



Supplement of

Improving the monitoring of deciduous broadleaf phenology using the Geostationary Operational Environmental Satellite (GOES) 16 and 17

Kathryn I. Wheeler and Michael C. Dietze

Correspondence to: Kathryn I. Wheeler (kiwheel@bu.edu)

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Supplementary Material

Table S1: Specific PhenoCam Sites and Regions of Interest.

Site name	PhenoCam site and region of interest
Harvard Forest	harvard_DB_0001
Hubbard Brook	hubbardbrooksfws_DB_3000
UMBS	umichbiological_DB_2000
Coweeta	coweeta_DB_0001
Bartlett	bartlettir_DB_1000
Missouri Ozarks	missouriozarks_DB_0001
Morgan Monroe	morganmonroe_DB_1000
Russell Sage	russellsage_DB_0001
Willow Creek	willowcreek_DB_1000
Bull Shoals	bullshoals_DB_1000
Duke	dukehw_DB_1000
Green Ridge	greenridge1_DB_1000
Shenandoah	shenandoah_DB_0001
Marcell	marcell_DB_1000
Shining Rock	shiningrock_DB_0003

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Table S2: Credible interval width comparison p -values.

Transition	GOES and PC	MODIS_N and PC	MODIS_E and PC	MODIS_N and GOES	MODIS_E and GOES	MODIS_E and MODIS_N
Spring Start	0	0	0	0.07	0	0.637
Spring Middle	0	0	0	0.029	0	0.972
Spring End	0	0	0	0.023	0	0.849
Autumn Start	0.002	0.013	0	0.171	0	0.269
Autumn Middle	0.006	0.003	0	0.076	0	0.323
Autumn End	0.001	0.004	0	0.215	0.026	0.929

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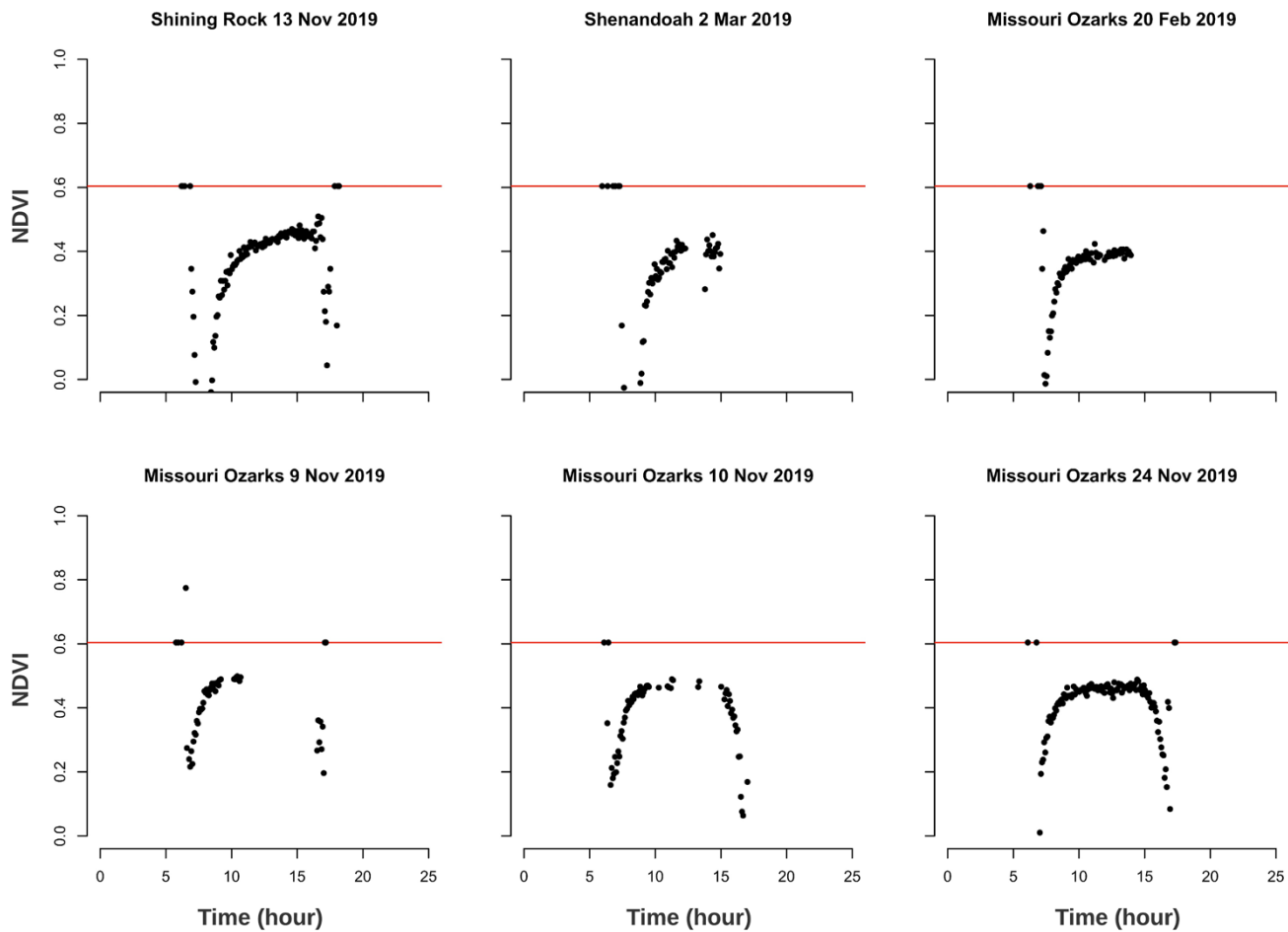
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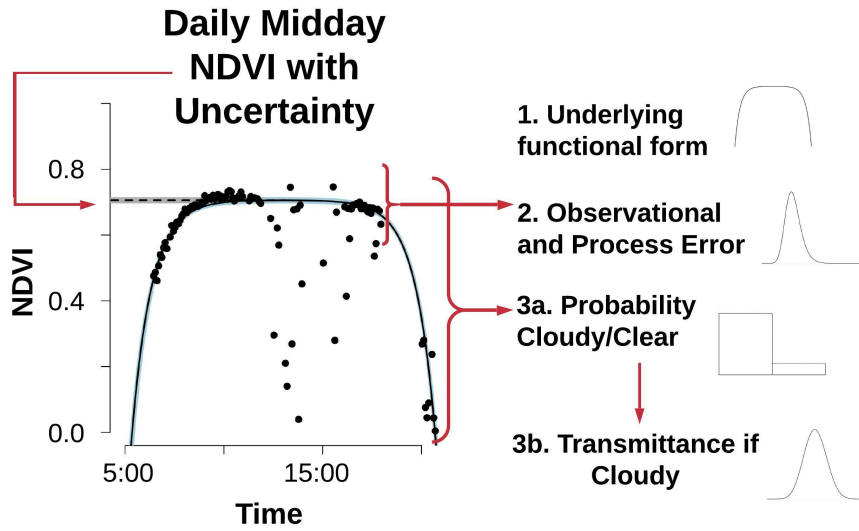
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40 **Table S3: Summary statistics** *Negative indicates the first source is earlier than the second. The width of the bias average credible interval (CI) is given in days.

Data Sources	R ²	RMSE (days)	Average Bias* (days; 95% CI)
<i>Start of Spring:</i>			
MODIS NDVI vs. GOES	0.25	12.79	-4.99 ± 0.1
MODIS EVI vs. GOES	0.37	11.73	-6.48 ± 0.04
MODIS EVI vs. MODIS NDVI	0.62	5.95	-1.48 ± 0.1
<i>Middle of Spring:</i>			
MODIS NDVI vs. GOES	0.3	12.34	-4.64 ± 0.05
MODIS EVI vs. GOES	0.5	10.41	-5.7 ± 0.04
MODIS EVI vs. MODIS NDVI	0.55	6.81	-1.05 ± 0.04
<i>End of Spring:</i>			
MODIS NDVI vs. GOES	0.25	12.85	-4.3 ± 0.1
MODIS EVI vs. GOES	0.56	9.89	-4.92 ± 0.04
MODIS EVI vs. MODIS NDVI	0.47	8.1	-0.62 ± 0.1
45 <i>Start of Autumn:</i>			
MODIS NDVI vs. GOES	0.00	17.73	5.25± 0.24
MODIS EVI vs. GOES	0.00	27.18	-20.09 ± 0.09
MODIS EVI vs. MODIS NDVI	0.00	29.24	-25.34 ± 0.24
<i>Middle of Autumn:</i>			
MODIS NDVI vs. GOES	0.34	9.72	-2.89 ± 0.05
MODIS EVI vs. GOES	0.00	23.69	-19.74± 0.06
MODIS EVI vs. MODIS NDVI	0.00	19.32	-16.85 ± 0.06
<i>End of Autumn:</i>			
MODIS NDVI vs. GOES	0.00	17.04	-11.03 ± 0.24
MODIS EVI vs. GOES	0.00	23.98	-19.39 ± 0.07
MODIS EVI vs. MODIS NDVI	0.00	12.64	-8.36± 0.24



50 **Figure S1: Examples of diurnal GOES data for different sites and dates that show the consistent noisy NDVI value of 0.6040 (horizontal red line), which we removed to improve fits.**



55 **Figure S2:** Representation of the GOES diurnal method used to estimate daily midday NDVI values. Reprinted from (Wheeler and Dietze, 2019). The light blue shading indicates the 95% credible interval (CI) and the dotted horizontal line (with gray shading) indicates the fitted midday maximum NDVI value (and 95% CI).

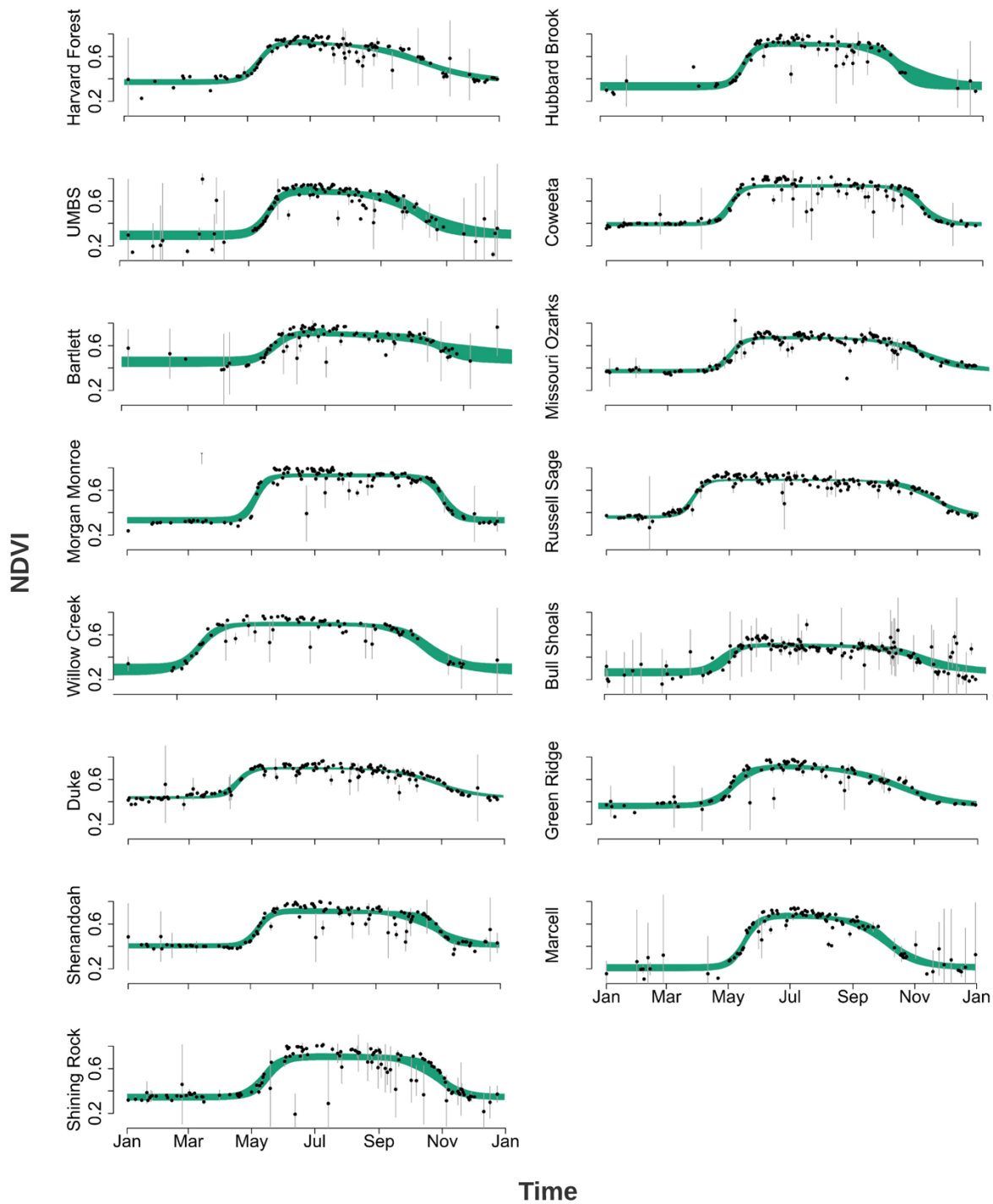
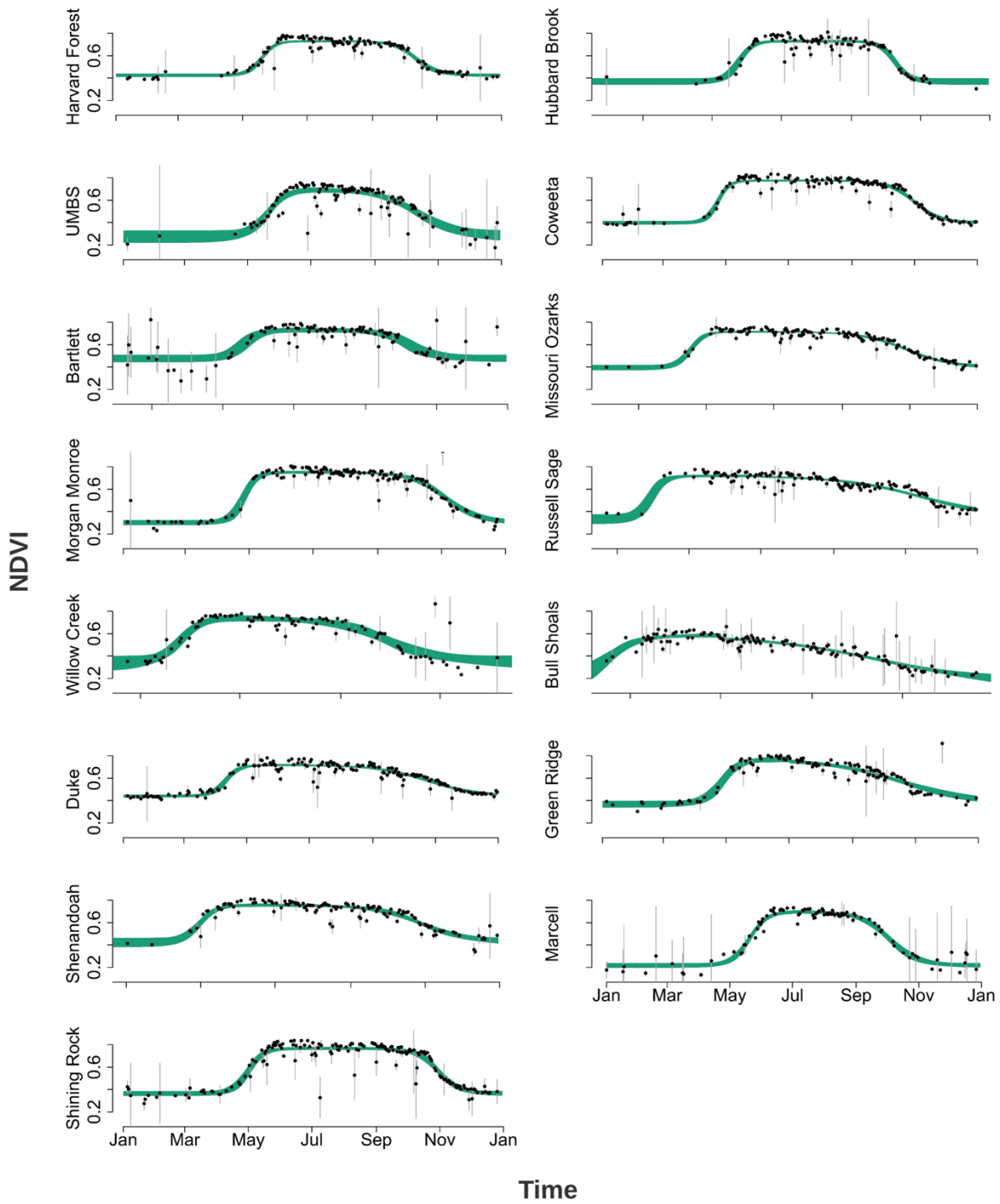
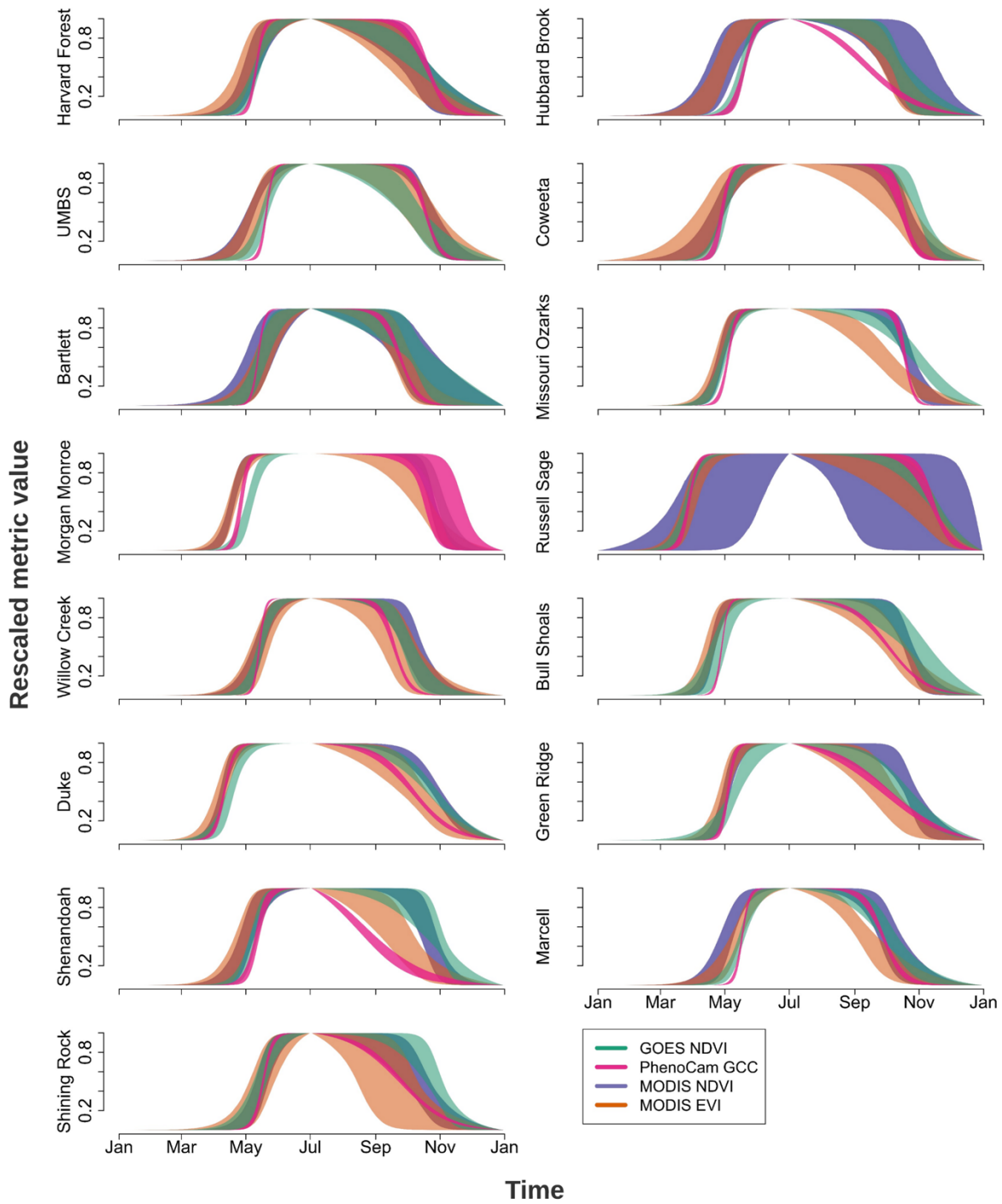


Figure S3: Phenological fits for GOES data at the different sites for 2018. The shading indicates the 95% credible intervals (CI). The points indicate the mean of the midday NDVI values from the daily diurnals with the gray vertical lines indicating the 95% CI on the daily data.



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Figure S4: Phenological fits for GOES data at the different sites for 2019. The shading indicates the 95% credible intervals (CI). The points indicate the mean of the midday NDVI values from the daily diurnals with the gray vertical lines indicating the 95% CI on the daily data.



65 **Figure S5: Rescaled 95% credible intervals for the phenology fits for 2018 for all data sources and sites.**

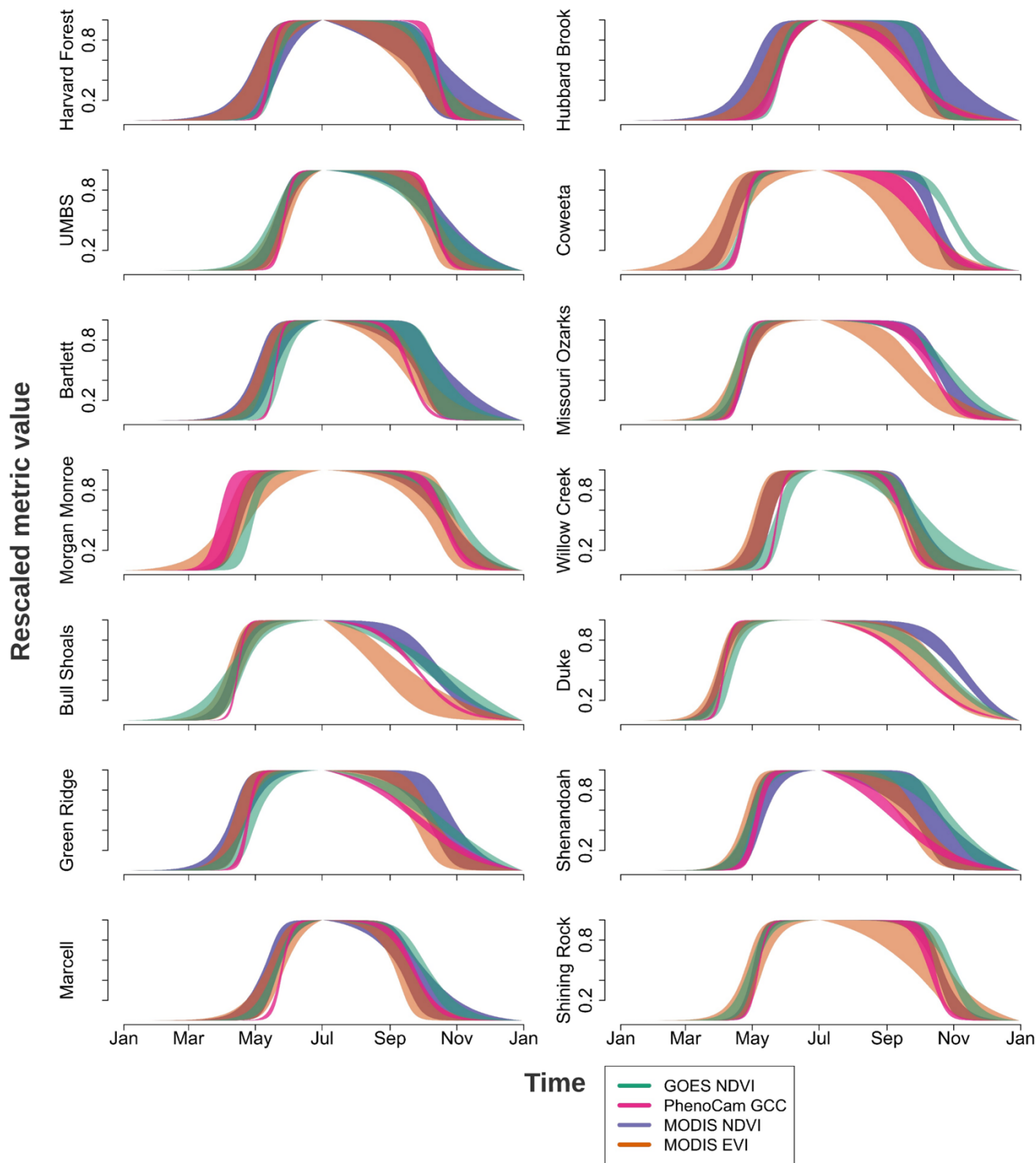


Figure S6: Rescaled 95% credible intervals for the phenology fits for 2019 for all data sources and sites.