SUPPORTING INFORMATION

Phytoremediation Reduces Dust Emissions from Metal(loid)-Contaminated Mine Tailings

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LIST OF SUPPLEMENTARY INFORMATION

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FIGURES

Table S1. Weather data for the Modified Wilson & Cooke (MWAC) samplers measurement period at IKMHSS.

Collection date	Season IK Met station Phase I	Temperature ˚C	Soil Temperature ˚C	ET %	Humidity %	Precipitation + Irrigation mm	Average Wind Speed m s^{-1}	
9/7/2011	May - Sept 2011	22.7 ± 10.5	21.5 ± 1.1	0.0029 ± 0.007	33.8 ± 19.0	383.8	5.1 ± 4.6	Min 0 Max 24
1/7/2012	Sept 2011 -Jan 2012	11.0 ± 8.8	11.4 ± 2.0	0.0014± 0.004	50.6 ± 24.5	232.3	3.3 ± 3.6	Min 0 Max 23
5/16/2012	Jan - May 2012	9.5 ± 9.6	10.0 ± 1.1	0.0019± 0.005	38.5 ± 21.6	100.4	4.4 ± 4.5	Min 0 Max 27

Table S2. R^2 and p-values for the exponential functions used to calculate total average horizontal dust flux from May 2011 to May 2012.

R^2 and p-Value from exponential decay function of horizontal dust flux from MWAC	
Treatment	**May 2011 – May 2012**
	Flux IN
Control	0.78 (0.008)[a]
Irrigation	0.86 (0.005)
16% Canopy	0.78 (0.069)
32% Canopy	0.78 (0.011)
	Flux OUT
Control	0.83 (0.015)
Irrigation	0.82 (0.038)
16% Canopy	0.77 (0.045)
32% Canopy	0.69 (0.131)

[a] Values represent R^2 and (p-values).

Table S3. Weather data for the DustTrak™ Aerosol Monitors measurement period at IKMHSS.

Collection date	Temperature	Soil Temperature	ET	Humidity	Precipitation + Irrigation	Average Wind Speed		Wind Direction[a]
	˚C	˚C	%	%	mm	m s^{-1}		
5/24/2011	22.4 ± 1.4	19.5 ± 1.9	0.029 ± 0.003	14.4 ± 2.4	0.2	5.0 ± 1.2	Min 2.2 Max 6.2	SW
6/6/2011	25.8 ± 0.4	20.1 ± 1.2	0.036 ± 0.002	13.9 ± 1.2	0.0	7.0 ± 0.7	Min 5.8 Max 8.5	S

Table S4 Total horizontal dust flux at the IKMHSS field site over the three sampling periods.

Treatments	Horizontal Flux[a] ($g\ m^{-2}\ y^{-1}$)		
	Flux IN ($g\ m^{-2}\ y^{-1}$)	**Flux OUT** ($g\ m^{-2}\ y^{-1}$)	[b]**NET Flux** ($g\ m^{-2}\ y^{-1}$)
Control Unirrigated	3951.4	6274.9	2323.5
Control Irrigated	3253.3	4765.3	1512.0
16% Canopy	2672.7	2300.9	-371.8
32% Canopy	2486.6	1880.5	-606.1

[a] Measurements were performed using passive samplers. Each measurement period was approximately three months. Values represent the total amount of wind-blown dust for all sampling heights integrated from 0 to 1 m above the soil surface.

[b] Net Flux values are the subtraction of the flux IN from the flux OUT (Eq. 4) to represent deposition or emission of dust as an effect of the vegetation cover.

Table S5. Total horizontal dust flux at IKMHSS field site for each of the three sampling periods.

Treatments	Horizontal Flux (g m^{-2} y^{-1}) [a]		
	Flux IN (g m^{-2} y^{-1})	Flux OUT (g m^{-2} y^{-1})	[b]NET Flux (g m^{-2} y^{-1})
May – Sept. 2011[c]			
Control Unirrigated	2540.9	4189.4	1648.46
Control Irrigated	2881.0	3855.2	974.24
16% Canopy	2144.1	2083.1	-60.97
32% Canopy	1981.1	1717.4	-263.64
Sept. 2011– Jan.2012 [c]			
Control Unirrigated	4819.8	6989.6	2169.84
Control Irrigated	3770.5	4759.4	988.90
16% Canopy	2677.5	2385.7	-291.80
32% Canopy	3167.7	1988.1	-1179.55
Jan. – May 2012 [c]			
Control Unirrigated	4493.7	7645.9	3152.22
Control Irrigated	3108.4	5681.4	2572.96
16% Canopy	3196.5	2434.0	-762.50
32% Canopy	2311.2	1936.0	-375.19

[a] Measurements were performed using passive samplers. Values represent the total amount of wind-blown dust or sediment for all sampling heights integrated from 0 to 1 m above the soil surface.

[b] Net Flux values are the subtraction of the flux IN from the flux OUT (Eq. 4) to represent deposition or emission of sediment (dust) as an effect of the vegetation cover.

[c] Three separate sampling events took place: May –September 2011 (109 days), September 2011 to January 2012 (123 days), and January – May 2012 (132 days).

Table S6. Horizontal dust flux by height at IKMHSS field site for each sampling periods.

Horizontal Flux	Flux IN (g m^{-2} y^{-1})					Flux OUT (g m^{-2} y^{-1})					[b]NET Flux (g m^{-2} y^{-1})				
Height (m)	**1.0**	**0.5**	**0.25**	**0.18**	**0.06**	**1.0**	**0.5**	**0.25**	**0.18**	**0.06**	**1.0**	**0.5**	**0.25**	**0.18**	**0.06**
Treatments	**May – Sept. 2011**														
Control Unirrigated	1064.1	1771.0	3571.9	4494.6	4635.9	1480.8	4449.9	6652.6	4978.3	7835.8	416.7	2678.9	3080.7	483.7	3199.8
Control Irrigated	937.6	1904.9	3117.9	5008.0	8356.7	1012.0	3609.1	7300.0	5588.5	6823.7	74.4	1704.1	4182.1	580.4	-1532.9
16% Canopy	878.1	1510.6	2344.0	2961.7	6332.6	1391.5	1890.1	2076.1	2939.3	3251.9	513.5	379.5	-267.2	-22.3	-3080.7
32% Canopy	803.7	1220.4	2024.0	3050.9	6325.2	1086.4	1503.2	2031.5	1852.9	3289.1	282.8	282.8	7.4	-1198.0	-3036.1
	Sept. 2011– Jan.2012														
Control Unirrigated	969.4	2380.6	5038.1	12450.2	14942.9	1134.2	6752.7	10616.9	13083.3	14309.8	164.9	4372.1	5578.9	633.0	-633.1
Control Irrigated	817.7	2703.7	4563.3	8605.7	8698.0	1839.8	2954.3	5730.5	7069.2	13835.0	1022.1	250.6	1167.2	-1536.5	5137.4
16% Canopy	1246.3	1773.9	4279.8	4563.3	4312.7	870.5	890.2	3943.4	4154.5	6910.9	-396.3	-1968.9	-1461.2	321.9	600.6
32% Canopy	751.8	1727.7	3620.3	5717.3	11190.7	692.4	2103.6	1912.4	3382.9	4279.8	-59.3	375.9	-1707.9	-2334.4	-6910.9
	Jan. – May 2012														
Control Unirrigated	1592.5	3646.3	5409.9	9160.3	8170.6	2232.4	6585.6	11162.1	13915.4	13930.3	639.9	2939.3	5752.2	4755.0	5759.6
Control Irrigated	1220.4	1637.1	2864.9	5156.9	11764.8	2403.6	6362.4	9138.0	7106.5	8170.6	1183.2	4725.3	6273.1	1949.6	-3594.2
16% Canopy	1591.3	3584.9	3801.7	3913.1	5392.9	1195.0	1616.0	2340.5	4235.1	5993.5	-396.3	-1968.9	-1461.2	321.9	600.6
32% Canopy	1003.0	1325.0	1894.7	5578.7	5987.4	1195.0	1671.8	2711.9	3046.3	2204.2	191.9	346.7	817.3	-2532.4	-3783.1

Table S7. Total metal(loid)s collected in upwind and downwind MWAC samplers

Treatment	Flux IN [a] (mg)	Flux OUT [a] (mg)	NET [c] Elemental mass	% Deposition [d]
		Al		
Control Unirrigated	23.389	67.859	44.470	67.0
Control Irrigated	20.761	58.852	38.091	60.9
16% Canopy	46.233	19.563	-26.670	-133.4
32% Canopy	26.801	26.825	0.024	30.4
		As		
Control Unirrigated	0.684	1.233	0.549	41.6
Control Irrigated	0.628	0.695	0.067	-1.9
16% Canopy	0.386	0.418	0.032	4.3
32% Canopy	0.470	0.206	-0.264	-133.7
		Cd		
Control Unirrigated	0.003	0.007	0.004	56.4
Control Irrigated	0.002	0.003	0.000	-17.2
16% Canopy	0.002	0.002	0.000	-3.0
32% Canopy	0.003	0.001	-0.002	-207.7
		Cu		
Control Unirrigated	0.028	0.058	0.030	52.0
Control Irrigated	0.023	0.037	0.013	33.9
16% Canopy	0.033	0.034	0.001	3.1
32% Canopy	0.038	0.024	-0.015	-66.8
		Cr		
Control Unirrigated	0.002	0.004	0.002	56.0
Control Irrigated	0.002	0.003	0.001	39.1
16% Canopy	0.003	0.002	-0.001	-29.4
32% Canopy	0.003	0.002	-0.001	-52.9
		Fe		
Control Unirrigated	21.607	40.758	19.151	48.0
Control Irrigated	25.272	30.782	5.510	10.2
16% Canopy	18.361	15.551	-2.810	-17.8
32% Canopy	20.873	11.635	-9.238	-79.1
		Mg		
Control Unirrigated	2.101	4.303	2.202	54.5
Control Irrigated	1.775	2.316	0.541	20.0
16% Canopy	1.263	2.283	1.020	34.84
32% Canopy	2.006	0.857	-1.149	-137.6
		Mn		
Control Unirrigated	0.052	0.112	0.061	56.2
Control Irrigated	0.046	0.065	0.019	28.5
16% Canopy	0.047	0.037	-0.010	-27.0
32% Canopy	0.058	0.027	-0.031	-52.9
		Pb		
Control Unirrigated	0.526	0.848	0.322	38.6
Control Irrigated	0.367	0.539	0.172	-29.5
16% Canopy	0.336	0.291	-0.045	-17.1
32% Canopy	0.382	0.202	-0.180	-89.9

[a] Elemental mass collected in the MWAC samplers located at the upwind and downwind edges of each plot treatment.

[b] Net elemental was estimated by elemental mass out – elemental mass in / elemental mass out.

[c] When percent deposition was calculated, the result was multiplied by 100. Negative numbers indicate *Deposition* and positive numbers indicate *Emission.*

Figures

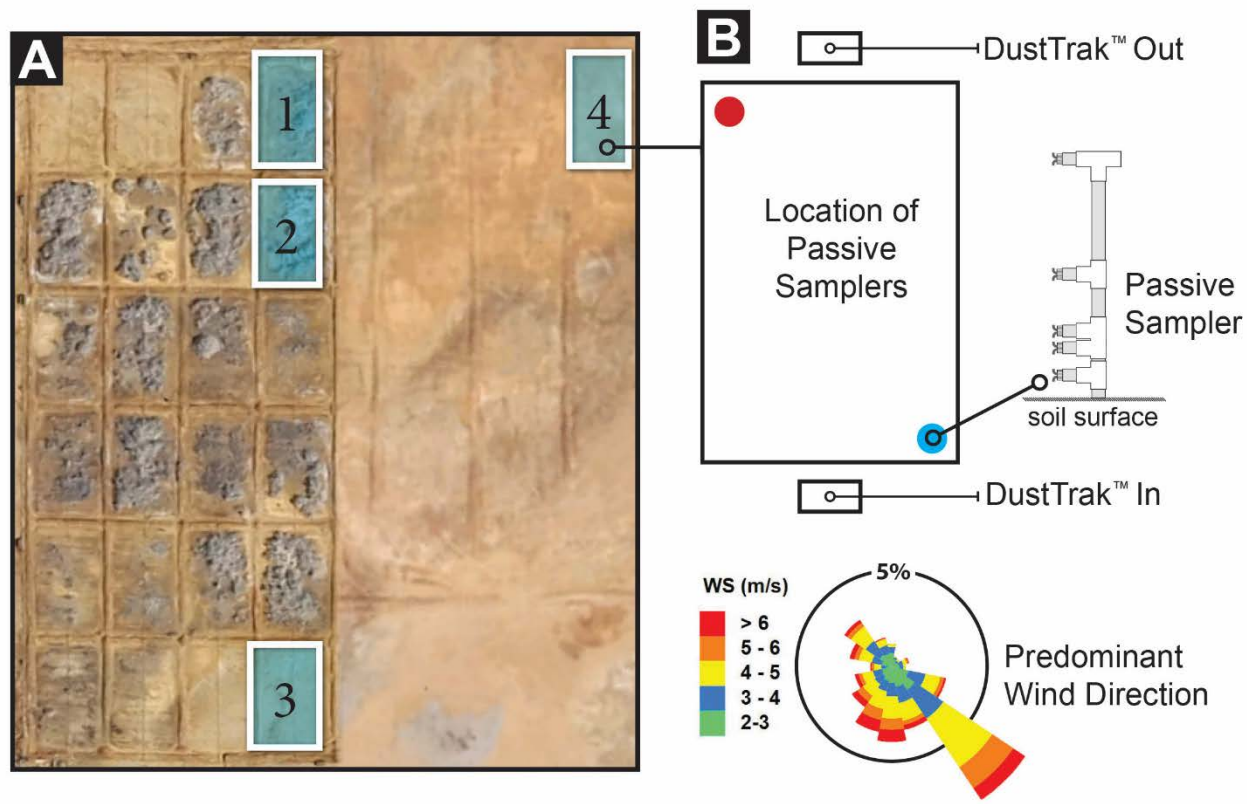
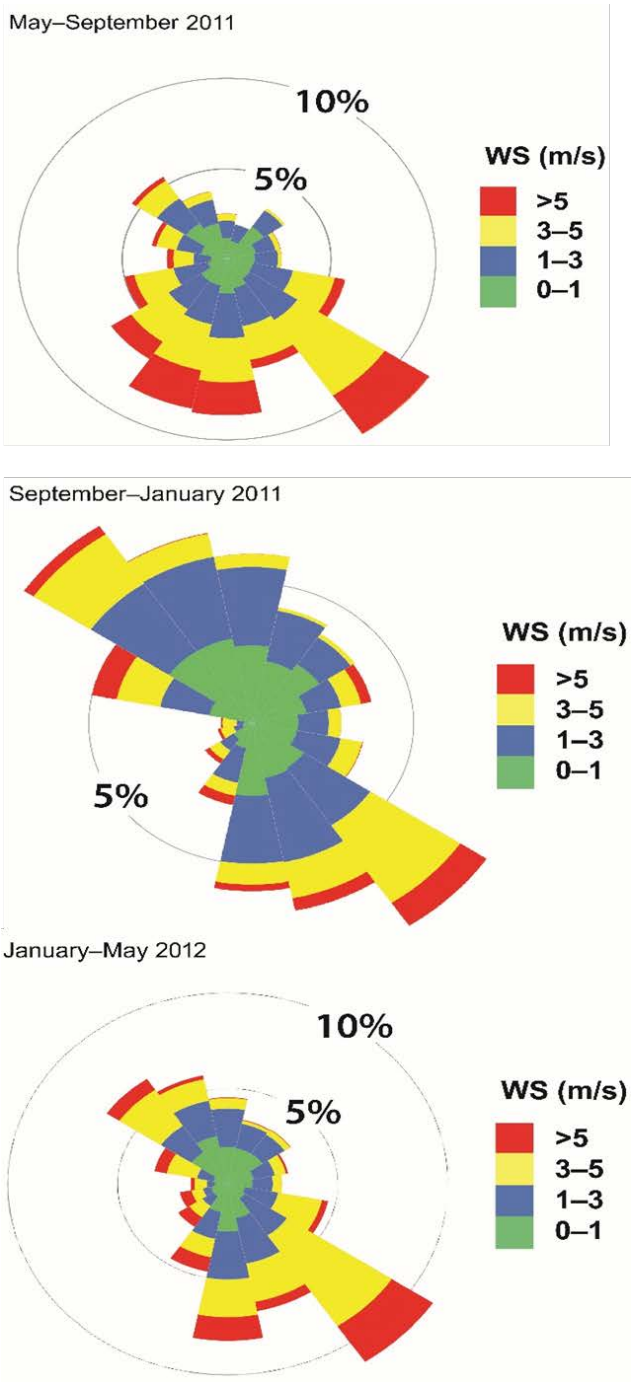


Figure S1. (A) Location of study areas for horizontal sediment flux measurements in relation to the phytoremediation field trial. Blue squares indicate the study area plots (9.6 m x 15 m per plot) selected as areas of study. Square (1) is 16% canopy cover study area, square (2) is the 32% canopy cover study area, square (3) is the irrigated control study area, and square (4) is the unirrigated control study area. **(B)** The rectangle in the upper left corner is a diagram of a study area plot to show the placement of samplers used in this study. The passive samplers are shown at the top left and bottom right of the plot with blue indicating the flux in and red indicating the flux out. The locations of the DustTrak™ samplers are shown as rectangles above and below the plot. At the bottom is a windrose showing the predominant wind direction (wind rose) at the site.

Figure S2. Wind speed and wind direction at IKMHSS field site for each of the three sampling periods using Modified Wilson & Cooke (MWAC) samplers.



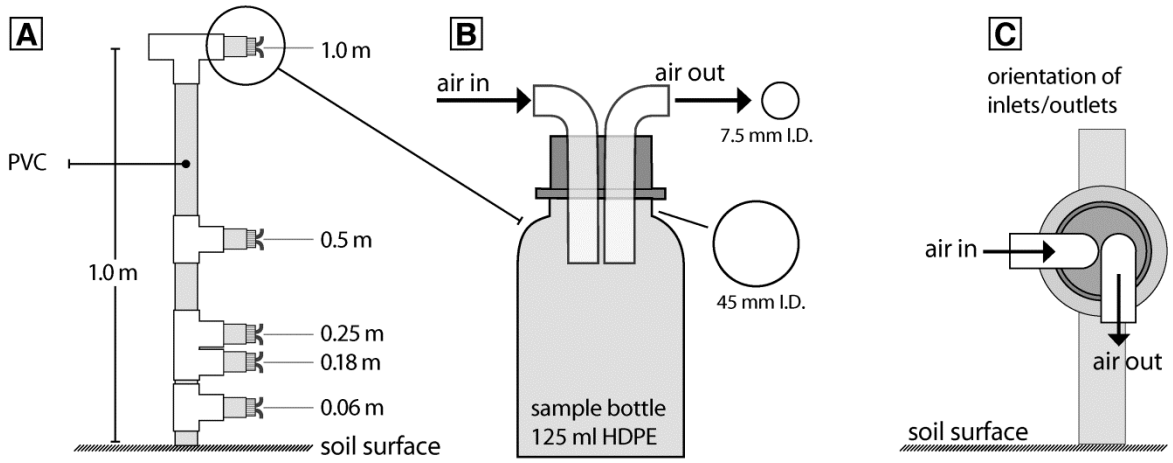


Figure S3. Diagram of the Modified Wilson & Cooke (MWAC) passive samplers. **(A)** Detail showing the high-density polyethylene (HDPE) samplers at 0.06, 0.18, 0.25, 0.5, and 1.0 m on the PVC mast. **(B)** Detail showing the design of the sampling bottle (Goossens et al., 2000). **(C)** Detail of the sampler showing the orientation of inlet and outlet tubes with an inside diameter of 7.5 mm and an outer diameter of 10 mm secured to each sampling bottle lid. The inlet tube is oriented to the predominant wind direction and outlet tube is oriented downwards to the soil surface.

Figure S4 Exponential decay functions used to calculate average total horizontal dust flux at the IKMHSS field site (May 2011 to May 2012).

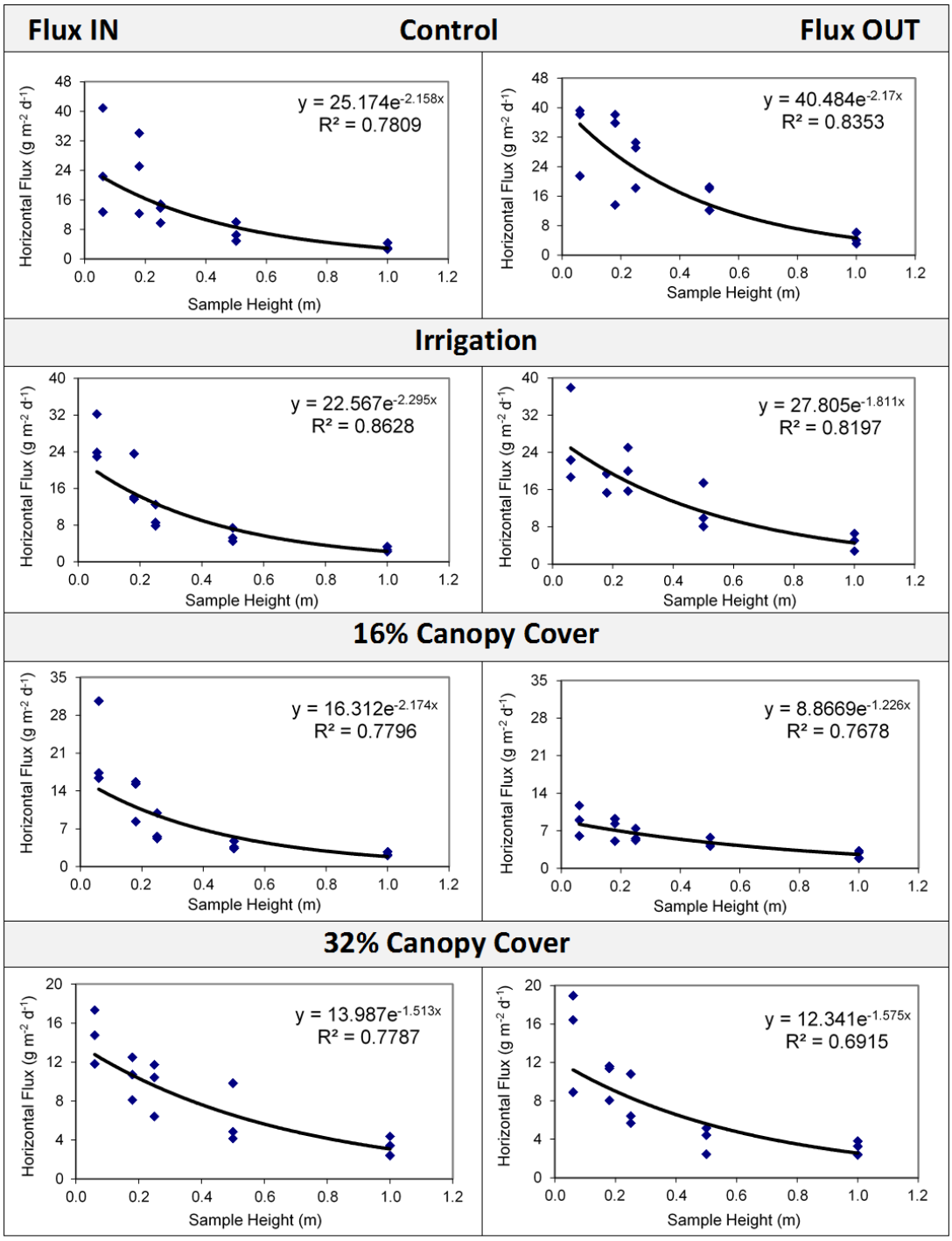


Figure S5 Meteorological data from weather station during the DustTrak™ measurement events. Red square highlights the time frame at which sampling was conducted. **(A)** Percent relative humidity, **(B)** Wind speed (m s^{-1}).