0.53±0.09[c]	0.44±0.13[d]	221.4	<0.001
MinT (^{o}C)	10.62±4.01[a]	10.73±4.73[a]	18.08±2.93[b]	14.99±4.07[c]	15.92±4.43[c]	119.7	<0.001
MaxT (^{o}C)	34.89±4.88[a]	33.21±3.42[b]	31.46±1.68[c]	31.10±2.14[c]	31.06±2.30[c]	52.5	<0.001
NF (fires y^{-1})	3.95±4.82[a]	7.58±6.70[b]	1.37±3.39[c]	4.23±3.46[b]	2.69±3.41[a]	96.3	<0.001
FI (MW)	45.18±39.95[a]	36.30±26.19[a]	11.59±+16.00[b]	47.03±73.76[c]	30.04±24.11[a]	99.7	<0.001
SOC (g kg^{-1})	9.15±3.33[a]	10.06±3.27[a]	18.78±7.62[b]	12.06±3.64[c]	17.00±7.66[d]	167.6	<0.001
CEC (cmol kg^{-1})	13.28±6.14[a]	12.22±8.52[b]	9.98±2.98[c]	10.73±5.00[bc]	11.56±5.79[bc]	8.4	<0.001
pH	4.88±0.36[a]	4.45±0.66[b]	3.38±0.44[c]	4.04±0.43[d]	3.58±0.67[e]	235.1	<0.001
Sand (%)	73.89±18.79[a]	74.69±16.19[a]	62.21±11.21[b]	62.96±9.52[b]	58.24±8.63[c]	59.3	<0.001