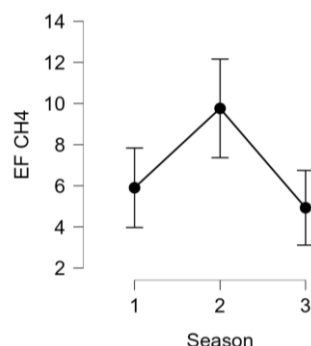


## Supplementary 1. ANOVAs

### Descriptives plots



### ANOVA

One-way ANOVA for CH<sub>4</sub>  
means by season, using n=86 (CO<sub>2</sub> outlier removed).

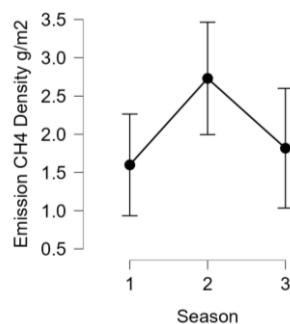
#### ANOVA - EF CH<sub>4</sub>

Cases	Sum of Squares	df	Mean Square	F	p	$\eta^2$	$\omega^2$
Season	401.024	2	200.512	6.639	0.002	0.138	0.116
Residuals	2506.752	83	30.202				

Note. Type III Sum of Squares

**Figure S1.** ANOVA for Methane Emission Factor by Season.

### Descriptives plots



### ANOVA

One-way ANOVA for CH<sub>4</sub>  
means by season, using n=86 (CO<sub>2</sub> outlier removed).

#### ANOVA - Emission CH<sub>4</sub> Density g/m<sup>2</sup>

Cases	Sum of Squares	df	Mean Square	F	p	$\eta^2$	$\omega^2$
Season	20.621	2	10.310	2.686	0.074	0.061	0.038
Residuals	318.599	83	3.839				

Note. Type III Sum of Squares

**Figure S2.** ANOVA for Methane Emission Density by Season.

## Supplementary 2. Pearson's Correlations

Tables S1–S16. Methane EF and ED Correlations for Key Variables by Fire Type and Season ( $n = 86$ ).

**Table S1.** Methane EF Correlations for Key Variables for All Fires.

EF CH4 and Byram\_act\_dry: grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as EF CH4. No transformed variables.

## Pearson's Correlations

Variable		EF CH4	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. EF CH4	Pearson's r	—									
	p-value	—									
2. MCE	Pearson's r	0.467***	—								
	p-value	< .001	—								
3. Log Byram Intensity	Pearson's r	-0.133	-0.226*	—							
	p-value	0.220	0.036	—							
4. 2.2- Grass %	Pearson's r	0.027	0.167	0.048	—						
	p-value	0.804	0.124	0.658	—						
5. True CC	Pearson's r	-0.126	-0.260*	0.606***	0.081	—					
	p-value	0.248	0.016	< .001	0.461	—					
6. Log Humidity	Pearson's r	0.242*	0.506***	-0.219*	-0.164	-0.044	—				
	p-value	0.025	< .001	0.042	0.132	0.690	—				
7. Eff_Visual (BE)	Pearson's r	3.218e-4	-0.280**	0.216*	-0.029	0.256*	-0.257*	—			
	p-value	0.998	0.009	0.046	0.790	0.017	0.017	—			
8. Log total moisture	Pearson's r	0.220*	0.235*	-0.415***	0.047	-0.383***	0.486***	-0.132	—		
	p-value	0.042	0.029	< .001	0.665	< .001	< .001	0.227	—		
9. Wind_speed (m/s)	Pearson's r	0.391***	0.202	-0.021	0.081	0.038	0.082	-0.059	0.161	—	
	p-value	< .001	0.096	0.864	0.509	0.756	0.504	0.629	0.188	—	
10. ambient_temp	Pearson's r	-0.244*	-0.219*	0.111	0.076	0.005	-0.505***	0.280**	-0.454***	-0.428***	—
	p-value	0.023	0.043	0.310	0.488	0.964	< .001	0.009	< .001	< .001	—

\* p < .05, \*\* p < .01, \*\*\* p < .001

**Table S2.** Methane EF Correlations for Key Variables for Head Fires.

Head Fires EF CH4 and Byram\_act\_dry: grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as EF CH4. No transformed variables.

## Pearson's Correlations

Variable		EF CH4	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. EF CH4	Pearson's r	—									
	p-value	—									
2. MCE	Pearson's r	0.467**	—								
	p-value	0.005	—								
3. Log Byram Intensity	Pearson's r	-0.109	-0.142	—							
	p-value	0.535	0.416	—							
4. 2.2- Grass %	Pearson's r	0.019	0.214	-0.028	—						
	p-value	0.913	0.218	0.874	—						
5. True CC	Pearson's r	-0.152	-0.179	0.461**	0.081	—					
	p-value	0.385	0.304	0.005	0.643	—					
6. Log Humidity	Pearson's r	0.218	0.434**	-0.194	-0.081	0.160	—				
	p-value	0.209	0.009	0.265	0.643	0.358	—				
7. Eff_Visual (BE)	Pearson's r	0.059	-0.300	0.026	-0.030	0.338*	-0.252	—			
	p-value	0.738	0.080	0.884	0.864	0.047	0.144	—			
8. Log total moisture	Pearson's r	0.154	0.070	-0.496**	0.120	-0.318	0.506**	-0.133	—		
	p-value	0.378	0.689	0.002	0.491	0.062	0.002	0.447	—		
9. Wind_speed (m/s)	Pearson's r	0.399*	0.364	-0.172	0.225	-0.156	0.042	0.007	0.361	—	
	p-value	0.032	0.052	0.371	0.240	0.420	0.827	0.970	0.054	—	
10. ambient_temp	Pearson's r	-0.425*	-0.247	0.044	0.138	0.114	-0.412*	0.260	-0.509**	-0.373*	—
	p-value	0.011	0.152	0.800	0.428	0.515	0.014	0.132	0.002	0.046	—

\* p < .05, \*\* p < .01, \*\*\* p < .001

**Table S3.** Methane EF Correlations for Key Variables for Backfires. Backfires EFCH4 and Byram\_act\_dry; grass\_biomass\_%, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity.

Pearson's Correlations		EF CH4	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. EF CH4	Pearson's r	—									
	p-value	—									
2. MCE	Pearson's r	0.470***	—								
	p-value	< .001	—								
3. Log Byram Intensity	Pearson's r	-0.162	-0.363**	—							
	p-value	0.257	0.009	—							
4. 2.2- Grass %	Pearson's r	0.035	0.125	0.049	—						
	p-value	0.808	0.384	0.733	—						
5. True CC	Pearson's r	-0.117	-0.304*	0.746***	0.084	—					
	p-value	0.413	0.030	< .001	0.557	—					
6. Log Humidity	Pearson's r	0.261	0.562***	-0.286*	-0.236	-0.152	—				
	p-value	0.064	< .001	0.042	0.096	0.287	—				
7. Eff_Visual (BE)	Pearson's r	-0.039	-0.276*	0.320*	-0.036	0.224	-0.264	—			
	p-value	0.785	0.050	0.022	0.804	0.114	0.061	—			
8. Log total moisture	Pearson's r	0.278*	0.355*	-0.501***	-0.027	-0.437**	0.469***	-0.141	—		
	p-value	0.048	0.010	< .001	0.852	0.001	< .001	0.324	—		
9. Wind_speed (m/s)	Pearson's r	0.381*	0.119	0.124	-0.006	0.133	0.120	-0.097	0.019	—	
	p-value	0.015	0.466	0.446	0.972	0.412	0.462	0.553	0.907	—	
10. ambient_temp	Pearson's r	-0.101	-0.202	0.152	0.020	-0.052	-0.587***	0.295*	-0.413**	-0.472**	—
	p-value	0.480	0.154	0.285	0.889	0.715	< .001	0.036	0.003	0.002	—

\* p &lt; .05, \*\* p &lt; .01, \*\*\* p &lt; .001

**Table S4.** Methane EF Correlations for Key Variables for Early Fires.

EDS EF CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as EF CH4. No transformed variables.

Pearson's Correlations		EF CH4	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. EF CH4	Pearson's r	—									
	p-value	—									
2. MCE	Pearson's r	0.439*	—								
	p-value	0.036	—								
3. Log Byram Intensity	Pearson's r	-0.002	-0.120	—							
	p-value	0.993	0.585	—							
4. 2.2- Grass %	Pearson's r	0.135	0.539**	-0.123	—						
	p-value	0.539	0.008	0.576	—						
5. True CC	Pearson's r	0.242	0.112	0.648***	0.249	—					
	p-value	0.267	0.611	< .001	0.251	—					
6. Log Humidity	Pearson's r	-0.094	-0.109	-0.104	-0.220	-0.181	—				
	p-value	0.669	0.621	0.638	0.313	0.408	—				
7. Eff_Visual (BE)	Pearson's r	-0.008	-0.266	0.208	-0.371	0.135	-0.229	—			
	p-value	0.971	0.221	0.340	0.081	0.540	0.294	—			
8. Log total moisture	Pearson's r	-0.253	-0.602**	-0.183	-0.311	-0.570**	0.377	0.202	—		
	p-value	0.244	0.002	0.404	0.149	0.005	0.077	0.355	—		
9. Wind_speed (m/s)	Pearson's r	0.271	0.268	0.204	-0.184	0.238	0.424*	-0.341	-0.177	—	
	p-value	0.212	0.216	0.351	0.400	0.273	0.044	0.112	0.420	—	
10. ambient_temp	Pearson's r	0.089	0.131	0.039	0.383	0.203	-0.879***	0.230	-0.312	-0.504*	—
	p-value	0.686	0.551	0.861	0.071	0.352	< .001	0.291	0.147	0.014	—

\* p &lt; .05, \*\* p &lt; .01, \*\*\* p &lt; .001

**Table S5.** Methane EF Correlations for Key Variables for Middle Fires.

MDS EF CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as EF CH4. No transformed variables.

## Pearson's Correlations

Variable		EF CH4	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. EF CH4	Pearson's r	—									
	p-value	—									
2. MCE	Pearson's r	0.692***	—								
	p-value	< .001	—								
3. Log Byram Intensity	Pearson's r	0.008	-0.154	—							
	p-value	0.966	0.409	—							
4. 2.2- Grass %	Pearson's r	-0.128	-0.110	0.018	—						
	p-value	0.493	0.555	0.922	—						
5. True CC	Pearson's r	-0.201	-0.290	0.677***	0.052	—					
	p-value	0.279	0.114	< .001	0.779	—					
6. Log Humidity	Pearson's r	0.398*	0.519**	-0.024	0.051	0.121	—				
	p-value	0.026	0.003	0.897	0.786	0.516	—				
7. Eff_Visual (BE)	Pearson's r	0.263	0.202	0.077	-0.130	0.246	0.117	—			
	p-value	0.153	0.276	0.680	0.485	0.182	0.531	—			
8. Log total moisture	Pearson's r	0.172	0.246	-0.430*	0.322	-0.280	0.432*	-0.057	—		
	p-value	0.354	0.183	0.016	0.078	0.127	0.015	0.761	—		
9. Wind_speed (m/s)	Pearson's r	0.289	0.010	-0.008	0.207	0.100	-0.008	0.207	0.002	—	
	p-value	0.115	0.956	0.968	0.265	0.591	0.964	0.264	0.991	—	
10. ambient_temp	Pearson's r	-0.229	-0.177	-0.161	-0.371*	-0.283	-0.595***	0.186	-0.199	-0.034	—
	p-value	0.215	0.339	0.386	0.040	0.123	< .001	0.316	0.282	0.856	—

\* p < .05, \*\* p < .01, \*\*\* p < .001

**Table S6.** Methane EF Correlations for Key Variables for Late Fires.

LDS EF CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as EF CH4. No transformed variables.

## Pearson's Correlations

Variable		EF CH4	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. EF CH4	Pearson's r	—									
	p-value	—									
2. MCE	Pearson's r	0.231	—								
	p-value	0.203	—								
3. Log Byram Intensity	Pearson's r	-0.190	0.044	—							
	p-value	0.299	0.810	—							
4. 2.2- Grass %	Pearson's r	0.081	0.644***	0.156	—						
	p-value	0.661	< .001	0.395	—						
5. True CC	Pearson's r	-0.202	-0.435*	0.144	-0.150	—					
	p-value	0.267	0.013	0.432	0.414	—					
6. Log Humidity	Pearson's r	-0.058	0.054	-0.193	-0.071	0.279	—				
	p-value	0.752	0.768	0.289	0.701	0.122	—				
7. Eff_Visual (BE)	Pearson's r	-0.549**	-0.078	0.114	-0.154	0.234	0.247	—			
	p-value	0.001	0.672	0.533	0.399	0.197	0.174	—			
8. Log total moisture	Pearson's r	-0.143	-0.191	-0.162	-0.344	0.325	0.759***	0.306	—		
	p-value	0.436	0.294	0.377	0.054	0.069	< .001	0.088	—		
9. Wind_speed (m/s)	Pearson's r	0.160	0.043	0.210	-0.159	-0.082	0.718**	-0.131	0.680**	—	
	p-value	0.568	0.879	0.454	0.570	0.771	0.003	0.642	0.005	—	
10. ambient_temp	Pearson's r	0.087	0.342	0.013	0.429*	-0.121	0.083	-0.139	-0.579***	-0.549*	—
	p-value	0.637	0.055	0.942	0.014	0.511	0.652	0.447	< .001	0.034	—

\* p < .05, \*\* p < .01, \*\*\* p < .001

**Table S7. Methane ED Correlations for Key Variables for All Fires.**

All fire Transformed: ED CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as ED CH4. No transformed variables.

## Pearson's Correlations

Variable		Emission CH4 Density g/m2	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. Emission CH4 Density g/m2	Pearson's r p-value	— —									
2. MCE	Pearson's r p-value	0.297** 0.005	— —								
3. Log Byram Intensity	Pearson's r p-value	0.134 0.219	-0.226* 0.036	— —							
4. 2.2- Grass %	Pearson's r p-value	0.097 0.374	0.167 0.124	0.048 0.658	— —						
5. True CC	Pearson's r p-value	0.109 0.317	-0.260* 0.016	0.606*** < .001	0.081 0.461	— —					
6. Log Humidity	Pearson's r p-value	0.024 0.826	0.506*** < .001	-0.219* 0.042	-0.164 0.132	-0.044 0.690	— —				
7. Eff_Visual (BE)	Pearson's r p-value	0.072 0.511	-0.280** 0.009	0.216* 0.046	-0.029 0.790	0.256* 0.017	-0.257* 0.017	— —			
8. Log total moisture	Pearson's r p-value	-0.026 0.809	0.235* 0.029	-0.415*** < .001	0.047 0.665	-0.383*** < .001	0.486*** < .001	-0.132 0.227	— —		
9. Wind_speed (m/s)	Pearson's r p-value	0.367** 0.002	0.202 0.096	-0.021 0.864	0.081 0.509	0.038 0.756	0.082 0.504	-0.059 0.629	0.161 0.188	— —	
10. ambient_temp	Pearson's r p-value	-0.135 0.217	-0.219* 0.043	0.111 0.310	0.076 0.488	0.005 0.964	-0.505*** < .001	0.280** 0.009	-0.454*** < .001	-0.428*** < .001	— —

\* p < .05, \*\* p < .01, \*\*\* p < .001

**Table S8. Methane ED Correlations for Key Variables for Head Fires.**

Headfire Transformed: ED CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as ED CH4. No transformed variables.

## Pearson's Correlations

Variable		Emission CH4 Density g/m2	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. Emission CH4 Density g/m2	Pearson's r p-value	— —									
2. MCE	Pearson's r p-value	0.371* 0.028	— —								
3. Log Byram Intensity	Pearson's r p-value	0.070 0.691	-0.142 0.416	— —							
4. 2.2- Grass %	Pearson's r p-value	0.048 0.786	0.214 0.218	-0.028 0.874	— —						
5. True CC	Pearson's r p-value	-0.152 0.384	-0.179 0.304	0.461** 0.005	0.081 0.643	— —					
6. Log Humidity	Pearson's r p-value	-0.061 0.727	0.434** 0.009	-0.194 0.265	-0.081 0.643	0.160 0.358	— —				
7. Eff_Visual (BE)	Pearson's r p-value	0.116 0.507	-0.300 0.080	0.026 0.884	-0.030 0.864	0.338* 0.047	-0.252 0.144	— —			
8. Log total moisture	Pearson's r p-value	-0.046 0.793	0.070 0.689	-0.496** 0.002	0.120 0.491	-0.318 0.062	0.506** 0.002	-0.133 0.447	— —		
9. Wind_speed (m/s)	Pearson's r p-value	0.372* 0.047	0.364 0.052	-0.172 0.371	0.225 0.240	-0.156 0.420	0.042 0.827	0.007 0.970	0.361 0.054	— —	
10. ambient_temp	Pearson's r p-value	-0.340* 0.046	-0.247 0.152	0.044 0.800	0.138 0.428	0.114 0.515	-0.412* 0.014	0.260 0.132	-0.509** 0.002	-0.373* 0.046	— —

\* p < .05, \*\* p < .01, \*\*\* p < .001

**Table S9.** Methane ED Correlations for Key Variables for Backfires.

Backfire Transformed: ED CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as ED CH4. No transformed variables.

Pearson's Correlations		Emission CH4 Density g/m2	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. Emission CH4 Density g/m2	Pearson's r p-value	— —									
2. MCE	Pearson's r p-value	0.267 0.058	— —								
3. Log Byram Intensity	Pearson's r p-value	0.250 0.076	-0.363** 0.009	— —							
4. 2.2- Grass %	Pearson's r p-value	0.145 0.311	0.125 0.384	0.049 0.733	— —						
5. True CC	Pearson's r p-value	0.223 0.116	-0.304* 0.030	0.746*** < .001	0.084 0.557	— —					
6. Log Humidity	Pearson's r p-value	0.087 0.545	0.562*** < .001	-0.286* 0.042	-0.236 0.096	-0.152 0.287	— —				
7. Eff_Visual (BE)	Pearson's r p-value	0.053 0.709	-0.276* 0.050	0.320* 0.022	-0.036 0.804	0.224 0.114	-0.264 0.061	— —			
8. Log total moisture	Pearson's r p-value	0.001 0.994	0.355* 0.010	-0.501*** < .001	-0.027 0.852	-0.437** 0.001	0.469*** < .001	-0.141 0.324	— —		
9. Wind_speed (m/s)	Pearson's r p-value	0.350* 0.027	0.119 0.466	0.124 0.446	-0.006 0.972	0.133 0.412	0.120 0.462	-0.097 0.553	0.019 0.907	— —	
10. ambient_temp	Pearson's r p-value	0.012 0.933	-0.202 0.154	0.152 0.285	0.020 0.889	-0.052 0.715	-0.587*** < .001	0.295* 0.036	-0.413** 0.003	-0.472** 0.002	— —

\* p < .05, \*\* p < .01, \*\*\* p < .001

**Table S10.** Methane ED Correlations for Key Variables for Early Fires.

EDS fire Transformed: ED CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as ED CH4. No transformed variables.

Pearson's Correlations		Emission CH4 Density g/m2	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. Emission CH4 Density g/m2	Pearson's r p-value	— —									
2. MCE	Pearson's r p-value	0.158 0.470	— —								
3. Log Byram Intensity	Pearson's r p-value	0.168 0.445	-0.120 0.585	— —							
4. 2.2- Grass %	Pearson's r p-value	-0.039 0.861	0.539** 0.008	-0.123 0.576	— —						
5. True CC	Pearson's r p-value	0.394 0.063	0.112 0.611	0.648*** < .001	0.249 0.251	— —					
6. Log Humidity	Pearson's r p-value	-0.112 0.611	-0.109 0.621	-0.104 0.638	-0.220 0.313	-0.181 0.408	— —				
7. Eff_Visual (BE)	Pearson's r p-value	0.199 0.363	-0.266 0.221	0.208 0.340	-0.371 0.081	0.135 0.540	-0.229 0.294	— —			
8. Log total moisture	Pearson's r p-value	-0.265 0.221	-0.602** 0.002	-0.183 0.404	-0.311 0.149	-0.570** 0.005	0.377 0.077	0.202 0.355	— —		
9. Wind_speed (m/s)	Pearson's r p-value	0.198 0.365	0.268 0.216	0.204 0.351	-0.184 0.400	0.238 0.273	0.424* 0.044	-0.341 0.112	-0.177 0.420	— —	
10. ambient_temp	Pearson's r p-value	0.086 0.695	0.131 0.551	0.039 0.861	0.383 0.071	0.203 0.352	-0.879*** < .001	0.230 0.291	-0.312 0.147	-0.504* 0.014	— —

\* p < .05, \*\* p < .01, \*\*\* p < .001

**Table S11.** Methane ED Correlations for Key Variables for Middle Fires.

MDS fire Transformed: ED CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as ED CH4. No transformed variables.

## Pearson's Correlations

Variable		Emission CH4 Density g/m2	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. Emission CH4 Density g/m2	Pearson's r	—									
	p-value	—									
2. MCE	Pearson's r	0.368*	—								
	p-value	0.042	—								
3. Log Byram Intensity	Pearson's r	0.391*	-0.154	—							
	p-value	0.030	0.409	—							
4. 2.2- Grass %	Pearson's r	-0.080	-0.110	0.018	—						
	p-value	0.670	0.555	0.922	—						
5. True CC	Pearson's r	0.182	-0.290	0.677***	0.052	—					
	p-value	0.327	0.114	< .001	0.779	—					
6. Log Humidity	Pearson's r	0.068	0.519**	-0.024	0.051	0.121	—				
	p-value	0.716	0.003	0.897	0.786	0.516	—				
7. Eff_Visual (BE)	Pearson's r	0.227	0.202	0.077	-0.130	0.246	0.117	—			
	p-value	0.219	0.276	0.680	0.485	0.182	0.531	—			
8. Log total moisture	Pearson's r	-0.184	0.246	-0.430*	0.322	-0.280	0.432*	-0.057	—		
	p-value	0.321	0.183	0.016	0.078	0.127	0.015	0.761	—		
9. Wind_speed (m/s)	Pearson's r	0.360*	0.010	-0.008	0.207	0.100	-0.008	0.207	0.002	—	
	p-value	0.047	0.956	0.968	0.265	0.591	0.964	0.264	0.991	—	
10. ambient_temp	Pearson's r	-0.216	-0.177	-0.161	-0.371*	-0.283	-0.595***	0.186	-0.199	-0.034	—
	p-value	0.243	0.339	0.386	0.040	0.123	< .001	0.316	0.282	0.856	—

\* p < .05, \*\* p < .01, \*\*\* p < .001

**Table S12.** Methane EF Correlations for Key Variables for Late Fires.

LDS fire Transformed: ED CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as ED CH4. No transformed variables.

## Pearson's Correlations

Variable		Emission CH4 Density g/m2	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. Emission CH4 Density g/m2	Pearson's r	—									
	p-value	—									
2. MCE	Pearson's r	0.367*	—								
	p-value	0.039	—								
3. Log Byram Intensity	Pearson's r	-0.048	0.044	—							
	p-value	0.796	0.810	—							
4. 2.2- Grass %	Pearson's r	0.209	0.644***	0.156	—						
	p-value	0.251	< .001	0.395	—						
5. True CC	Pearson's r	-0.186	-0.435*	0.144	-0.150	—					
	p-value	0.308	0.013	0.432	0.414	—					
6. Log Humidity	Pearson's r	-0.035	0.054	-0.193	-0.071	0.279	—				
	p-value	0.851	0.768	0.289	0.701	0.122	—				
7. Eff_Visual (BE)	Pearson's r	-0.545**	-0.078	0.114	-0.154	0.234	0.247	—			
	p-value	0.001	0.672	0.533	0.399	0.197	0.174	—			
8. Log total moisture	Pearson's r	-0.116	-0.191	-0.162	-0.344	0.325	0.759***	0.306	—		
	p-value	0.528	0.294	0.377	0.054	0.069	< .001	0.088	—		
9. Wind_speed (m/s)	Pearson's r	0.215	0.043	0.210	-0.159	-0.082	0.718**	-0.131	0.680**	—	
	p-value	0.442	0.879	0.454	0.570	0.771	0.003	0.642	0.005	—	
10. ambient_temp	Pearson's r	0.090	0.342	0.013	0.429*	-0.121	0.083	-0.139	-0.579***	-0.549*	—
	p-value	0.622	0.055	0.942	0.014	0.511	0.652	0.447	< .001	0.034	—

\* p < .05, \*\* p < .01, \*\*\* p < .001

### Supplementary 3. Methane and Carbon Monoxide EF Correlations

**Table S13.** Methane and Carbon Monoxide EF correlation with Ambient Weather Conditions for all fires.

Pearson's Correlations		Variable	EF CH4	EF CO	Wind_speed (m/s)	ambient_temp	Log Humidity
1. EF CH4	Pearson's r p-value	— —					
2. EF CO	Pearson's r p-value	-0.525*** < .001	— —				
3. Wind_speed (m/s)	Pearson's r p-value	0.391*** < .001	-0.205 0.091	— —			
4. ambient_temp	Pearson's r p-value	-0.244* 0.023	0.197 0.068	-0.428*** < .001	— —		
5. Log Humidity	Pearson's r p-value	0.242* 0.025	-0.489*** < .001	0.082 0.504	-0.505*** < .001	— —	

\* p < .05, \*\* p < .01, \*\*\* p < .001

### Supplementary 4. Methane EF and ED Correlations for Local and Random Fires

Tables S1–S16. Methane EF and ED Correlations for Key Variables by Local and Random Fire

**Table S14.** Methane EF Correlations for Key Variables for Local Fires.

Local EF CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as EF CH4. No transformed variables.

Pearson's Correlations		Variable	EF CH4	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. EF CH4	Pearson's r p-value	— —										
2. MCE	Pearson's r p-value	0.655* 0.021	— —									
3. Log Byram Intensity	Pearson's r p-value	0.534 0.073	0.214 0.504	— —								
4. 2.2- Grass %	Pearson's r p-value	-0.396 0.202	-0.098 0.762	-0.486 0.109	— —							
5. True CC	Pearson's r p-value	-0.055 0.865	-0.325 0.302	0.379 0.224	-0.029 0.929	— —						
6. Log Humidity	Pearson's r p-value	0.105 0.745	0.300 0.343	-0.042 0.896	0.004 0.989	0.528 0.078	— —					
7. Eff_Visual (BE)	Pearson's r p-value	0.319 0.313	0.108 0.739	-0.022 0.946	-0.101 0.755	0.199 0.534	0.081 0.802	— —				
8. Log total moisture	Pearson's r p-value	-0.462 0.131	-0.159 0.621	-0.450 0.142	0.401 0.196	0.080 0.805	0.330 0.294	0.004 0.991	— —			
9. Wind_speed (m/s)	Pearson's r p-value	0.229 0.475	-0.201 0.532	0.153 0.635	-0.146 0.651	0.129 0.690	-0.154 0.633	0.226 0.480	-0.490 0.105	— —		
10. ambient_temp	Pearson's r p-value	-0.281 0.377	-0.466 0.127	-0.117 0.717	0.082 0.800	-0.462 0.130	-0.775** 0.003	-0.063 0.846	0.105 0.744	-0.006 0.986	— —	

\* p < .05, \*\* p < .01, \*\*\* p < .001



**Table S15.** Methane EF Correlations for Key Variables for Random Fires.

Random EF CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as EF CH4. No transformed variables.

## Pearson's Correlations

Variable		EF CH4	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. EF CH4	Pearson's r	—									
	p-value	—									
2. MCE	Pearson's r	0.736***	—								
	p-value	< .001	—								
3. Log Byram Intensity	Pearson's r	-0.205	-0.365	—							
	p-value	0.399	0.124	—							
4. 2.2- Grass %	Pearson's r	0.018	-0.124	0.222	—						
	p-value	0.940	0.612	0.362	—						
5. True CC	Pearson's r	-0.261	-0.325	0.738***	0.038	—					
	p-value	0.281	0.175	< .001	0.878	—					
6. Log Humidity	Pearson's r	0.709***	0.835***	-0.017	-0.111	-0.044	—				
	p-value	< .001	< .001	0.946	0.652	0.859	—				
7. Eff_Visual (BE)	Pearson's r	0.224	0.294	0.127	-0.107	0.301	0.203	—			
	p-value	0.357	0.222	0.603	0.663	0.210	0.404	—			
8. Log total moisture	Pearson's r	0.564*	0.601**	-0.453	0.137	-0.432	0.475*	-0.064	—		
	p-value	0.012	0.006	0.052	0.575	0.064	0.040	0.796	—		
9. Wind_speed (m/s)	Pearson's r	0.357	0.243	-0.084	0.283	0.079	0.017	0.252	0.215	—	
	p-value	0.133	0.317	0.733	0.241	0.747	0.944	0.299	0.377	—	
10. ambient_temp	Pearson's r	-0.242	-0.007	-0.214	-0.384	-0.250	-0.407	0.334	-0.200	0.194	—
	p-value	0.319	0.977	0.379	0.105	0.301	0.084	0.163	0.411	0.426	—

\* p < .05, \*\* p < .01, \*\*\* p < .001

**Table S16.** Methane ED Correlations for Key Variables for Local Fires.

Local fire Transformed: ED CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as ED CH4. No transformed variables.

## Pearson's Correlations

Variable		Emission CH4 Density g/m2	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. Emission CH4 Density g/m2	Pearson's r	—									
	p-value	—									
2. MCE	Pearson's r	0.472	—								
	p-value	0.121	—								
3. Log Byram Intensity	Pearson's r	0.576	0.214	—							
	p-value	0.050	0.504	—							
4. 2.2- Grass %	Pearson's r	-0.512	-0.098	-0.486	—						
	p-value	0.089	0.762	0.109	—						
5. True CC	Pearson's r	-0.248	-0.325	0.379	-0.029	—					
	p-value	0.436	0.302	0.224	0.929	—					
6. Log Humidity	Pearson's r	-0.246	0.300	-0.042	0.004	0.528	—				
	p-value	0.441	0.343	0.896	0.989	0.078	—				
7. Eff_Visual (BE)	Pearson's r	0.250	0.108	-0.022	-0.101	0.199	0.081	—			
	p-value	0.434	0.739	0.946	0.755	0.534	0.802	—			
8. Log total moisture	Pearson's r	-0.689*	-0.159	-0.450	0.401	0.080	0.330	0.004	—		
	p-value	0.013	0.621	0.142	0.196	0.805	0.294	0.991	—		
9. Wind_speed (m/s)	Pearson's r	0.345	-0.201	0.153	-0.146	0.129	-0.154	0.226	-0.490	—	
	p-value	0.271	0.532	0.635	0.651	0.690	0.633	0.480	0.105	—	
10. ambient_temp	Pearson's r	0.086	-0.466	-0.117	0.082	-0.462	-0.775**	-0.063	0.105	-0.006	—
	p-value	0.791	0.127	0.717	0.800	0.130	0.003	0.846	0.744	0.986	—

\* p < .05, \*\* p < .01, \*\*\* p < .001

**Table S17.** Methane ED Correlations for Key Variables for Random Fires.

Random fire Transformed: ED CH4 and Byram\_act\_dry; grass\_biomass\_%, m/s, Total Moisture, Wind\_Speed (m/s), ambient\_temp, humidity, everything that went into the regression with Y as ED CH4. No transformed variables.

## Pearson's Correlations

Variable		Emission CH4 Density g/m2	MCE	Log Byram Intensity	2.2- Grass %	True CC	Log Humidity	Eff_Visual (BE)	Log total moisture	Wind_speed (m/s)	ambient_temp
1. Emission CH4 Density g/m2	Pearson's r	—									
	p-value	—									
2. MCE	Pearson's r	0.258	—								
	p-value	0.287	—								
3. Log Byram Intensity	Pearson's r	0.339	-0.365	—							
	p-value	0.156	0.124	—							
4. 2.2- Grass %	Pearson's r	0.168	-0.124	0.222	—						
	p-value	0.492	0.612	0.362	—						
5. True CC	Pearson's r	0.371	-0.325	0.738***	0.038	—					
	p-value	0.118	0.175	< .001	0.878	—					
6. Log Humidity	Pearson's r	0.414	0.835***	-0.017	-0.111	-0.044	—				
	p-value	0.078	< .001	0.946	0.652	0.859	—				
7. Eff_Visual (BE)	Pearson's r	0.228	0.294	0.127	-0.107	0.301	0.203	—			
	p-value	0.348	0.222	0.603	0.663	0.210	0.404	—			
8. Log total moisture	Pearson's r	0.142	0.601**	-0.453	0.137	-0.432	0.475*	-0.064	—		
	p-value	0.563	0.006	0.052	0.575	0.064	0.040	0.796	—		
9. Wind_speed (m/s)	Pearson's r	0.346	0.243	-0.084	0.283	0.079	0.017	0.252	0.215	—	
	p-value	0.147	0.317	0.733	0.241	0.747	0.944	0.299	0.377	—	
10. ambient_temp	Pearson's r	-0.424	-0.007	-0.214	-0.384	-0.250	-0.407	0.334	-0.200	0.194	—
	p-value	0.070	0.977	0.379	0.105	0.301	0.084	0.163	0.411	0.426	—

\* p < .05, \*\* p < .01, \*\*\* p < .001