

Supplementary Material:

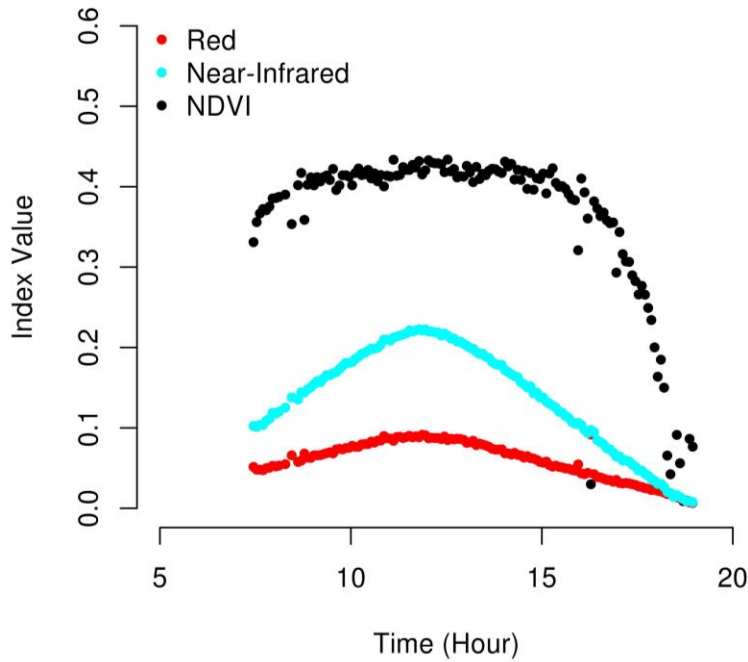


Figure S1. The red band, near-infrared band, and the computed NDVI values for one example day (2018-05-13 at Hubbard Brook). Both red and near-infrared increase and then decrease during the day, but near-infrared has a greater absolute sensitivity to sun-angle, which causes the overall NDVI diurnal shape.

Methods for Simulation of Pseudo-data:

We simulated a variety of pseudo-data from known parameter values to investigate if the proposed diurnal fit methodology produced the known parameter values. Data were simulated to represent each of the six categories described in section 2.3.3 of the main text. The parameters a , c , k , α , and β were kept constant for simplicity as 0.000375, 0.8, 12, 10, and 10, respectively. For the different categories, the parameters p (probability of cloudy), σ (observation standard deviation), and the times of observations were varied. The p values were 0.001, 0.1, 0.1, 0.005,

0.06, 0.2 for the categories low noise and tight fit, high noise and tight fit, missing midday window and tight fit, low noise and wide fit, high noise and wide fit, and missing midday window and wide fit, respectively. The simulated pseudo-data and the outputs of the model are shown in Figure S1.

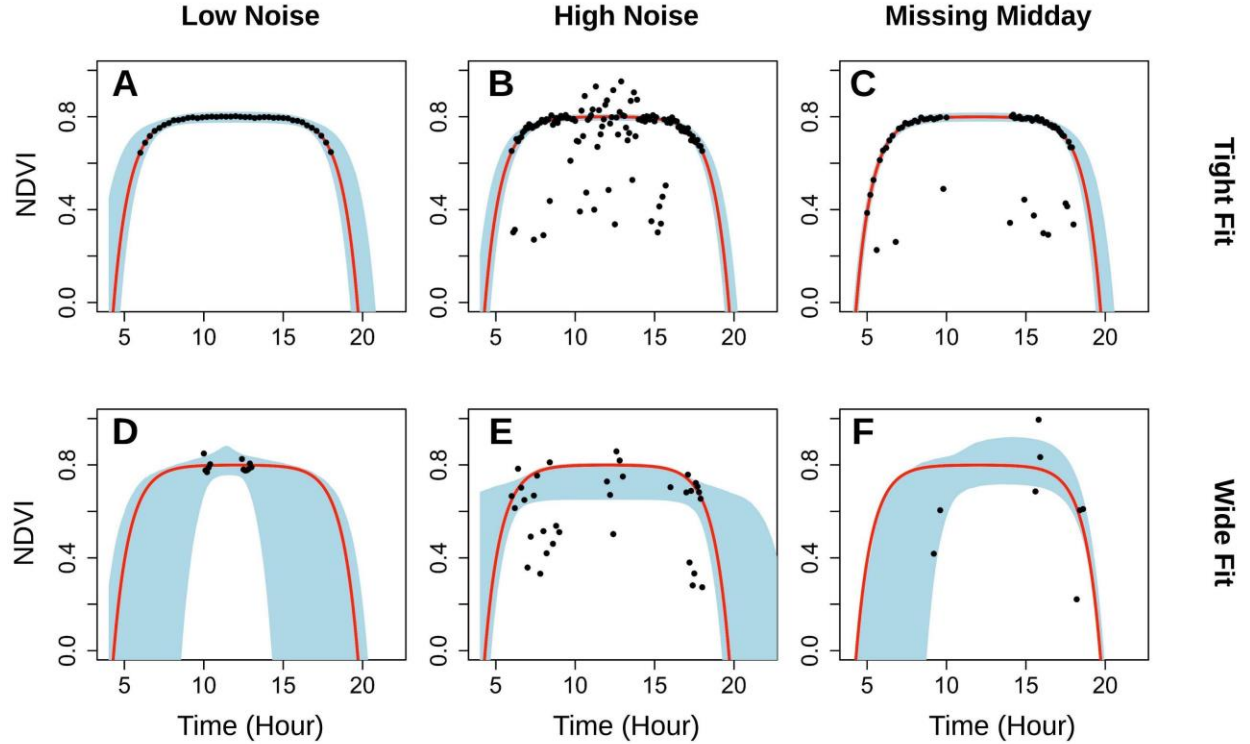


Figure S2. Example fits for six days of simulated data. Data were simulated by selecting values for the parameters a , c , p , α , β , and σ in the model and using varying amounts of observation frequencies. Simulated data are represented by the black points. Based off of the selected parameter values, the true diurnal curve is given as the red line. The blue shading around the diurnal curve indicates the 95% credible interval (CI) from the model output. Classification methods of the data and fit in each panel are given in section 2.3.3 of the main text. The 95% CI for the model fits includes the true diurnal curves, strengthening the validity of our diurnal fit methodology.

Table S1: The number of days in each diurnal fit category for each site.

Site Name	Number of Days with Observations	No window & tight fit	No window & wide fit	Low noise & tight fit	Low noise & wide fit	High noise & tight fit	High noise & wide fit
Harvard Forest	210	34	52	65	1	42	14
Hubbard Brook	179	34	47	52	2	29	9
UMB	230	32	36	84	3	63	11
Coweeta	226	25	37	97	7	48	9
Bartlett	193	32	46	50	5	38	16
Missouri Ozarks	229	26	30	88	4	73	7
Morgan Monroe	204	31	34	65	2	55	12
Russell Sage	253	26	38	74	2	91	18
Willow Creek	189	22	56	58	7	35	9
Bull Shoals	256	24	36	73	3	99	19
Duke	236	31	27	97	5	60	14
Green Ridge	207	36	40	49	4	68	8
Shenandoah	228	29	38	73	4	70	9
Marcell	240	29	45	82	9	69	4
Shining Rock	219	26	49	53	7	60	21
Total	2088	437	611	1060	65	900	180

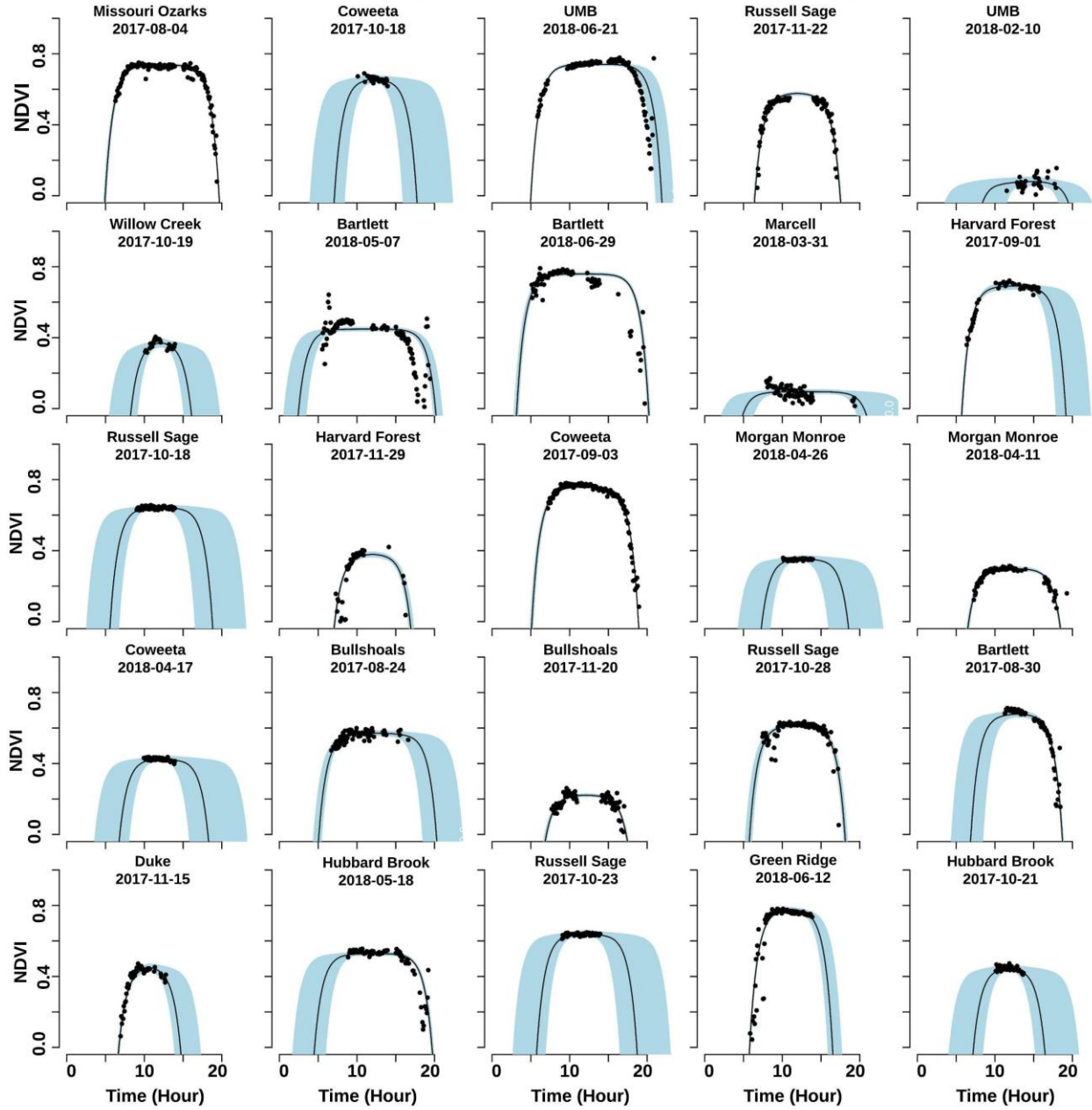


Figure S3: Random days that had low noise within the 4-hour midday window and a tight CI from the diurnal fit estimate. Blue shading indicates 95% CI.

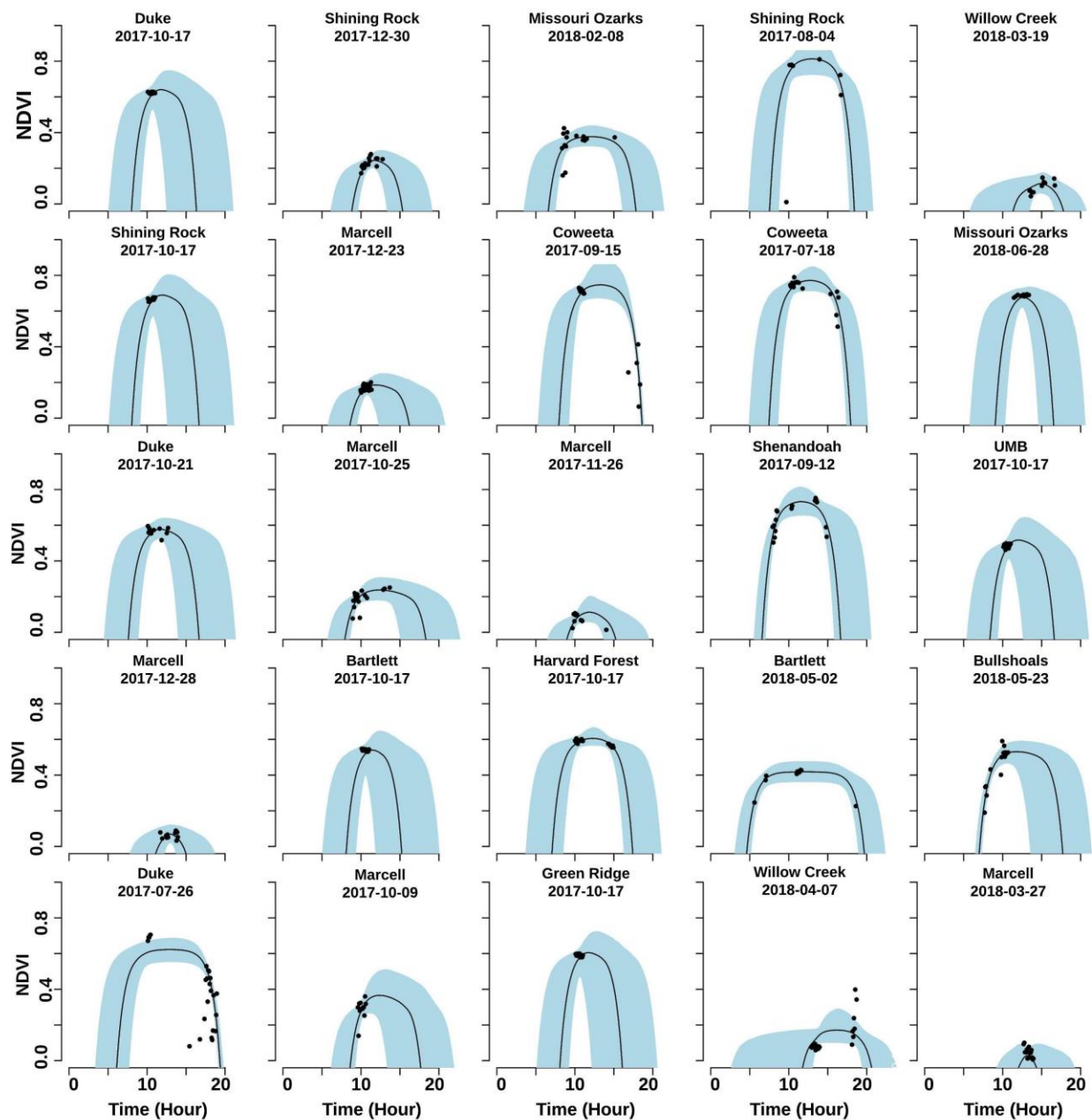


Figure S4: Random days that had low noise within the 4-hour midday window and a wide CI from the diurnal fit estimate. Blue shading indicates 95% CI.

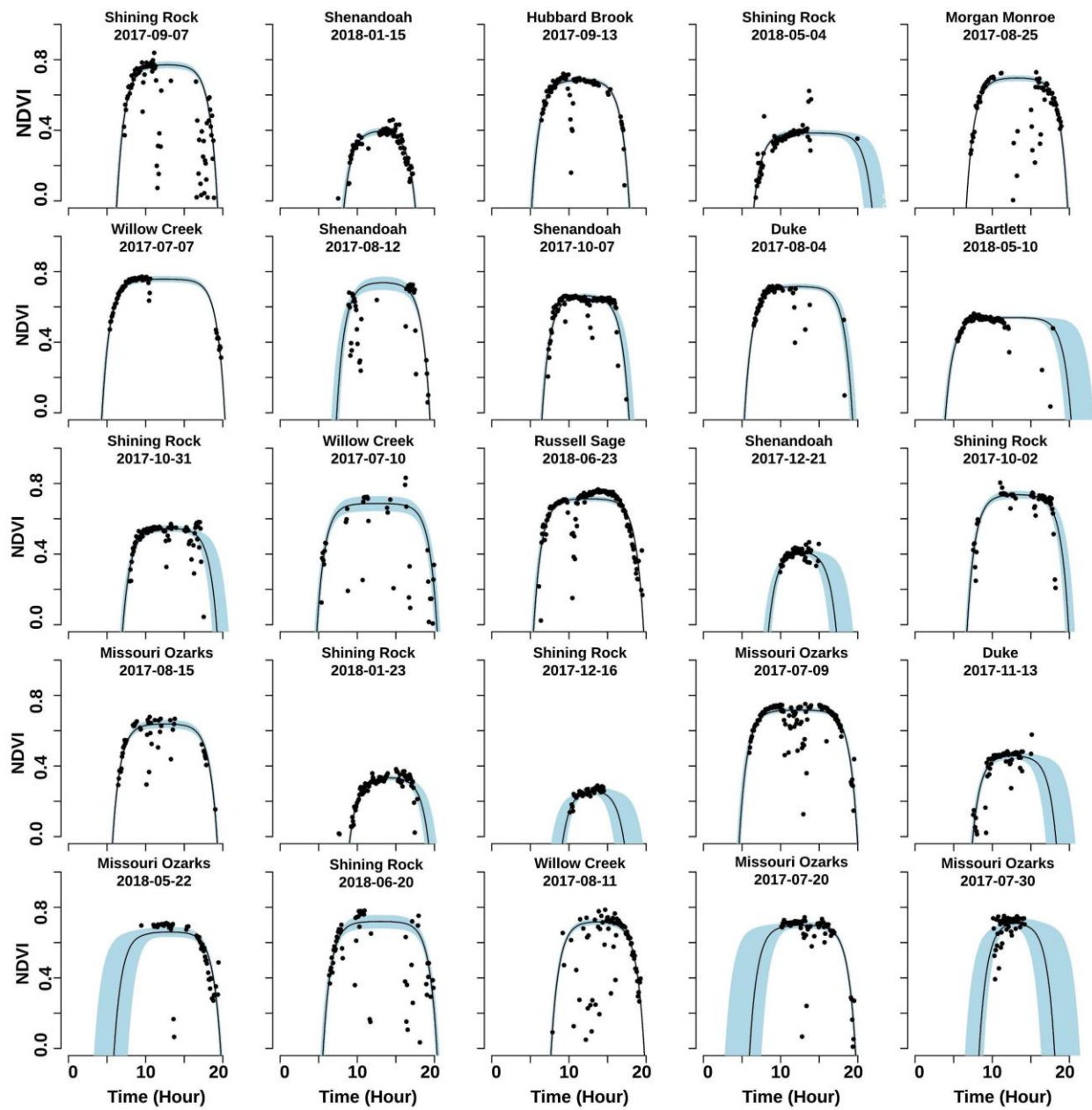


Figure S5: Random days that had high noise within the 4-hour midday window and a tight CI from the diurnal fit estimate. Blue shading indicates 95% CI.

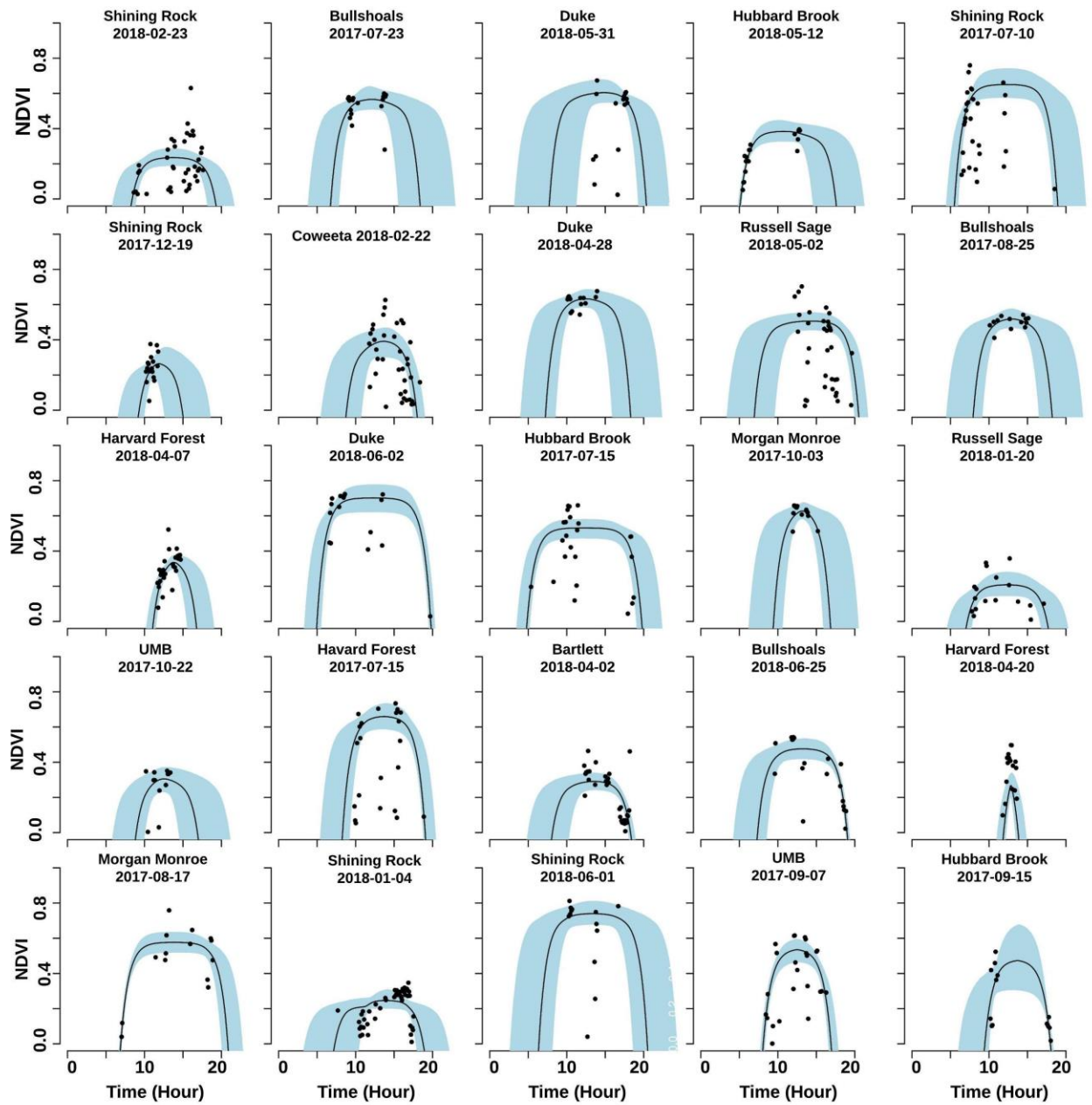


Figure S6: Random days that had high noise within the 4-hour midday window and a wide CI from the diurnal fit estimate. Blue shading indicates 95% CI.

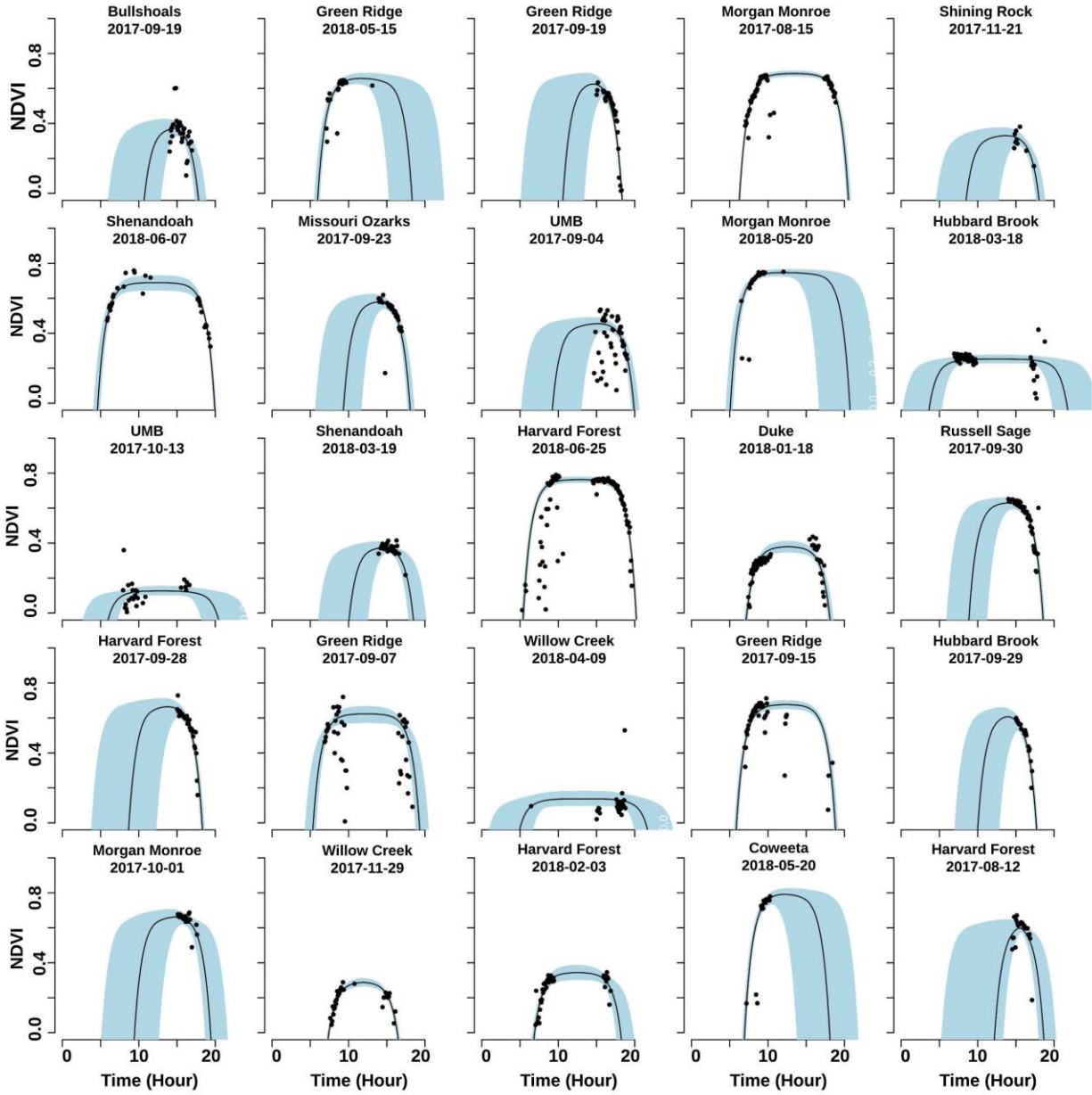


Figure S7: Random days that had <5 observations within the 4-hour midday window and a tight CI from the diurnal fit estimate. Blue shading indicates 95% CI.

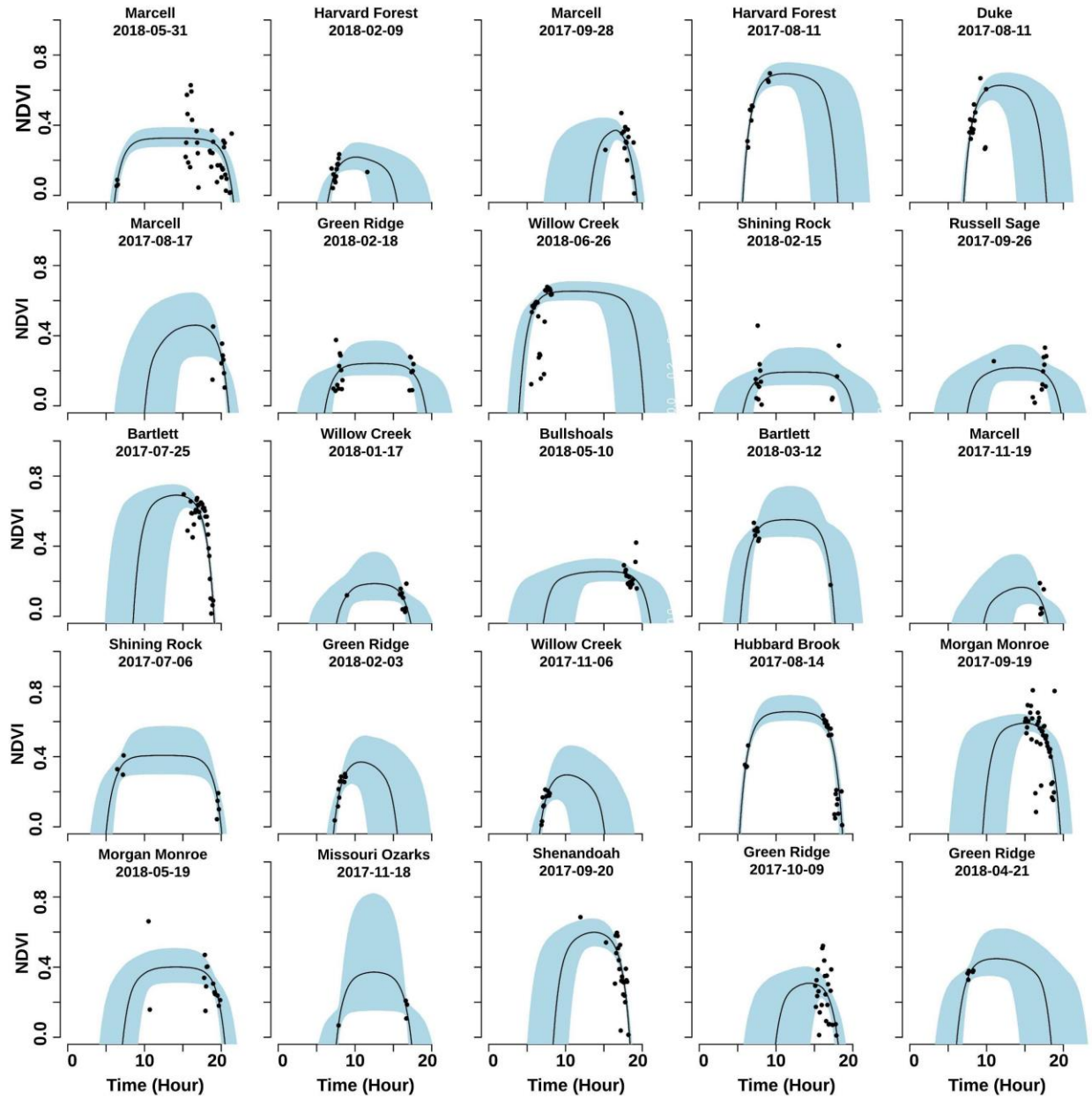


Figure S8: Random days that had <5 observations within the 4-hour midday window and a wide CI from the diurnal fit estimate. Blue shading indicates 95% CI.

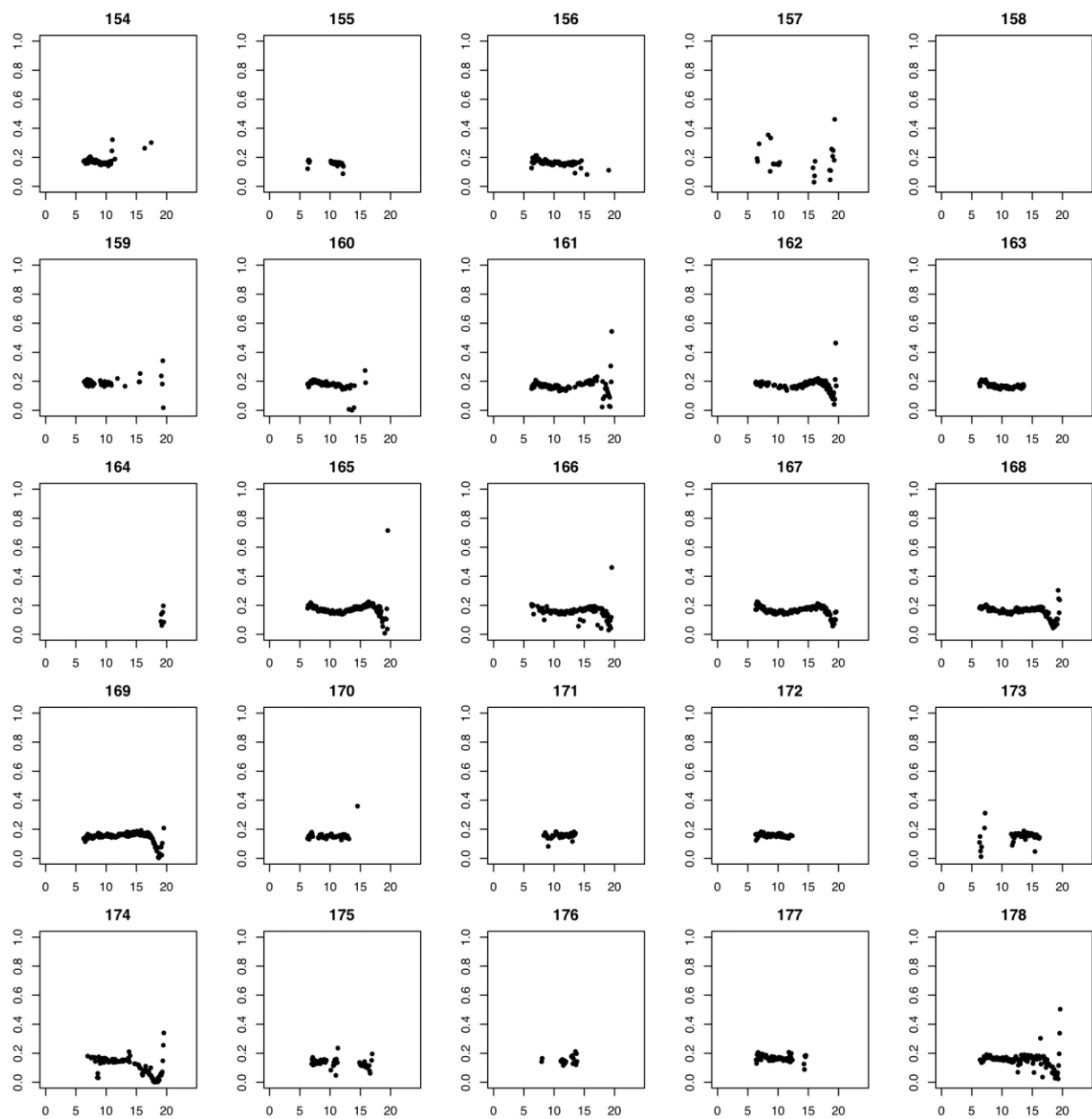


Figure S9: Diurnal pattern of data from a shrubland site (Lucky Hills; 31.7439°N 110.0520°W) that shows a different pattern than that found in the studied deciduous broadleaf sites. Days of the year (2017) are shown as the title for each plot. NDVI observations are shown on the *y-axis* and time (hour) is shown on the *x-axis*.