Supplementary Material

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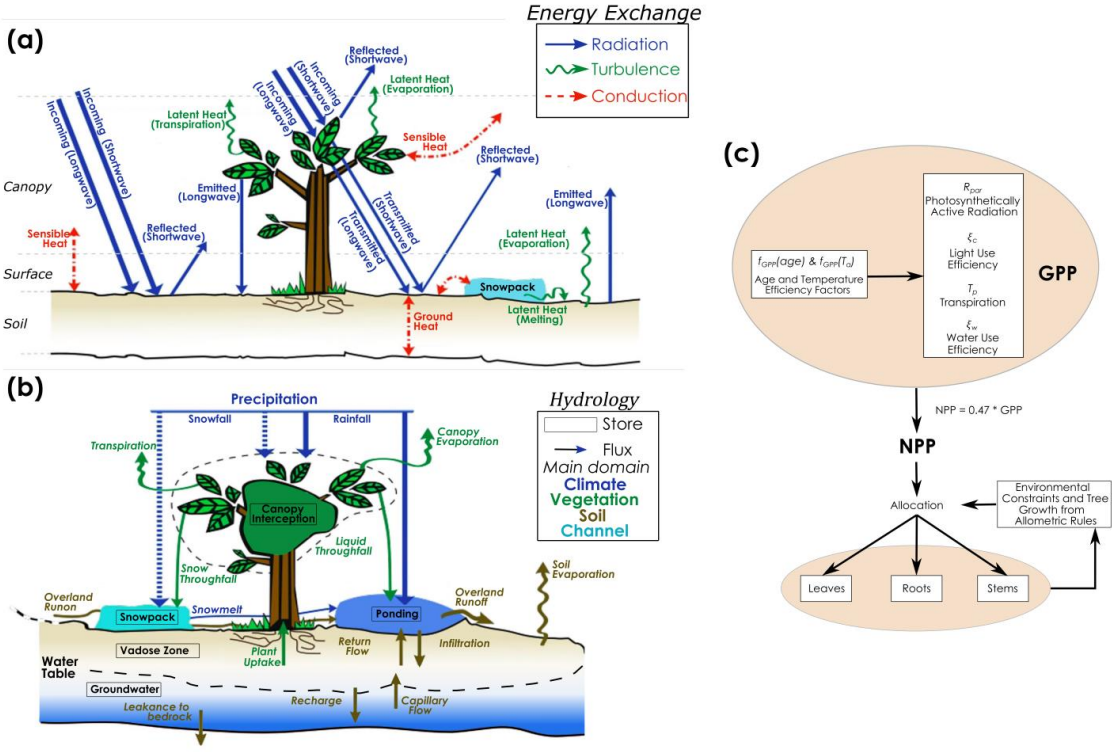

Figure S1: Conceptual diagram of the (a) energy and (b) water balance within EcH$_2$O-iso, and the (c) carbon uptake and allocation within vegetation to roots, stem, and leaves. Modified from Smith et al., 2020 and Maneta, 2021.

Table S1: Calibrated soil parameters for below Willow and Grass, presented as the mean, standard deviation (±), and skew. Note: field capacity is not directly calibration, but is a function of Brooks-Corey, air entry pressure, porosity, and residual moisture content.

	Willow		Grass	
	Mean ± std	**Skew**	**Mean (std)**	**Skew**
Albedo	0.25 ± 0.11	-0.01	0.22 ± 0.06	-0.39
Brooks-Corey Lambda	3.76 ± 0.68	0.46	3.78 ± 0.92	-0.09
Air entry pressure	0.24 ± 0.12	0.56	0.14 ± 0.12	0.96
Field Capacity	0.2 ± 0.01	-0.09	0.16 ± 0.01	0.02
Porosity	0.41 ± 0.02	-0.06	0.4 ± 0.02	-0.39
Residual Moisture Content	0.01 ± 0.01	0.11	0.01 ± 0	0.03
Vertical Conductivity	1.1E-4 ± 9E-5	1.01	6.8E-4 ± 2E-4	0.24
Root Distribution Parameter (K_{root})	13.33 ± 3.98	0.79	8.21 ± 1.05	0.35

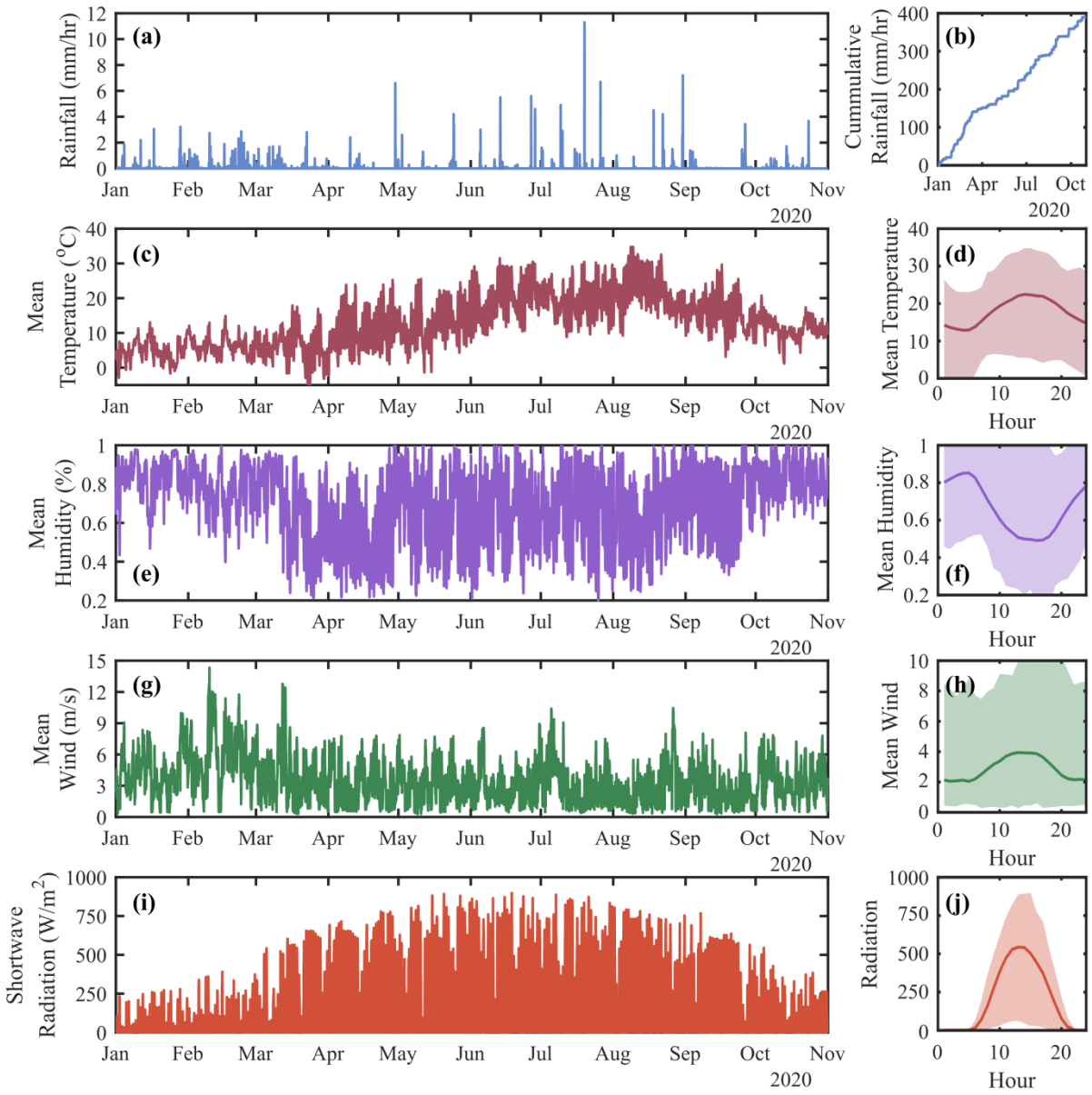

Figure S2: Climate data used within EcH$_2$O-iso for the study site between January and November 2020. (a) Hourly precipitation, (b) cumulative precipitation, (c) mean hourly temperature, (d) mean diel temperature (and range) during the growing season (May – September), (e) mean hourly relative humidity, (f) mean diel humidity (and range) during the growing season (May –September), (g) mean hourly wind speed, (h) mean diel wind speed (and range) during the growing season (May –September), (i) mean hourly shortwave radiation, and (j) mean diel radiation (and range) during the growing season (May –September).

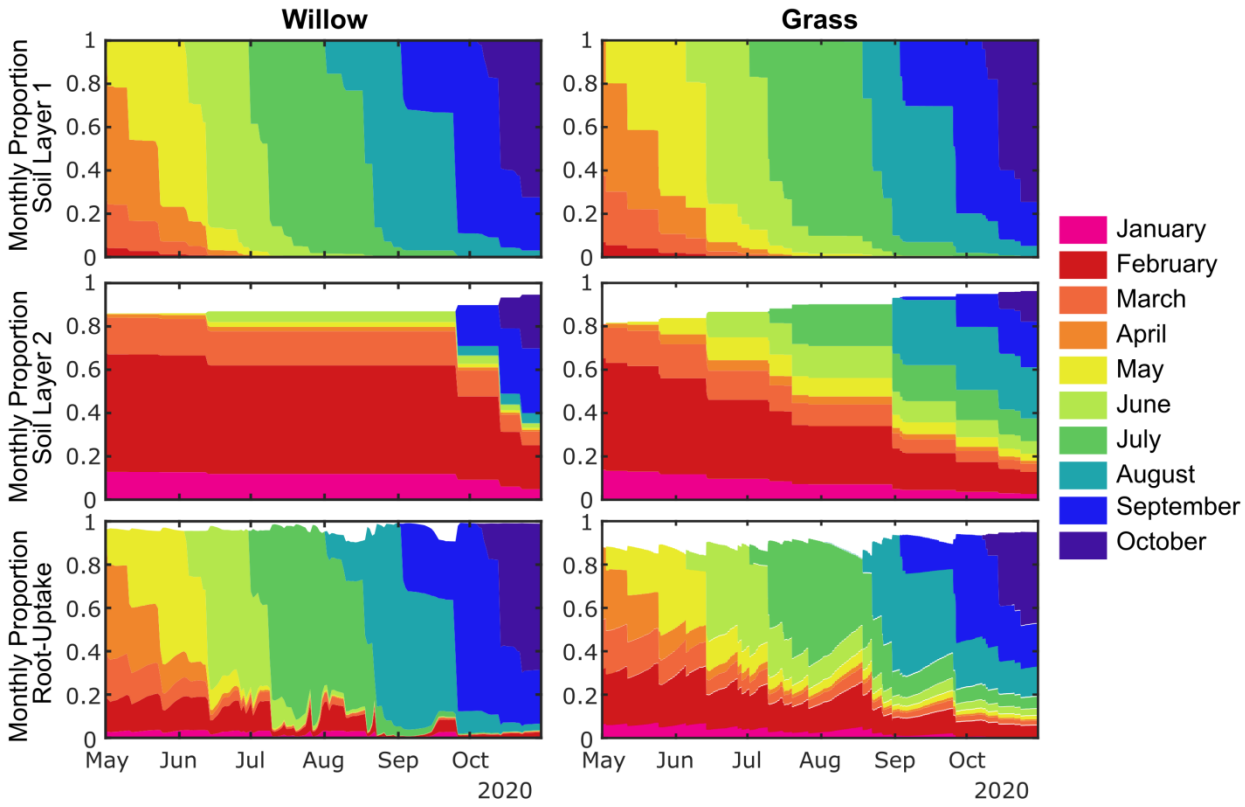

Figure S3: Cumulative proportion of water in storage and in root-uptake from each month since the beginning of the simulation (January). White regions indicate water is older than the simulation

Table S2: Proportion of water in storage or flux for the willows older than or equal to precipitation in each month (e.g. older than or equal to January precipitation). Proportions are displayed for each period of the growing season. N/A indicates not applicable.

	Willow								
	May 1 - June15			*June 15-July31*			*Aug1 - Oct31*		
	Layer 1	*Layer 2*	*RWU*	*Layer 1*	*Layer 2*	*RWU*	*Layer 1*	*Layer 2*	*RWU*
≥ *Jan*	0.00	0.27	0.07	0.00	0.25	0.05	0.00	0.21	0.05
≥ *Feb*	0.02	0.80	0.21	0.00	0.75	0.13	0.00	0.64	0.08
≥ *Mar*	0.13	0.97	0.33	0.00	0.91	0.16	0.00	0.77	0.09
≥ *Apr*	0.42	0.99	0.56	0.01	0.93	0.17	0.00	0.79	0.09
≥ *May*	0.89	1.00	0.91	0.04	0.95	0.20	0.00	0.81	0.09
≥ *June*	1.00	1.00	1.00	0.46	1.00	0.53	0.00	0.85	0.09
≥ *July*	N/A	N/A	N/A	1.00	1.00	1.00	0.19	0.85	0.24
≥ *Aug*	N/A	N/A	N/A	N/A	N/A	N/A	0.55	0.87	0.57
≥ *Sept*	N/A	N/A	N/A	N/A	N/A	N/A	0.86	0.96	0.87
≥ *Oct*	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00

Table S3: Proportion of water in storage or flux for the grass older than or equal to precipitation in each month (e.g. older than or equal to January precipitation). Proportions are displayed for each period of the growing season. N/A indicates not applicable.

	Grass								
	May 1 - June15			*June 15-July31*			*Aug1 - Oct31*		
	Layer 1	*Layer 2*	*RWU*	*Layer 1*	*Layer 2*	*RWU*	*Layer 1*	*Layer 2*	*RWU*
≥ *Jan*	0.00	0.29	0.19	0.00	0.21	0.14	0.00	0.12	0.11
≥ *Feb*	0.03	0.76	0.42	0.00	0.54	0.29	0.00	0.30	0.20
≥ *Mar*	0.18	0.92	0.57	0.01	0.66	0.35	0.00	0.37	0.24
≥ *Apr*	0.48	0.95	0.73	0.03	0.71	0.38	0.00	0.39	0.25
≥ *May*	0.93	0.99	0.96	0.11	0.80	0.46	0.00	0.45	0.28
≥ *June*	1.00	1.00	1.00	0.59	0.94	0.75	0.03	0.56	0.33
≥ *July*	N/A	N/A	N/A	1.00	1.00	1.00	0.28	0.72	0.50
≥ *Aug*	N/A	N/A	N/A	N/A	N/A	N/A	0.59	0.91	0.75
≥ *Sept*	N/A	N/A	N/A	N/A	N/A	N/A	0.86	0.98	0.92
≥ *Oct*	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.00	1.00

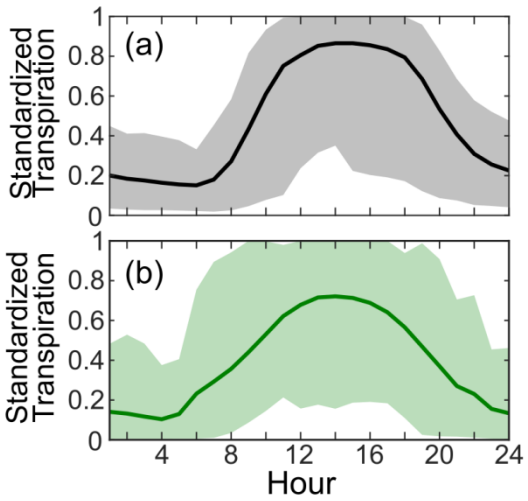

Figure S4: Hourly variability of standardized (0 to maximum transpiration) of (a) measured sap flow, and (b) simulated transpiration.

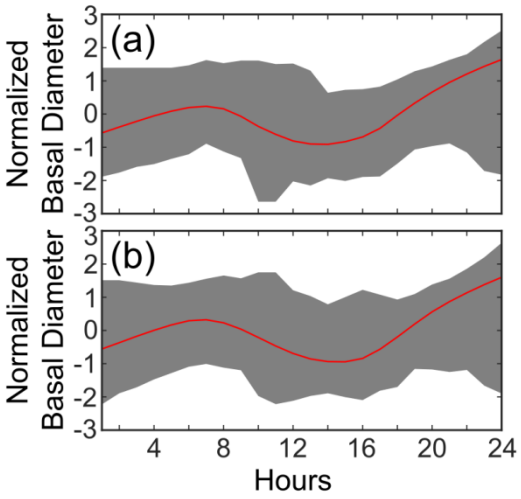

Figure S5: Normalized daily basal diameter for (a) Willow 1 and (b) Willow 2

Table S4: Average (± standard deviation) transit time in hours of root water in each layer to 1m measurement height in Willow 1 and Willow 2.

	Simulated Data		Measured Data	
Soil Layer	**Willow 1 (hr)**	**Willow 2 (hr)**	**Willow 1 (hr)**	**Willow 2 (hr)**
Layer 1	160.0 ± 21.2	140.5 ± 3.8	217.3 ± 40.0	196.0 ± 44.8
Layer 2	205.0 + 97.3	82.1 ± 12.1	224.0 ± 127.4	160.7 ± 23.5
Layer 3	85.2 ± 26.8	78.8 ± 8.4	85.6 ± 1.0	132.8 ± 10.3