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Supplement of

Using multiple methods to investigate the effects of land-use changes on groundwater recharge in a semi-arid area

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Supplement Table S1: Geochemistry and hydraulic conductivities of groundwater at Gatun.

Sampling date	Sample	Sample depth (m)	Landscape position	K _s m day ⁻¹	EC μS cm ⁻¹	TDS	Na	Mg	Ca	Si	K mg L ⁻¹	Cl	SO ₄	HCO ₃	NO ₃	Br	¹⁴ C pMC	³ H TU
Pasture Catchment																		
23/05/2018	63	15.5	Upper	0.31	442	282	62.8	3.19	0.56	13.6	1.21	45.2	27.9	68.3	59.3	0.16	104 ± 0.35	1.48 ± 0.03
23/05/2018	3013	19.2	Upper		5770	3930	1200	162	84.6	26.4	8.89	2210	208	13.4	14.3	6.29	92.0 ± 0.32	0.50 ± 0.02
1/11/2018	3013	19.2	Upper		4850	3390	1010	160	80.6	24.7	8.67	1830	176	56.1	38.6	5.43		
24/05/2018	3001	10.7	Mid	0.06	9390	6380	1650	346	164	37.7	7.26	3810	314	42.7	1.65	10.3	77.6 ± 0.27	0.25 ± 0.02
24/05/2018	3002	8.0	Mid	0.08	9590	6370	1670	258	198	32.2	10.8	3720	298	173	2.19	10.4	84.5 ± 0.29	0.02 ± 0.01
24/05/2018	3004	10.6	Mid	0.07	6410	4090	1190	143	142	28.9	4.05	2300	229	37.8	7.40	7.39	72.3 ± 0.27	0.13 ± 0.02
23/05/2018	3019	13.3	Mid	0.11	3680	2100	686	70.9	14.3	34.8	7.17	1130	88.0	52.5	17.2	3.42	89.5 ± 0.31	0.72 ± 0.02
23/05/2018	3007	17.0	Drainage	0.08	7700	5210	1450	238	40.8	33.1	15.6	3110	260	47.6	2.16	9.11	92.9 ± 0.32	0.08 ± 0.02
7/09/2018	3008	1.3	Drainage		7640	7850	2410	396	125	20.0	0.16	4570	305	1.22	6.56	13.8	98.3 ± 0.30	1.10 ± 0.03
3/07/2018	PD1	1	Drainage		3940	4130	1250	181	36.2	106	11.4	2340	189	11.0	1.15	7.09	91.1 ± 0.29	0.16 ± 0.02
7/09/2018	PD1	1	Drainage		6710	3890	1200	166	31.5	37.6	9.22	2230	180	24.4	1.26	6.64		
1/11/2018	PD1	1	Drainage		5150	4010	1230	181	34.4	40.1	10.5	2270	185	43.9	5.02	6.79		
3/07/2018	PD2	1	Drainage		8740	6100	1850	267	88.8	29.3	12.3	3430	299	110	2.86	10.2	88.2 ± 0.33	0.26 ± 0.02
7/09/2018	PD2	1	Drainage		6970	3960	1210	169	48.7	29.8	8.49	2270	189	30.5	1.36	6.74		
1/11/2018	PD2	1	Drainage		5800	4640	1390	198	44.3	37.8	11.4	2680	223	37.8	5.84	8.19		
24/05/2018	64	29.7	Lower	0.31	9410	6390	1490	348	244	36.0	11.1	3790	338	121	1.55	12.3	70.7 ± 0.28	bdl (0.02)
3/07/2018	PB1	1	Lower		6520	7460	1830	442	365	17.4	1.78	4390	364	35.4	3.25	14.0	86.0 ± 0.28	0.79 ± 0.02
6/09/2018	PB1	1	Lower		10100	7240	1830	392	312	25.8	0.13	4240	405	19.5	2.33	13.2		
1/11/2018	PB1	1	Lower		8750	7700	1930	441	339	29.3	0.85	4400	438	101	8.10	14.2		
6/09/2018	PB2	1	Lower		10000	7260	1980	320	270	12.1	2.88	4140	439	79.3	2.12	12.3	85.5 ± 0.28	0.69 ± 0.02
1/11/2018	PB2	1	Lower		9660	8180	2260	401	342	18.1	2.31	4570	451	115	5.17	13.8		
Forest Catchment																		
23/05/2018	3662	16.9	Upper	0.002	7210	5270	1270	398	192	31.3	8.57	3040	299	1.22	24.4	10.1	94.7 ± 0.32	1.15 ± 0.03
22/05/2018	3663	24.8	Upper	0.13	7150	5200	1490	329	62.1	37.7	21.6	2970	273	1.22	7.29	9.40	89.9 ± 0.31	0.09 ± 0.01
22/05/2018	3665	13.0	Upper	0.18	4960	3920	1170	192	48.8	35.9	11.8	2250	195	1.22	6.97	6.30	93.7 ± 0.32	0.05 ± 0.02
31/10/2018	3665	13.0	Upper		5120	3830	1140	189	49.1	29.7	11.5	2200	192	1.22	13.9	6.14		
22/05/2018	3668	28.4	Mid	0.18	3060	1840	438	87.2	119	28.5	12.3	794	72.2	288	2.26	2.52	29.5 ± 0.35	0.02 ± 0.02
22/05/2018	3658	15.8	Drainage	0.007	1430	1060	196	43.9	58.9	2.88	7.68	248	64.0	432	1.86	0.65	82.9 ± 0.30	1.43 ± 0.04
31/10/2018	3658	15.8	Drainage		1750	1190	260	65.0	85.3	11.7	9.04	330	79.7	339	3.45	0.84		
22/05/2018	3666	28.0	Drainage	0.009	7510	5810	1180	335	251	27.8	20.9	3510	461	15.9	1.82	9.85	38.1 ± 0.32	bdl (0.02)
22/05/2018	3667	18.0	Drainage	0.18	7520	5460	1230	319	217	31.1	20.6	3220	415	1.22	1.21	8.87	53.3 ± 0.29	bdl (0.02)
6/09/2018	3669	9.0	Drainage		5220	3440	1010	146	73.0	30.2	8.15	1930	201	30.5	4.55	5.71	89.4 ± 0.29	0.03 ± 0.02
31/10/2018	3669	9.0	Drainage		4710	3460	1030	148	73.0	32.2	8.85	1910	199	45.1	8.29	5.71		
7/09/2018	FD1	1	Drainage		1210	746	210	17.3	14.6	18.1	0.82	311	109	61.0	2.06	1.48		
6/09/2018	FD2	1	Drainage		257	169	37.8	4.24	2.89	18.0	1.25	47.4	27.3	25.6	4.30	0.59	102 ± 0.32	4.10 ± 0.06
7/09/2018	FD3	1	Drainage		3600	2060	680	43.6	39.7	17.6	1.64	1030	103	139	2.55	3.44		
7/09/2018	FD4	1	Drainage		3240	2220	595	57.1	59.9	20.7	0.61	949	162	366	1.25	5.47	91.1 ± 0.29	2.63 ± 0.05
31/10/2018	FD4	1	Drainage		3790	2490	744	82.6	76.5	14.8	0.83	1220	178	161	4.56	5.80		
22/05/2018	3656	28.8	Lower	0.002	9830	7070	1680	394	288	19.5	19.8	4180	344	128	2.68	11.1	89.9 ± 0.30	1.01 ± 0.03
6/09/2018	3657	2.5	Lower		8210	5780	1490	298	225	18.4	0.98	3290	384	54.9	6.21	8.87	101 ± 0.31	2.14 ± 0.04
31/10/2018	3657	2.5	Lower		8030	6850	1850	429	157	22.4	1.55	3930	412	28.1	7.50	10.6		
7/09/2018	FB1	1	Lower		253	339	35.9	5.56	7.09	3.21	4.84	56.8	5.69	220	0.19	0.16		
7/09/2018	FB2	1	Lower		1550	868	275	11.2	7.49	14.2	2.08	411	100	42.7	1.33	2.04		
31/10/2018	FB2	1	Lower		2470	1680	521	36.4	24.8	14.7	4.47	863	190	18.3	1.57	3.73		
3/07/2018	FB3	1	Lower		11800	8290	2230	442	250	13.9	6.08	4750	483	97.6	3.78	13.7		2.01 ± 0.04
6/09/2018	FB3	1	Lower		14000	10000	2580	550	339	12.6	3.95	5820	571	96.4	18.6	16.5		
31/10/2018	FB3	1	Lower		13700	13600	3300	759	462	16.4	4.64	8140	781	80.5	16.7	23.4		
3/07/2018	FB4	1	Lower		11700	7850	2070	492	266	9.29	10.6	4580	365	36.6	10.6	13.6		
7/09/2018	FB4	1	Lower		6830	4180	1110	239	133	6.66	4.72	2420	179	75.6	1.32	6.85		
1/5/2018 to 31/05/2019	Rainfall																	2.79 ± 0.05

Upper, Mid, and Lower slopes as discussed in text. Sample depth is the middle of the screened interval. bdl = below detection limit. The yearly ³H value of rainfall is the aggregate value.