Table S1. Chemical and mineralogical characterization of the Oxisols [21].

Soils	pH_{KCl}	pH_{H2O}	ΔpH	CEC	H+Al	Al^{3+}	Ca^{2+}	Mg^{2+}	K^+	SB	P
						$cmol_c\ kg^{-1}$					$mg\ kg^{-1}$
P1	5.24±0.05	5.30±0.02	-0.05±0.05	4.51±0.15	4.08±0.11	0.43±0.03	0.26±0.03	0.14±0.02	0.04±0.005	0.44±0.05	1.01±0.11
P2	5.30±0.02	5.27±0.03	0.03±0.02	3.34±0.10	3.19±0.10	0.47±0.02	0.05±0.01	0.07±0.02	0.03±0.004	0.15±0.02	0.76±0.07
P3	4.18±0.03	4.64±0.05	-0.46±0.03	9.37±0.61	8.98±0.64	2.08±0.23	0.08±0.03	0.28±0.15	0.04±0.001	0.40±0.17	0.93±0.14

					CBD		OAA			SOC
Solos	K	Gb	Gt	Hm	Fe_2O_3	Al_2O_3	Fe_2O_3	Al_2O_3	Fe_o/Fe_d	$g\ kg^{-1}$
		$g\ kg^{-1}$				$g\ kg^{-1}$				
P1	227.20±6.52	285.56±5.53	70.20±6.37	120.58±6.37	190.78±4.43	13.89±0.62	0.93±0.05	1.27±0.05	0.003	9.71±0.83
P2	370.37±4.34	209.02±3.35	51.48±7.28	132.52±7.28	184.00±1.46	11.55±0.26	0.81±0.13	0.83±0.04	0.003	7.10±0.93
P3	218.43±5.89	169.99±0.02	72.68±1.65	50.16±1.65	122.84±1.43	25.25±3.16	0.61±0.07	1.51±0.05	0.004	16.96±1.03

K: kaolinite; Gb: gibbsite; Gt: goethite; Hm: hematite; CBD: citrate-bicarbonate-dithionite method; OAA: ammonium oxalate method; SOC: soil organic carbon; Fe_o/Fe_d: ratio of poorly and well crystallized iron oxides. Methods described in [32] and detailed in [21]. Mean values were compared with their respective 95% confidence intervals.

Table S2. Additional information about the general description of the Oxisols and the Bw horizons studied.

(P1) Latossolo Vermelho Distroférrico típico/Rhodic Haplustox	Bw 110 cm - red (10 R 2.5/2, wet); very clayey; small to very small microgranular (microaggregates); friable; plastic and sticky. Additional information about Bw horizon of soil profile: Structure: Gr Size: Very small Degree: Strong Mineralogy: K, Gb, Gt, Hm Ratio – Hm/(Hm+Gt): 0.63 K: kaolinite; Gb: gibbsite; Hm: hematite; Gt: goethite; Hm/(Hm + Gt) relations between minerals; Gr: microgranular structure. Profile described by: Thaís Nascimento Pessoa

(P2) Latossolo Vermelho Acriférrico típico/Anionic Acrustox	Bw 80+ cm - red (2.5 YR 2.5/3, wet); very clayey; medium subangular block that breaks up into small to very small microgranular (microaggregates); friable; plastic and slightly sticky.
	Additional information about Bw horizon of soil profile: Structure: Sb Size: Small Degree: Moderate Mineralogy: K, Gb, Gt, Hm Ratio - Hm/(Hm+Gt): 0.72 K: kaolinite; Gb: gibbsite; Hm: hematite; Gt: goethite; Hm/(Hm + Gt) relations between minerals; Sb: structure in subangular blocks, that breaks up into very small microgranular. Observations: intense biological activity in the profile. Profile described by: Thaís Nascimento Pessoa

(P3) Latossolo Bruno Distrófico típico/Typic Hapludox

Bw1 135 - 170 cm - red (2.5 YR 4/6, wet); very clayey; moderate large subangular block that crumbles into small to very small subangular block (microaggregates); friable; very plastic and very sticky; diffuse and clear transition.

Additional information about Bw horizon of soil profile:
Structure: Sb
Size: Large/moderate
Degree: Strong
Mineralogy: K, Gb, Gt, Hm, V
Ratio - Hm/(Hm+Gt): 0.72

K: kaolinite; Gb: gibbsite; Hm: hematite; Gt: goethite; V: vermiculite with hydroxy-Al; Hm/(Hm + Gt) relations between minerals; Sb: structure in subangular blocks.

Observations: intense termite biological activity throughout the profile.

Profile described by: Flávio A. Marques and Márcia Regina Calegari

Table S3. Pearson's correlation matrix for pore size distribution, parameters from 3D image analysis, and physical, chemical, and mineralogical attributes.

	20-100 μm	100-300 μm	300-500 μm	500-700 μm	>700 μm	FC	PWP	K_{sat}	EN_{total}	EN_{big}	$Surf_{Dens}$	SOC	Clay	SSA	Gt	Hm	Gb	K
20-100 μm	1																	
100-300 μm	-0.20	1																
300-500 μm	-0.84	0.70	1															
500-700 μm	-0.99	0.29	0.89	1														
>700 μm	-0.22	-0.91	-0.35	0.12	1													
FC	-1.00	0.29	0.89	0.99*	0.12	1												
PWP	-0.99	0.33	0.91	0.99*	0.08	0.99*	1											
K_{sat}	0.99	-0.35	-0.91	-0.99*	-0.06	-0.99*	-0.99*	1										
EN_{total}	-0.10	-0.95	-0.46	0.01	0.99	0.01	-0.03	0.05	1									
EN_{big}	-0.99*	0.25	0.87	0.99*	0.17	0.99*	1.00	-0.99	0.05	1								
$Surf_{Dens}$	0.98	-0.38	-0.93	-0.99	-0.03	-0.99	-0.99*	0.99*	0.09	-0.99	1							
SOC	-0.98	0.00	0.72	0.96	0.41	0.96	0.94	-0.94	0.30	0.97	-0.93	1						
Clay	-0.79	0.75	1.00	0.85	-0.42	0.85	0.87	-0.88	-0.53	0.82	-0.89	0.66	1					
SSA	-0.97	0.44	0.95	0.99	-0.04	0.99	0.99	-0.99	-0.16	0.98	-0.99*	0.90	0.92	1				
Gt	-0.64	-0.63	0.12	0.56	0.89	0.56	0.53	-0.51	0.83	0.60	-0.48	0.78	0.04	0.42	1			
Hm	0.99*	-0.13	-0.80	-0.99	-0.29	-0.99	-0.98	0.97	-0.18	-0.99	0.97	-0.99	-0.75	-0.95	-0.69	1		
Gb	0.72	-0.82	-0.98	-0.78	0.52	-0.78	-0.81	0.82	0.62	-0.75	0.84	-0.57	-0.99	-0.87	0.08	0.66	1	
K	0.59	0.67	-0.06	-0.51	-0.91	-0.51	-0.48	0.46	-0.86	-0.55	0.43	-0.74	0.02	-0.37	-0.99*	0.65	-0.13	1

FC: field capacity (-10 kPa); PWP: permanent wilting point (-1500 kPa); K_{sat}: saturated hydraulic conductivity; EN_{total}: Euler number for total sample; $EN_{bigpore}$: Euler number for the biggest connected pore; $Surf_{Dens}$: surface density; SOC: soil organic carbon; SSA: specific surface area; Gt: goethite; Hm: hematite; Gb: gibbsite; K: kaolinite. *Significant for $p < 0.05$.

Table S4. Results of eigenvalues and eigenvectors extracted from the principal components analysis (PCA).

Variables	PC1	PC2
Eigenvalues	12.65	5.35
Explained variance (%)	70.28	29.72
Accumulated variance (%)	70.28	100
Eigenvectors		
100-20 μm	-0.28	-0.06
100-300 μm	0.10	-0.41
300-500 μm	0.26	-0.18
500-700 μm	0.28	0.02
>700 μm	0.02	0.43
FC	0.28	0.02
PWP	0.28	0.00
K_{sat}	-0.28	0.00
EN_{total}	-0.01	0.43
EN_{big}	0.28	0.04
$Surf_{Dens}$	-0.28	0.02
SOC	0.26	0.15
Clay	0.25	-0.21
SSA	0.28	-0.05
Gt	0.15	0.37
Hm	-0.27	-0.09
Gb	-0.23	0.25
K	-0.13	-0.38