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Supplement of

Seasonal shifts in depth-to-water uptake by young thinned and overstocked lodgepole pine (*Pinus contorta*) forests under drought conditions in the Okanagan Valley, British Columbia, Canada

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Supplementary Tables and Figures

Table S1. Mean (standard deviation), minimum, maximum, and median monthly meteorological variables recorded in block 1 treatment 2 including temperature (°C), relative humidity (%), solar radiation(W/m^2), windspeed (km/h), vapor pressure deficit (VPD - pa), precipitation (mm), daily PET using the Hargraves and Priestly-Taylor methods (mm/day), monthly PET using the Thornthwaite method (mm/month), dryness index (PET/P), standard precipitation index (SPI) using a 3 month period and a 6 month period, and standardized precipitation evaporation index (SPEI) with 3 and 6 month intervals (missing indicates interval periods would enough data).

	06	07	08	09	10	Overall
Temperature						
Mean (SD)	12.6 (9.08)	16.9 (6.58)	13.0 (6.74)	8.21 (5.65)	4.00 (4.68)	12.2 (7.86)
Median [Min, Max]	11.1 [-2.68, 37.8]	16.7 [0.0789, 34.8]	12.8 [-0.676, 30.8]	7.29 [-2.92, 27.0]	4.17 [-4.26, 16.9]	11.3 [-4.26, 37.8]
Relative Humidity						
Mean (SD)	63.3 (21.5)	50.1 (17.9)	64.2 (22.8)	71.2 (19.7)	72.9 (13.5)	62.7 (21.7)
Median [Min, Max]	65.4 [17.0, 97.6]	48.5 [16.0, 97.6]	63.7 [13.7, 97.9]	75.4 [23.9, 98.3]	76.8 [40.2, 93.5]	62.3 [13.7, 98.3]
Solar Radiation						
Mean (SD)	236 (339)	240 (331)	145 (235)	109 (197)	91.7 (177)	176 (282)
Median [Min, Max]	54.4 [0.600, 1280]	54.4 [0.600, 1240]	25.6 [0.600, 1160]	4.40 [0.600, 1120]	0.600 [0.600, 884]	29.4 [0.600, 1280]
Windspeed						
Mean (SD)	0 (0)	0 (0)	0.00020117 (0.0134863)	0 (0)	0 (0)	0. 00004925 (0.00666268)
Median [Min, Max]	0 [0, 0]	0 [0, 0]	0 [0, 0.560]	0 [0, 0]	0 [0, 0]	0 [0, 0.560]
VPD						
Mean (SD)	0.829 (0.989)	1.16 (0.807)	0.727 (0.719)	0.416 (0.449)	0.263 (0.216)	0.755 (0.794)
Median [Min, Max]	0.423 [0.0221, 5.13]	0.947 [0.0269, 4.63]	0.520 [0.0192, 3.52]	0.242 [0.0128, 2.70]	0.185 [0.0372, 1.05]	0.489 [0.0128, 5.13]

Precipitation						
Mean (SD)	0.00896 (0.0927)	0.00843 (0.275)	0.00703 (0.0559)	0.00916 (0.0680)	0.00337 (0.0523)	0.00808 (0.150)
Median [Min, Max]	0 [0, 3.40]	0 [0, 16.0]	0 [0, 1.19]	0 [0, 1.80]	0 [0, 1.19]	0 [0, 16.0]
Daily PET						
Hargreaves						
Mean (SD)	79.8 (46.4)	111 (56.6)	77.5 (40.9)	70.2 (43.5)	61.3 (26.8)	83.3 (48.4)
Median [Min, Max]	64.8 [20.2, 172]	99.8 [31.4, 191]	68.3 [22.7, 146]	64.7 [13.5, 154]	64.9 [22.3, 94.2]	77.5 [13.5, 191]
Priestly Taylor						
Mean (SD)	130 (28.1)	141 (8.65)	91.4 (22.1)	53.6 (16.1)	30.0 (4.76)	99.2 (42.5)
Median [Min, Max]	132 [81.6, 175]	142 [121, 153]	93.4 [39.7, 140]	52.8 [29.5, 87.1]	30.3 [23.5, 37.8]	100 [23.5, 175]
Monthly PET						
Thornthwaite PET						
Mean (SD)	138 (NA)	164 (NA)	106 (NA)	70.5 (NA)	37.6 (NA)	103 (50.7)
Median [Min, Max]	138 [138, 138]	164 [164, 164]	106 [106, 106]	70.5 [70.5, 70.5]	37.6 [37.6, 37.6]	106 [37.6, 164]
PET/P						
Mean (SD)	1.58 (NA)	1.94 (NA)	2.46 (NA)	1.53 (NA)	10.0 (NA)	3.51 (3.67)
Median [Min, Max]	1.58 [1.58, 1.58]	1.94 [1.94, 1.94]	2.46 [2.46, 2.46]	1.53 [1.53, 1.53]	10.0 [10.0, 10.0]	1.94 [1.53, 10.0]
spi3						
Mean (SD)	-1.26 (NA)	-1.20 (NA)	-1.38 (NA)	NA (NA)	-1.44 (NA)	-1.32 (0.109)
Median [Min, Max]	-1.26 [-1.26, -1.26]	-1.20 [-1.20, -1.20]	-1.38 [-1.38, -1.38]	NA [NA, NA]	-1.44 [-1.44, -1.44]	-1.32 [-1.44, -1.20]
Missing	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	1 (20.0%)
spi6						
Mean (SD)	-1.13 (NA)	NA (NA)	NA (NA)	NA (NA)	-1.59 (NA)	-1.36 (0.325)

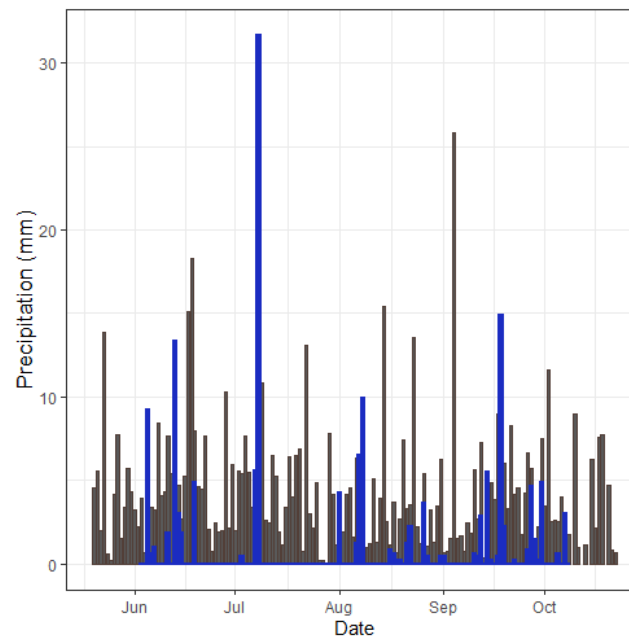| Median [Min, Max]	-1.13 [-1.13, -1.13]	NA [NA, NA]	NA [NA, NA]	NA [NA, NA]	-1.59 [-1.59, -1.59]	-1.36 [-1.59, -1.13]
Missing	0 (0%)	1 (100%)	1 (100%)	1 (100%)	0 (0%)	3 (60.0%)
spei3						
Mean (SD)	-1.23 (NA)	-1.40 (NA)	-1.77 (NA)	-1.50 (NA)	-1.43 (NA)	-1.47 (0.198)
Median [Min, Max]	-1.23 [-1.23, -1.23]	-1.40 [-1.40, -1.40]	-1.77 [-1.77, -1.77]	-1.50 [-1.50, -1.50]	-1.43 [-1.43, -1.43]	-1.43 [-1.77, -1.23]
spei6						
Mean (SD)	-0.855 (NA)	-1.33 (NA)	-1.73 (NA)	-1.68 (NA)	-1.67 (NA)	-1.45 (0.371)
Median [Min, Max]	-0.855 [-0.855, -0.855]	-1.33 [-1.33, -1.33]	-1.73 [-1.73, -1.73]	-1.68 [-1.68, -1.68]	-1.67 [-1.67, -1.67]	-1.67 [-1.73, -0.855]

Figure S1. Mean daily historical (1997?-2008: grey) and 2021 (blue) rainfall (mm) from June to October.

Table S2. Proportion of source water uptake by xylem water for six scenarios using different combinations of isotopes (single and dual) and sources including soil water (5 cm, 35cm, 45-100cm, and the average of 35-100 cm) and groundwater.

	Isotopes Used	Sources	Runtime	Percent contributed									Gelman-Rubin
Scenario	d18O	5, 35	normal	5 cm	SD	35 cm	SD	45-100 cm	SD	GW	SD	Total	
1	Month											0	4
	6			**0.76**	0.325	0.167333	0.100667					0.927333	
	7			**0.343**	0.179	0.259	0.133					0.602	
	9			**0.131**	0.274	0.121333	0.119333					0.252333	
	10			0.001	0.003	**0.725333**	0.141667					0.726333	
2	d2H	5, 35	normal									0	3
	6			**0.852667**	0.087333	0.147333	0.087333					1	
	7			**0.672**	0.087	0.328	0.087					1	
	9			**0.806667**	0.094333	0.193333	0.094333					1	
	10			0.066333	0.041667	**0.933667**	0.041667					1	
3	d18O + d2H	5, 35	normal									0	
	6			**0.76**	0.325	0.108	0.045667					0.868	15
	7			**0.343**	0.179	0.137	0.066333					0.48	

9				0.131	0.274	**0.347 333**	0.032 333					0.478 333	
10				0.001	0.003	**0.994**	0.017 5					0.995	
4	d18O + d2H	5, 35, 45-100	norm al									0	
6				**0.76**	0.325	0.214 333	0.233 333	0.027	0.044			1.001 333	120
7				0.343	0.179	0.134 333	0.168 333	**0.379**	0.08			0.856 333	
9				0.131	0.274	**0.366**	0.343 333	0.174	0.109			0.671	
10				0.001	0.003	0.001 667	0.005	**0.9963 33**	0.008 667			0.999	
5	d18O + d2H	5, 35-100, GW	norm al									0	153
6				0.312 333	0.245 333	**0.669 333**	0.404 333			0.074	0.204 667	1.055 667	
7				0.253 333	0.311	**0.455**	0.401			0.035 667	0.128	0.744	
9				0.200 667	0.137 667	**0.335**	0.409 333			0.06	0.126	0.595 667	
10				**0.753 5**	0.306	0.166 333	0.278 333			0.086 667	0.147 667	1.006 5	
6	d18O + d2H	5, 35, 45-100, GW	norm al									0	15
6				**0.767 667**	0.321 667	0.083 333	0.182 667	0.027	0.01	0.136 333	0.261 667	1.014 333	
7				**0.477 333**	0.225 667	0.074	0.135 667	0.18	0.174	0.066 667	0.134 333	0.798	
9				0.134 667	0.290 333	**0.427 667**	0.346 333	0.1276 67	0.032 667	0.237 667	0.345 667	0.927 667	

| | 10 | | | 0.001 333 | 0.004 333 | 0.001 333 | 0.005 | **0.338** | 0.650 667 | 0.001 | 0.004 667 | 0.341 667 | |