

# Supplementary Materials

## Supplementary Tables

Table S1 briefly summarizes the climatology of the region. Note that dynamic wetland mapping is not incorporated into the land cover comparison here since wetland areal extent changes depending on the time of year. For land cover type comparisons of annual and interannual rainfall differences, masking permanent wetland areas from the MODIS MCD12Q1 Version 6 IGBP classification is sufficient. For analyses at finer temporal resolutions, dynamic wetland classification is used to define wetland areal extent (Figures 16 through 18).

**Table S1.** Mean seasonal and annual accumulated precipitation for each land cover type

Year	Land Cover Type*	Rainy Season Period (November to October)	Rainy Season Mean Precipitation (mm/season)	Dry Season Mean Precipitation (mm/season)	Annual** Mean Precipitation (mm/yr)
2009	All Land Cover	2009–2010	970.28	87.62	1020.92
	Miombo		994.23	96.85	1063.06
	Woody Savanna		1262.08	126.58	1303.98
	Grass Savanna		862.81	70.19	912.20
	Barren/Built-up		1113.65	104.40	1189.69
	Permanent Wetlands		873.45	70.80	895.49
2010	All Land Cover	2010–2011	952.93	54.03	1023.82
	Miombo		964.44	53.29	1024.96
	Woody Savanna		1154.25	104.04	1351.15
	Grass Savanna		881.52	36.12	910.11
	Barren/Built-up		1052.49	60.04	1171.89
	Permanent Wetlands		965.55	32.61	938.92
2011	All Land Cover	2011–2012	869.33	49.52	973.16
	Miombo		858.14	51.89	982.28
	Woody Savanna		1112.14	83.28	1180.56
	Grass Savanna		790.21	36.76	899.49
	Barren/Built-up		1021.98	68.68	1088.07
	Permanent Wetlands		780.00	31.58	963.74
2012	All Land Cover	2012–2013	784.56	61.25	894.93
	Miombo		760.65	59.19	872.40
	Woody Savanna		1060.61	109.24	1187.21
	Grass Savanna		696.99	44.81	802.86
	Barren/Built-up		958.76	70.99	1074.52
	Permanent Wetlands		686.44	44.33	762.20
2013	All Land Cover	2013–2014	973.50	57.41	899.79
	Miombo		975.56	58.11	876.16
	Woody Savanna		1203.54	97.26	1188.27
	Grass Savanna		897.38	43.61	810.70
	Barren/Built-up		1084.71	81.80	1048.45
	Permanent Wetlands		880.46	42.35	801.36
2014	All Land Cover	2014–2015	725.31	49.08	966.00
	Miombo		758.45	51.35	990.83
	Woody Savanna		1008.32	91.87	1262.36
	Grass Savanna		623.66	34.25	862.97
	Barren/Built-up		867.89	80.24	1148.62
	Permanent Wetlands		580.16	27.29	863.42
2015	All Land Cover	2015–2016	803.95	43.18	768.38
	Miombo		824.94	47.12	822.24
	Woody Savanna		1086.95	85.36	1141.58
	Grass Savanna		708.52	28.25	633.73

	Barren/Built-up		903.21	59.93	926.78
	Permanent Wetlands		737.07	26.70	606.99
2016	All Land Cover	2016–2017	936.01	59.84	885.68
	Miombo		946.19	60.56	889.97
	Woody Savanna		1186.55	126.42	1193.57
	Grass Savanna		855.05	38.22	787.78
	Barren/Built-up		1097.61	88.04	1012.61
	Permanent Wetlands		818.46	31.35	791.97
2017	All Land Cover	2017–2018	910.02	66.42	1020.98
	Miombo		914.71	72.64	1042.64
	Woody Savanna		1179.21	113.54	1346.67
	Grass Savanna		826.98	49.79	915.23
	Barren/Built-up		1057.42	85.76	1203.66
	Permanent Wetlands		844.05	52.35	914.59
2018	All Land Cover	2018–2019	819.00	66.29	961.39
	Miombo		840.38	68.36	950.18
	Woody Savanna		1171.21	114.99	1290.78
	Grass Savanna		701.55	49.95	860.42
	Barren/Built-up		1012.08	83.50	1141.88
	Permanent Wetlands		633.60	58.76	858.06

\* Since the dynamic wetland mapping changes depending on the time of year, MCD12Q1 annual land cover was used to identify permanent wetland areas. The areas corresponding to other land cover types are masked here based on the remaining land cover pixels after permanent wetland are masked out. \*\* Annual precipitation here is accumulated over the calendar year, from January to December.

Based on the mean albedo values for grass savanna listed in Table S2 and the mean annual calendar year precipitation for grass savanna listed in Table S1, grass savanna land cover exhibits the largest interannual variability in albedo. Miombo and woody savanna albedo values are more consistent from year to year, which may be attributed to more extensive lateral root systems and vertical tap roots associated with trees and woody plants in this region. Albedo values for grass savanna increase in drier years (i.e., 2015 and 2016 albedo values are relatively high for grass savanna with the least amount of accumulated rainfall relative to other years in the study period), as expected for increased bare soil exposure as grass savanna plants experience water stress.

**Table S2.** Mean albedo values and accumulated precipitation (JFMA, MJJAS, OND) for each land cover type

Year	Land Cover Type*	Annual Mean Albedo (12:00 Local Time)	JFMA** Mean Precipitation (mm/period)	MJJAS ** Mean Precipitation (mm/period)	OND** Mean Precipitation (mm/period)
2009	All Land Cover	0.13	574.99	39.15	364.82
	Miombo	0.13	558.23	42.56	385.29
	Woody Savanna	0.11	697.15	51.69	524.72
	Grass Savanna	0.13	540.46	33.92	303.41
	Barren/Built-up	0.14	576.83	40.17	379.93
	Permanent Wetlands	0.10	547.25	38.39	280.15
2010	All Land Cover	0.13	610.25	15.49	356.95
	Miombo	0.13	585.55	15.70	350.54
	Woody Savanna	0.11	779.66	27.87	512.36
	Grass Savanna	0.13	560.30	10.91	304.35
	Barren/Built-up	0.15	568.35	11.37	347.22
	Permanent Wetlands	0.10	593.53	15.64	299.18
2011	All Land Cover	0.13	593.10	15.30	323.55
	Miombo	0.12	580.04	15.51	317.39
	Woody Savanna	0.11	688.63	25.20	439.51

	Grass Savanna	0.13	567.62	11.70	285.87
	Barren/Built-up	0.14	572.71	18.24	351.47
	Permanent Wetlands	0.10	649.53	13.33	268.09
2012	All Land Cover	0.13	542.97	18.59	297.79
	Miombo	0.13	512.54	18.32	280.59
	Woody Savanna	0.11	703.49	35.67	420.84
	Grass Savanna	0.14	498.48	12.55	260.96
	Barren/Built-up	0.14	562.55	20.35	324.23
	Permanent Wetlands	0.10	508.55	15.82	214.61
2013	All Land Cover	0.13	495.76	17.09	350.34
	Miombo	0.13	468.95	18.23	328.93
	Woody Savanna	0.11	686.63	30.48	444.29
	Grass Savanna	0.14	440.16	12.14	327.09
	Barren/Built-up	0.14	492.53	19.53	314.51
	Permanent Wetlands	0.10	483.67	12.80	280.86
2014	All Land Cover	0.13	620.30	12.79	292.60
	Miombo	0.13	618.57	12.39	292.62
	Woody Savanna	0.11	797.15	23.30	413.45
	Grass Savanna	0.14	566.30	9.36	254.12
	Barren/Built-up	0.14	618.61	15.16	321.54
	Permanent Wetlands	0.10	605.93	11.86	221.14
2015	All Land Cover	0.13	437.55	19.23	281.22
	Miombo	0.13	450.48	20.70	295.80
	Woody Savanna	0.11	639.48	41.06	435.03
	Grass Savanna	0.14	370.07	11.56	227.89
	Barren/Built-up	0.14	447.82	24.56	295.08
	Permanent Wetlands	0.10	363.71	11.60	215.52
2016	All Land Cover	0.14	512.37	21.95	314.74
	Miombo	0.13	497.81	22.59	310.25
	Woody Savanna	0.11	669.59	46.22	449.84
	Grass Savanna	0.15	469.50	13.82	274.53
	Barren/Built-up	0.14	469.02	24.71	324.23
	Permanent Wetlands	0.11	522.14	12.94	236.77
2017	All Land Cover	0.13	617.37	18.02	343.27
	Miombo	0.13	606.57	18.50	347.17
	Woody Savanna	0.11	788.90	31.78	495.40
	Grass Savanna	0.14	571.05	13.53	295.81
	Barren/Built-up	0.14	611.22	18.58	344.46
	Permanent Wetlands	0.11	580.07	13.96	296.99
2018	All Land Cover	0.13	574.98	19.46	327.58
	Miombo	0.13	542.52	18.41	321.35
	Woody Savanna	0.11	736.26	35.29	489.16
	Grass Savanna	0.14	536.03	14.59	278.18
	Barren/Built-up	0.14	561.57	20.08	340.44
	Permanent Wetlands	0.11	562.81	14.44	251.67

\* Since the dynamic wetland mapping changes depending on the time of year, MCD12Q1 annual land cover was used to identify permanent wetland areas. The areas corresponding to other land cover types are masked here based on the remaining land cover pixels after permanent wetland are masked out. \*\* JFMA, MJJAS, and OND refer to the months of the year, namely January, February, March, and April (JFMA), May, June, July, August, and September (MJJAS), and October, November, and December (OND).