Table S1 The snowmelt and ignition trends for all ecoregions. All trends are retrieved using simple linear regressions. Values in **bold** indicate significance level at $p < 0.05$, and values in *italic* represent significance level at $p < 0.1$.

Ecoregion	Area (10^4 km^2)	Snowmelt trend 2001-2019 (days dec^{-1})	Snow-melt trend 1980-2019 (days dec^{-1})	Snow-melt trend 1980-2000 (days dec^{-1})	Number of ignitions 2001-2019	Number of ignition trend 1980-2019 ($\times 10^{-6}$ ignitions km^{-2} dec^{-1})	Ignition timing trend, all ignitions 2001-2019 (days dec^{-1})
Alaska Boreal Interior	4.23	-3.06	**-2.61**	-0.35	962	**2.32**	**-6.29**
Alaska Tundra	3.82	**-7.87**	**-2.71**	*-0.48*	121	**0.36**	*-9.01*
Boreal Cordillera	7.45	-4.11	-0.48	-0.25	1073	0.52	-1.82
Boreal Plain	6.88	0.22	1.36	0.02	2285	0.02	**11.01**
Brooks Range Tundra	1.59	-3.79	**-2.03**	-0.21	66	*0.24*	-3.15
Cold Deserts	0.53	0.35	-2.20	-1.35	1002	**11.47**	**11.66**
Hudson Plain	3.72	4.81	-0.40	0.19	499	0.02	**-4.17**
Marine West Coast Forest	5.19	-10.77	-0.65	-0.57	705	**0.72**	**-10.31**
Mixed Wood Shield	3.90	3.43	*2.07*	0.15	570	-0.50	**-24.78**
Eastern Softwood Shield	7.38	2.96	1.27	-0.01	836	0.36	-0.39
Western Softwood Shield	7.56	-0.35	-0.23	0.02	2050	-0.95	**-5.18**
Taiga Cordillera	3.01	**-5.17**	-1.72	-0.31	411	0.64	-3.09
Taiga Plain	6.29	**-4.78**	-1.48	-0.11	1178	**1.20**	**-17.72**
Eastern Taiga Shield	7.55	**7.61**	-0.30	-0.01	481	-0.17	-2.42
Western Taiga Shield	6.29	-3.07	-0.76	0.38	1143	*1.27*	**3.07**
Western Cordillera	6.43	-2.96	-0.90	-0.34	4526	**7.08**	2.05

Table S2 The retrieval of ignitions from the Arctic-Boreal Vulnerability Experiment Fire Emission Database (ABoVE-FED) database compared to Alaska Fire Emission Database (AKFED) version 2 ignition data (Scholten et al., 2021). The ignition algorithm relies on buffered burned area and a minimum search radius. We tested different combinations of buffers (1 km and 2 km), minimum search radius (5 km, 7.5 km, 10 km, and 15 km), and minimum burned area (removal of 0 pixels, 1 pixel, and 2 pixels from the ABoVE-FED). The comparison of the ABoVE-FED ignition retrieval to AKFED ignition retrieval was performed over Alaska, Yukon, and the Northwest Territories between 2001 and 2018. The absolute sum of ignitions and overlap between the two datasets as well as the relative differences between the datasets were analyzed. Based on these performance metrics, we chose for the ignition retrieval with 2 km buffers, within a 7.5 km minimum search radius, and with a minimum burned area of approximately 64 ha (highlighted in **bold**).

	Total	Overlap	% of AKFED	% overlap
AKFED	3624			
ABoVE				
0 pixels removed				
1km buffer, 5km search radius	4957	2953	136.78%	81.48%
1km buffer, 7.5km search radius	4566	2888	125.99%	79.69%
1km buffer, 10km search radius	4452	2858	122.85%	78.86%
1km buffer, 15 search radius	4353	2824	120.12%	77.92%
2km buffer, 5km search radius	4737	2900	130.71%	80.02%
2km buffer, 7.5km search radius	4327	2817	119.40%	77.73%
2km buffer, 10km search radius	4196	2768	115.78%	76.38%
2km buffer, 15 search radius	4053	2700	111.84%	74.50%
1 pixel removed				
1km buffer, 5km search radius	4485	2895	123.76%	79.88%
1km buffer, 7.5km search radius	4094	2830	112.97%	78.09%
1km buffer, 10km search radius	3980	2800	109.82%	77.26%
1km buffer, 15 search radius	3881	2766	107.09%	76.32%
2km buffer, 5km search radius	4342	2843	119.81%	78.45%
2km buffer, 7.5km search radius	3934	2760	108.55%	76.16%
2km buffer, 10km search radius	3804	2712	104.97%	74.83%
2km buffer, 15 search radius	3491	2356	96.33%	65.01%
2 pixels removed				
1km buffer, 5km search radius	4218	2820	116.39%	77.81%
1km buffer, 7.5km search radius	3827	2755	105.60%	76.02%
1km buffer, 10km search radius	3713	2725	102.46%	75.19%
1km buffer, 15 search radius	3614	2691	99.72%	74.25%
2km buffer, 5km search radius	4105	2773	113.27%	76.52%
2km buffer, 7.5km search radius	**3698**	**2690**	**102.04%**	**74.23%**
2km buffer, 10km search radius	3568	2642	98.45%	72.90%
2km buffer, 15 search radius	3236	2181	89.29%	60.18%

Table S3 Relative humidity (%), actual and saturation vapor pressure (hPa) were calculated using the following equations.

Variable	Dependency	Equation
Relative humidity (RH) (%)	Existing (*e*) and saturation vapor pressure (e_s)	$RH = \frac{e}{e_s} 100$
Actual vapor pressure (hPa)	2m dew point temperature (T_d)	$e = 6.1078 e^{\frac{17.27 T_d}{T_d + 237.3}}$
Saturation vapor pressure (hPa)	2m air temperature (*T*)	$e_s = 6.1078 e^{\frac{17.27 T}{T + 237.3}}$

Table S4 Results from the linear mixed-effect model for predicting snowmelt timing of the 20th percentile of the ignition timing distribution for all ecoregions combined, ecoregions with earlier snowmelt timing trends, and ecoregions with later snowmelt timing trends. The values in **bold** indicate significant predictors at $p < 0.05$ and values in *italic* represent significant predictors at $p < 0.1$.

All	Value	Standard error	Degrees freedom	t-value	p-value
Intercept	0.00	0.05	277	0.00	1.00
Precipitation	0.03	0.06	277	0.60	0.55
No precipitation	0.17	0.29	277	0.58	0.56
Rainfall	0.21	0.19	277	1.12	0.26
Snowfall	0.42	0.34	277	1.21	0.22
Relative humidity	0.02	0.06	277	0.32	0.75
Temperature	**-0.46**	**0.08**	**277**	**-5.72**	**0.00**

Early snowmelt	Value	Standard error	Degrees freedom	t-value	p-value
Intercept	-0.01	0.06	170	-0.11	0.92
Precipitation	-0.00	0.09	170	-0.05	0.96
No precipitation	0.43	0.37	170	1.17	0.24
Rainfall	0.34	0.24	170	1.41	0.16
Snowfall	0.67	0.44	170	1.54	0.13
Relative humidity	*0.16*	*0.09*	170	*1.74*	*0.08*
Temperature	**-0.36**	**0.11**	170	**-3.65**	**0.00**

Later snowmelt	Value	Standard error	Degrees freedom	t-value	p-value
Intercept	0.03	0.07	101	0.45	0.65
Precipitation	0.07	0.07	101	0.97	0.34
No precipitation	-0.56	0.48	101	-1.17	0.25
Rainfall	-0.21	0.31	101	-0.69	0.49
Snowfall	-0.38	0.57	101	-0.67	0.50
Relative humidity	*-0.16*	*0.09*	101	*-1.75*	*0.08*
Temperature	**-0.59**	**0.12**	101	**-4.96**	**0.00**

Table S5 Results of the linear mixed-effect model for predicting the ignition timing of early season fires in relation to snowmelt timing, fuel moisture codes, and meteorological variables for all ecoregions combined, ecoregions with earlier snowmelt timing, and later snowmelt timing. The values in **bold** indicate significant predictors ($p < 0.05$) and values in *italic* also represent significant predictors ($p < 0.1$).

All	Value	Standard error	Degrees freedom	t-value	p-value
Intercept	0.00	0.06	278	0.01	1.00
Snowmelt	**0.42**	**0.05**	**278**	**8.29**	**0.00**
Convective available potential energy	*-0.09*	*0.05*	*278*	*-1.68*	*0.09*
Precipitation	0.07	0.05	278	1.21	0.23
Relative humidity	**0.18**	**0.07**	**278**	**2.67**	**0.01**
Temperature	*-0.11*	*0.07*	*278*	*-1.63*	*0.10*
Intercept	0.00	0.05	280	0.00	1.00
Fine fuel moisture code	**-0.15**	**0.06**	**280**	**-2.48**	**0.01**
Duff moisture code	**-0.30**	**0.07**	**280**	**-4.35**	**0.00**
Drought code	0.05	0.07	280	-0.70	0.48

Early snowmelt	Value	Standard error	Degrees freedom	t-value	p-value
Intercept	0.03	0.06	171	0.48	0.63
Snowmelt	**0.36**	**0.06**	**171**	**6.51**	**0.00**
Convective available potential energy	-0.08	0.06	171	-1.36	0.18
Precipitation	**0.18**	**0.06**	**171**	**2.93**	**0.00**
Relative humidity	**0.15**	**0.08**	**171**	**2.02**	**0.04**
Temperature	**-0.20**	**0.08**	**171**	**-2.57**	**0.01**
Intercept	0.02	0.06	173	0.28	0.78
Fine fuel moisture code	**-0.17**	**0.07**	**173**	**-2.61**	**0.01**
Duff moisture code	**0.30**	**0.08**	**173**	**-3.75**	**0.00**
Drought code	*0.13*	*0.07*	*173*	*1.84*	*0.07*

Late snowmelt	Value	Standard error	Degrees freedom	t-value	p-value
Intercept	-0.04	0.11	102	-0.34	0.74
Snowmelt	**0.55**	**0.10**	**102**	**5.50**	**0.00**
Convective available potential energy	-0.07	0.11	102	-0.61	0.54
Precipitation	-0.09	0.10	102	-0.82	0.41
Relative humidity	*0.25*	*0.13*	*102*	*1.87*	*0.06*
Temperature	-0.00	0.12	102	-0.01	0.99
Intercept	-0.08	0.10	104	-0.82	0.41
Fine fuel moisture code	-0.06	0.13	104	-0.44	0.66
Duff moisture code	**-0.34**	**0.13**	**104**	**-2.64**	**0.01**
Drought code	*-0.29*	*0.15*	*104*	*-1.89*	*0.06*

Table S6 Results of variance partitioning for predicting snowmelt timing in relation to different meteorological variables for all ecoregions combined, ecoregions with earlier and later snowmelt timing. Precipitation type is a grouped variable consisting of number of days with snowfall, rainfall or no precipitation, The variance partitioning for the ignition timing in relation to different grouped variables (snowmelt timing, weather variables after the snowmelt timing, and fire weather variables) for all ecoregions combined (*n* = 299), ecoregion with earlier trends (*n* = 186) and later snowmelt timing trends (*n* = 113). The values express the adjusted R^2 values for the unique variation explained by the different variables and the shared variance between these groups. The shared variation cannot be tested, and a negative shared variation indicates no relationship between the explanatory and response variables. All values indicated in **bold** and *italic* are significant ($p < 0.05$ and $p < 0.1$)

Variance partitioning, snowmelt

Ecoregions	Precipitation	Precipitation type	Relative humidity	Temperature	Shared	Residual	Explained
All	**0.02**	0.00	**0.04**	**0.15**	0.00	0.80	0.20
Early snowmelt	0.00	0.00	**0.11**	**0.12**	0.00	0.76	0.24
Late snowmelt	**0.04**	0.00	0.01	**0.18**	0.00	0.77	0.23

Variance partitioning, ignition

Ecoregions	Snowmelt	Weather	Fire weather	Shared	Residual	Explained
All	**0.13**	**0.12**	**0.06**	0.00	0.69	0.31
Early snowmelt	**0.14**	**0.19**	**0.09**	0.00	0.58	0.42
Late snowmelt	**0.13**	**0.07**	**0.07**	0.00	0.72	0.28

Table S7 The values of R based on linear models between the response variables (snowmelt and ignition timing (day of the year)) and the hypothesized explanatory variables for all ecoregions (*n* = 299), ecoregions with earlier (*n* = 186) and later snowmelt timing trends (*n* = 113). For snowmelt timing, we evaluated all meteorological variables 30 days prior to the day of snowmelt. For ignition timing, we evaluated all the fire weather and meteorological variables between the snowmelt and ignition timing. Values represented in **bold** are significant at $p < 0.05$, while values in *italic* are significant at levels of $p < 0.1$. All variables where included in the variance partitioning analysis.

Snowmelt	Precipitation	No precipitation	Rainfall	Snowfall	Relative humidity	Temperature
All	**0.14**	**-0.49**	**-0.25**	**0.55**	**0.28**	**-0.59**
Earlier snowmelt	0.11	**-0.45**	**-0.23**	**0.50**	**0.35**	**-0.52**
Later snowmelt	*0.17*	**-0.57**	**-0.31**	**0.63**	*0.16*	*-0.71*

Ignition	Fine fuel moisture code	Duff moisture coed	Drought code	Convective available potential energy	Precipitation	Relative humidity	Temperature	Snowmelt
All	**-0.27**	**-0.34**	**-0.17**	**-0.13**	*0.10*	**0.35**	**-0.39**	**0.50**
Earlier snow-melt	**-0.29**	**-0.32**	-0.10	**-0.17**	**0.16**	**0.39**	**-0.43**	**0.46**
Later snow-melt	**-0.25**	**-0.38**	**-0.32**	-0.08	0.03	**0.32**	**-0.35**	**0.56**

Table S8 The number of observations, direction and strength of the relationship, significance level, and correlation between snowmelt and ignition timing lightning and anthropogenic ignitions, and ignitions with unknown cause, between 2001 and 2019. Values in **bold** indicate significance level of $p < 0.05$, and values in *italic* represent significance level of $p < 0.1$.

Lightning cause	Observations	Slope	Correlation
Alaska Boreal Interior	138	0.02	0.02
Alaska Tundra	32	0.12	0.16
Boreal Cordillera	**93**	**0.64**	**0.60**
Boreal Plain	42	0.37	0.23
Brooks Range Tundra	*14*	*0.91*	*0.49*
Cold Deserts	**33**	**0.71**	**0.48**
Hudson Plain	**64**	**0.65**	**0.49**
Marine West Coast Forest	**26**	**0.39**	**0.46**
Mixed Wood Shield	**18**	**1.03**	**0.52**
Eastern Softwood Shield	**93**	**0.82**	**0.80**
Western Softwood Shield	**276**	**0.70**	**0.42**
Taiga Cordillera	**74**	**0.40**	**0.37**
Taiga Plain	**172**	**0.51**	**0.39**
Eastern Taiga Shield	**53**	**1.05**	**0.60**
Western Taiga Shield	**197**	**0.77**	**0.51**
Western Cordillera	**233**	**0.44**	**0.39**

Anthropogenic cause	Observations	Slope	Correlation
Alaska Boreal Interior	19	0.21	0.10
Alaska Tundra	0	nan	nan
Boreal Cordillera	**17**	**0.35**	**0.54**
Boreal Plain	**77**	**0.35**	**0.38**
Brooks Range Tundra	0	nan	nan
Cold Deserts	38	0.47	0.24
Hudson Plain	**8**	**2.42**	**0.81**
Marine West Coast Forest	**13**	**0.53**	**0.81**
Mixed Wood Shield	*32*	*0.67*	*0.31*
Eastern Softwood Shield	**39**	**0.94**	**0.76**
Western Softwood Shield	**50**	**0.71**	**0.67**
Taiga Cordillera	0	nan	nan
Taiga Plain	**20**	**0.44**	**0.52**
Eastern Taiga Shield	*5*	*1.18*	*0.82*
Western Taiga Shield	2	1.47	1.00
Western Cordillera	**94**	**0.63**	**0.34**

Unknown cause	Observations	Slope	Correlation
Alaska Boreal Interior	**58**	**0.73**	**0.56**
Alaska Tundra	8	0.15	0.28
Boreal Cordillera	**122**	**0.59**	**0.65**
Boreal Plain	**346**	**0.46**	**0.36**
Brooks Range Tundra	11	0.53	0.36
Cold Deserts	**137**	**1.06**	**0.43**
Hudson Plain	**39**	**0.99**	**0.68**
Marine West Coast Forest	**113**	**0.44**	**0.42**
Mixed Wood Shield	**77**	**1.68**	**0.43**
Eastern Softwood Shield	**57**	**0.68**	**0.61**
Western Softwood Shield	**110**	**0.58**	**0.37**
Taiga Cordillera	**25**	**0.51**	**0.52**
Taiga Plain	**66**	**0.77**	**0.56**
Eastern Taiga Shield	**66**	**0.29**	**0.25**
Western Taiga Shield	**55**	**0.89**	**0.52**
Western Cordillera	**587**	**0.84**	**0.52**

Table S9 Average fire size (×10^2 hectare ± standard deviation) for fires ignited earlier and later than the earliest 20th percentile day of ignition timing and the duration of the snow-free season and fire season per ecoregion between 2001 and 2019. Values in bold indicate significant trends at $p < 0.05$, and values in *italic* represent significant trends at $p < 0.1$.

Ecoregion	Early fire size (×10^2 ha ± SD)	Late fire size (×10^2 ha ± SD)	Fraction of early burned area (%)	Fraction of late burned area (%)	Duration of snow-free season trend, 2001-2019 (days dec^{-1})	Fire season change trend, 2001-2019 (day dec^{-1})
Alaska Boreal Interior	255.3 ± 499.5	197.9 ± 433.1	27.1%	72.9%	*7.10*	1.73
Alaska Tundra	39.3 ± 84.5	53.3 ± 147.0	26.7%	73.3%	**13.84**	25.25
Boreal Cordillera	188.1 ± 625.8	104.5 ± 334.4	33.7%	66.3%	*7.52*	3.11
Boreal Plain	66.0 ± 412.0	43.5 ± 288,2	28.4%	71.6%	-7.56	-12.22
Brooks Range Tundra	69.6 ± 206.5	15.7 ± 36.1	73.0%	27.0%	-0.50	11.74
Cold Deserts	21.4 ± 111.2	4.3 ± 13.5	56.9%	43.1%	0.79	**-26.62**
Hudson Plain	138.3 ± 536.8	57.6 ± 404.8	41.0%	59.0%	-7.15	-12.64
Marine West Coast Forest	24.2 ± 99.8	8.1 ± 102.6	45.1%	54.9%	15.67	10.41
Mixed Wood Shield	26.1 ± 132.7	7.2 ± 34.4	52.1%	47.9%	-9.80	-19.52
Eastern Softwood Shield	106.4 ± 476.4	181.1 ± 473.3	20.9%	79.1%	-4.65	-9.34
Western Softwood Shield	234.7 ± 744.0	105.2 ± 410.5	37.9%	62.1%	-0.97	**-28.74**
Taiga Cordillera	213.3 ± 636.8	88.0 ± 382.9	44.4%	55.6%	*5.99*	1.65
Taiga Plain	271.2 ± 1100.8	194.1 ± 1007.7	28.3%	71.7%	**5.73**	-22.26
Eastern Taiga Shield	76.3 ± 203.8	56.9 ± 193.3	31.8%	68.2%	**-12.95**	9.36
Western Taiga Shield	328.5 ± 917.3	146.1 ± 611.1	39.2%	60.8%	1.05	10.42
Western Cordillera	86.2 ± 472.8	12.6 ± 123.5	63.8%	36.2%	-0.07	-14.84

Table S10 The piecewise structural equation model (pSEM) for the MODIS snowmelt timing, ignition timing, or all ecoregions combined. The results show the standardized estimates of paths from predictor variables to response variables scaled for the ratio of standard deviation of the response and explanatory variables. The weather variables are divided into prior to snowmelt timing (pre) and after the snowmelt timing (post) while the fuel moisture codes are only derived for days after the snowmelt timing. The effect sizes were used to scale the arrows in Figure 5. All variables in **bold** and *italic* indicate significant effect size ($p < 0.05$, $p < 0.1$). The number of ignitions analyzed, Fisher's C statistics, the corresponding p-value, and the Akaike information criterion (AIC) were derived for the whole pSEM. The model resembles the hypothesized pSEM when $p > 0.05$. Marginal R^2 (M-R^2) and conditional R^2 (C-R^2) values are derived for each response variable and represent the variation explained solely by the fixed effects, and the fixed and random effects combined, respectively.

Response	Predictor	Standardized estimate
Snowmelt timing	Pre precipitation	0.03
	Snowfall	0.42
	Rainfall	0.21
	No precipitation	0.17
	Pre relative humidity	0.02
	Pre temperature	**-0.46**
Snowfall	Pre precipitation	0.04
	Pre temperature	**-0.81**
Rainfall	Pre precipitation	**0.36**
	Pre temperature	**0.56**
Ignition timing	Snowmelt	**0.42**
	Fine fuel moisture code	**-0.15**
	Duff moisture code	**-0.30**
	Drought code	0.04
	Post convective available potential energy	*-0.09*
	Post precipitation	0.06
	Relative humidity	**0.18**
	Post temperature	*-0.11*
Fine fuel moisture code	Snowmelt timing	**-0.10**
	Post precipitation	**-0.27**
	Relative humidity	**-0.28**
	Post temperature	*0.08*
Duff moisture code	Snowmelt timing	**-0.13**
	Post precipitation	**-0.09**
	Relative humidity	**-0.43**
	Post temperature	**0.33**
Drought code	Snowmelt timing	**-0.13**
	Post precipitation	**-0.20**
	Post temperature	**0.13**
Post precipitation	Snowmelt timing	-0.07
Post relative humidity	Snowmelt timing	**0.21**
Post temperature	Snowmelt timing	**-0.35**
Post convective available potential energy	Snowmelt timing	**-0.13**
Fine fuel moisture code - - duff moisture code		**0.24**
Fine fuel moisture code - - drought code		**0.13**
Duff moisture code - - drought code		**0.48**
No precipitation - - pre precipitation		**-0.36**
No precipitation - - rainfall		**-0.25**
No precipitation - - snowfall		**-0.51**
Snowfall - - rainfall		**-0.35**

$n = 299$
Fisher's $C_{80} = 82.24$, $p = 0.41$, AIC = 220.24

Snowmelt: M-$R^2 = 0.38$, C-$R^2 = 0.38$
Rainfall: M-$R^2 = 0.41$, C-$R^2 = 0.41$
Snowfall: M-$R^2 = 0.67$, C-$R^2 = 0.67$
Ignition, fire weather: M-$R^2 = 0.14$, C-$R^2 = 0.14$
Ignition, weather: M-$R^2 = 0.34$, C-$R^2 = 0.36$
Fine fuel moisture code: M-$R^2 = 0.27$, C-$R^2 = 0.66$
Duff moisture code: M-$R^2 = 0.58$, C-$R^2 = 0.61$
Drought code: M-$R^2 = 0.09$, C-$R^2 = 0.09$
Convective Available Potential Energy: M-$R^2 = 0.02$, C-$R^2 = 0.02$
Precipitation: M-$R^2 = 0.01$, C-$R^2 = 0.01$
Relative humidity: M-$R^2 = 0.05$, C-$R^2 = 0.06$
Temperature: M-$R^2 = 0.12$, C-$R^2 = 0.13$

Table S11 The piecewise structural equation model (pSEM) for the MODIS snowmelt timing, MODIS ignition timing, fuel moisture code, and duff moisture code for all ecoregions exhibiting earlier snowmelt timing trends. The results show the standardized estimates of paths from predictor variables to response variables scaled for the ratio of standard deviation of the response and explanatory variables. The weather variables are divided into prior to snowmelt timing (pre) and after the snowmelt timing (post). The effect sizes were used to scale the arrows in Figure S7a. All variables in **bold** and *italic* indicate significant effect size ($p < 0.05$, $p < 0.1$). The number of ignitions analyzed, Fisher's C statistics, the corresponding p-value, and the Akaike information criterion (AIC) were derived for the whole pSEM. The model resemble the hypothesized pSEM when $p > 0.05$. Marginal R^2 (M-R^2) and conditional R^2 (C-R^2) values are derived for each response variable and represent the variation explained solely by the fixed effects, and the fixed and random effects combined, respectively.

Response	Predictor	Standardized estimate
Snowmelt timing	Pre precipitation	0.00
	Snowfall	0.71
	Rainfall	0.36
	No precipitation	0.45
	Pre relative humidity	*0.15*
	Pre temperature	**-0.37**
Snowfall	Pre precipitation	**0.10**
	Pre temperature	**-0.82**
Rainfall	Pre precipitation	**0.37**
	Pre temperature	**0.57**
Ignition timing	Snowmelt	**0.40**
	Fine fuel moisture code	**-0.20**
	Duff moisture code	**-0.34**
	Drought code	*0.16*
	Post convective available potential energy	-0.09
	Post precipitation	**0.19**
	Relative humidity	**0.16**
	Post temperature	**-0.21**
Fine fuel moisture code	Snowmelt timing	*-0.09*
	Post precipitation	**-0.31**
	Relative humidity	**-0.25**
	Post temperature	0.05
Duff moisture code	Snowmelt timing	**-0.11**
	Post precipitation	**-0.12**
	Relative humidity	**-0.49**
	Post temperature	**0.31**
Drought code	Snowmelt timing	-0.09
	Post precipitation	**-0.17**
	Post temperature	**0.17**
Post precipitation	Snowmelt timing	*-0.14*
Post relative humidity	Snowmelt timing	**0.15**
Post temperature	Snowmelt timing	**-0.27**
Convective available potential energy	Snowmelt timing	**-0.15**
Fine fuel moisture code - - duff moisture code		**0.27**
Fine fuel moisture code - - drought code		**0.19**
Duff moisture code - - drought code		**0.55**
No precipitation - - pre precipitation		**-0.41**
No precipitation - - rainfall		**-0.23**
No precipitation - - snowfall		**-0.50**
Snowfall - - rainfall		**-0.35**

n = 186
Fisher's C_{86} = 96.31, p = 0.21, AIC = 234.31

Snowmelt: M-R^2 = 0.32, C-R^2 = 0.32
Snowfall: M-R^2 = 0.68, C-R^2 = 0.68
Rainfall: M-R^2 = 0.45, C-R^2 = 0.45
Ignition, fire weather: M-R^2 = 0.15, C-R^2 = 0.15
Ignition, weather: M-R^2 = 0.39, C-R^2 = 0.39
Fine fuel moisture code: M-R^2 = 0.24, C-R^2 = 0.68
Duff moisture code: M-R^2 = 0.59, C-R^2 = 0.61
Drought code: M-R^2 = 0.07, C-R^2 = 0.07
Convective Available Potential Energy: M-R^2 = 0.02, C-R^2 = 0.03
Precipitation: M-R^2 = 0.02, C-R^2 = 0.02
Relative humidity: M-R^2 = 0.02, C-R^2 = 0.03
Temperature: M-R^2 = 0.07, C-R^2 = 0.08

Table S12 The piecewise structural equation model (pSEM) for the MODIS snowmelt timing, MODIS ignition timing, fuel moisture code, and duff moisture code for all ecoregions exhibiting later snowmelt timing trends. The results show the standardized estimates of paths from predictor variables to response variables scaled for the ratio of standard deviation of the response and explanatory variables. The weather variables are divided into prior to snowmelt timing (pre) and after the snowmelt timing (post). The effect sizes were used to scale the arrows in Figure S7b. All variables in **bold** and *italic* indicate significant effect size ($p < 0.05$, $p < 0.1$). The number of ignitions analyzed, Fisher's C statistics, the corresponding p-value, and the Akaike information criterion (AIC) were derived for the whole pSEM. The model resemble the hypothesized pSEM when $p > 0.05$. Marginal R^2 (M-R^2) and conditional R^2 (C-R^2) values are derived for each response variable and represent the variation explained solely by the fixed effects, and the fixed and random effects combined, respectively.

Response	Predictor	Standardized estimate
Snowmelt timing	Pre precipitation	0.08
	Snowfall	-0.35
	Rainfall	-0.19
	No precipitation	-0.51
	Pre relative humidity	*-0.16*
	Pre temperature	**-0.58**
Snowfall	Pre precipitation	-0.03
	Pre temperature	**-0.82**
Rainfall	Pre precipitation	**0.35**
	Pre temperature	**0.53**
Ignition timing	Snowmelt	**0.49**
	Fine fuel moisture code	-0.05
	Duff moisture code	**-0.28**
	Drought code	**-0.19**
	Post convective available potential energy	-0.05
	Post precipitation	-0.08
	Relative humidity	*0.23*
	Post temperature	-0.00
Fine fuel moisture code	Snowmelt timing	*-0.11*
	Post precipitation	**-0.17**
	Relative humidity	**-0.36**
	Post temperature	*0.15*
Duff moisture code	Snowmelt timing	**-0.19**
	Post precipitation	-0.11
	Relative humidity	**-0.27**
	Post temperature	**0.41**
Drought code	Snowmelt timing	**-0.26**
	Post precipitation	**-0.34**
	Post temperature	0.02
Post precipitation	Snowmelt timing	0.01
Post relative humidity	Snowmelt timing	**0.30**
Post temperature	Snowmelt timing	**-0.46**
Convective available potential energy	Snowmelt timing	-0.10
Fine fuel moisture code - - duff moisture code		**0.18**
Fine fuel moisture code - - drought code		0.01
Duff moisture code - - drought code		**0.26**
No precipitation - - pre precipitation		**-0.31**
No precipitation - - rainfall		**-0.24**
No precipitation - - snowfall		**-0.48**
Snowfall - - rainfall		**-0.40**

n = 113
Fisher's C_{112} = 107.14, p = 0.61, AIC = 245.14

Snowmelt: M-R^2 = 0.53, C-R^2 = 0.53
Snowfall: M-R^2 = 0.67, C-R^2 = 0.67
Rainfall: M-R^2 = 0.34, C-R^2 = 0.34
Ignition, fire weather: M-R^2 = 0.18, C-R^2 = 0.18
Ignition, weather: M-R^2 = 0.35, C-R^2 = 0.37
Fine fuel moisture code: M-R^2 = 0.36, C-R^2 = 0.65
Duff moisture code: M-R^2 = 0.60, C-R^2 = 0.67
Drought code: M-R^2 = 0.19, C-R^2 = 0.23
Convective Potential Available Energy: M-R^2 = 0.01, C-R^2 = 0.01
Precipitation: M-R^2 = 0.00, C-R^2 = 0.00
Relative humidity: M-R^2 = 0.09, C-R^2 = 0.09
Temperature: M-R^2 = 0.21, C-R^2 = 0.21