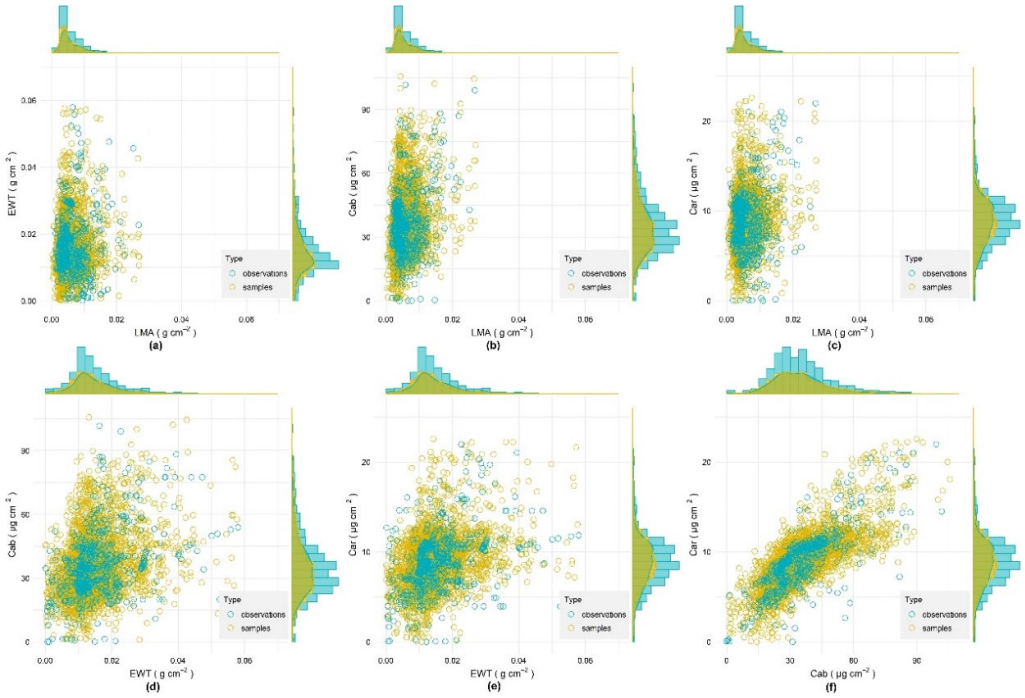

Figure S1. Constrained random samples of herbaceous LMA, EWT, Cab, Car based on field observations using Gaussian copula for (**a**) LMA vs. EWT; (**b**) LMA vs. Cab; (**c**) LMA vs. Car; (**d**) EWT vs. Cab; (**e**) EWT vs. Car; (**f**) Cab vs. Car.

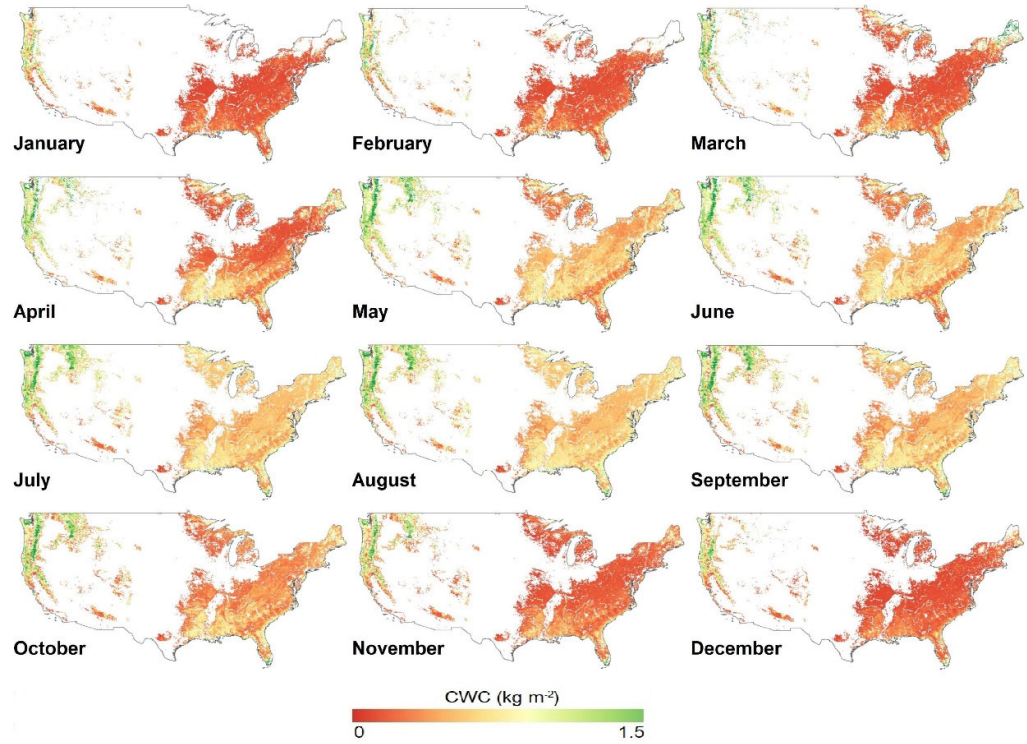

Figure S2. Monthly mean CWC spatial distribution of CONUS at 500 meters resolution in 2017–2021 based on PRO4SAIL inversion.

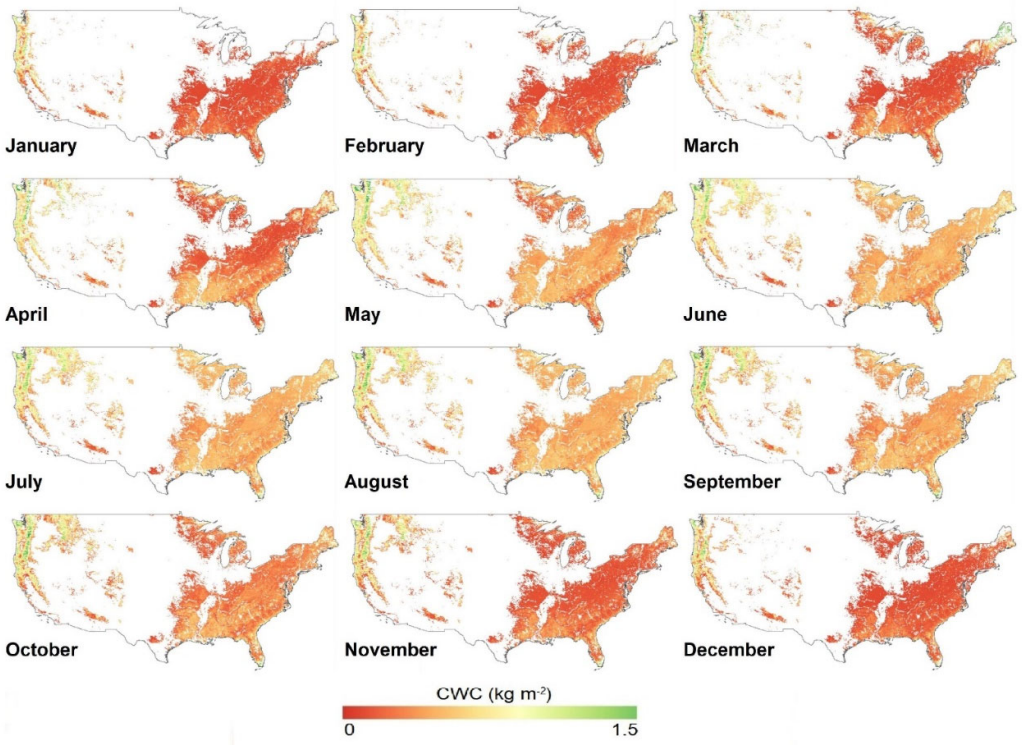

Figure S3. Monthly mean CWC spatial distribution of CONUS at 500 meters resolution in 2017–2021 based on PRO4SAIL2 inversion.

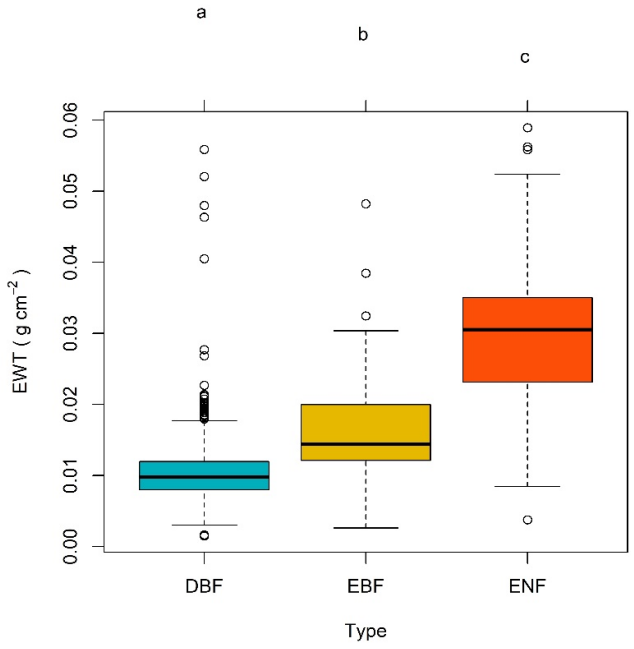

Figure S4. Box plot for the EWT of NEON field observations between deciduous and evergreen forests. The statistical significance is shown by lowercase letters at the level of $p < 0.001$ using one-way analysis of variance (ANOVA).

Table S1. Parameterization of RTMs' inputs for forest CWC inversion.

Canopy	Parameters	Units	Symbol	4SAIL				4SAIL2		GeoSail	
				Understory		Overstory					
				Parameterization	Source	Parameterization	Source	Parameterization	Source	Parameterization	Source
	Sun zenith angle	(°)	tts	20 - 30	[1]	20 - 30	[1]	20 - 30	[1]	20 - 30	[1]
	View zenith angle	(°)	tto	0	[2]	0	[2]	0	[2]	0	[2]
	Relative azimuth angle	(°)	psi	0		0		0		0	
	Leaf area index	m^2 m^{-2}	LAI	0.09 - 1.89 (3.5, 4)	NEON	0 - 8 (3.5, 4)	[2-4]	0 - 8 (3.5, 4)	[2-4]	0 - 8 (3.5, 4)	[2-4]
	Crown cover fraction	/	Cv	/	/	LAI/6	[5]	LAI/6	[5]	LAI/6	[5]
	Leaf inclination distribution function (LIDF) type	/	LIDF	35-80 (60, 12)	[1]	Plagiophile, Erectophile, Spherical	[6]	Plagiophile, Erectophile, Spherical	[6]	Plagiophile, Erectophile, Spherical	[6]
	Tree shape factor	/	CHW			1 - 3		1 - 3		1 - 3	
	Hot spot	/	hspot	0.1 – 0.5 (0.2, 0.2)	[1]	0.5/LAI		0.5/LAI		0.5/LAI	

Connect to the table above

Leaf	Parameters	Units	Symbol	4SAIL				4SAIL2		GeoSail	
				Understory		Overstory					
				Parameterization	Source	Parameterization	Source	Parameterization	Source	Parameterization	Source
	Leaf structure parameter	/	N	1.1 – 3 (1.7, 0.32)	LOPEX93, ANGERS, NEON	1.05 – 2.74 (1.54, 0.27)	LOPEX93, ANGERS, NEON	1.05 – 2.74 (1.54, 0.27)	LOPEX93, ANGERS, NEON	1.05 – 2.74 (1.54, 0.27)	LOPEX93, ANGERS, NEON
	Dry mass content	g cm^{-2}	LMA	Gaussian copula	NEON	Gaussian copula	NEON	Gaussian copula	NEON	Gaussian copula	NEON
	Water content	g cm^{-2}	EWT								
	Chlorophyll content	µg cm^{-2}	Cab								
	Carotenoid content	µg cm^{-2}	Car								
	Brown pigment	/	Cbp	0	[2-4,6]	0	[2-4,6]	0	[2-4,6]	0	[2-4,6]
Soil	Soil factor	/	psoil	0.1 – 1 (0.8, 0.6)	[2-4]	/	/	/	/	/	/

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