

Supplementary Material

Supplementary Table S1. Sensitivity analyses using conventional growing degree-days (GDD)

Base temperature	Model	IRR per 100 GDD (95% CI)	P value
10.2°C (larval moulting)	Year FE	1.729 (1.617–1.849)	<0.001
	Prefecture + year FE	0.964 (0.751–1.236)	0.772
11.8°C (nymphal moulting)	Year FE	1.753 (1.638–1.877)	<0.001
	Prefecture + year FE	0.957 (0.745–1.229)	0.731
12.2°C (egg hatching)	Year FE	1.761 (1.644–1.887)	<0.001
	Prefecture + year FE	0.954 (0.742–1.225)	0.709

*GDD was calculated from daily mean temperatures as $GDD = \sum \max(T_{\text{daily mean}} - T_{\text{base}}, 0)$ from April 1 through October 31, using developmental base temperatures reported for *Haemaphysalis longicornis* by Yano et al. (1987).*

Supplementary Table S2. Sensitivity analyses of the association between CTE and SFTS incidence

Sensitivity analysis	Model/specification	Estimate (95% CI)	P value	AIC
Temperature window	April–October	1.704 (1.595–1.821)	<0.001	1955.0
	May–October	1.937 (1.784–2.103)	<0.001	1950.2
	April–September	1.957 (1.798–2.131)	<0.001	1955.7
	May–September	2.417 (2.158–2.707)	<0.001	1950.6
1-year lag	Year FE	1.678 (1.568–1.795)	<0.001	—
	Prefecture + year FE	1.329 (1.054–1.677)	0.016	—
	Spatial NB-GAM + year FE	1.060 (0.913–1.231)	0.441	—
Spatial adjustment	Spatial NB-GAM + year FE	0.995 (0.857–1.155)	0.945	—
Geographic exclusion	Excluding Hokkaido & Okinawa	2.000 (1.818–2.200)	<0.001	—
Covariate set	CTE + year FE	1.567 (1.469–1.671)	<0.001	2148.4
	+ humidity	1.634 (1.532–1.743)	<0.001	2112.4
	+ precipitation	1.517 (1.413–1.628)	<0.001	2105.3
	+ forest cover	1.704 (1.595–1.821)	<0.001	1955.0
Spline specification	Primary	Fitted maximum: 5169	—	—
	Alternative boundary knots	Fitted maximum: 5211	—	—
	Alternative internal knots	Fitted maximum: 5208	—	—

Estimates are incidence rate ratios (IRRs) per 100-unit increase in CTE (or per 100 GDD units, where applicable) unless otherwise noted, with 95% confidence intervals. Unless otherwise specified, models included year fixed effects and the population offset. The location of maximum slope was sensitive to spline specification and was therefore not interpreted as a biological threshold. The fitted maximum was relatively stable at approximately 5,169–5,211 CTE units but occurred near the sparsely observed upper tail of the exposure distribution.

Supplementary Table S3. Residual spatial autocorrelation before and after spatial adjustment, 2013–2025

Year	Moran's I before spatial adjustment	P value	Moran's I after spatial adjustment	P value
2013	0.136	0.022	0.16	0.012
2014	0.24	<0.001	0.122	0.03
2015	0.168	0.011	−0.074	0.859
2016	0.158	0.014	0.177	0.006
2017	0.008	0.35	−0.113	0.864
2018	0.372	<0.001	−0.020	0.491
2019	0.164	0.009	−0.022	0.502
2020	0.306	<0.001	0.035	0.243
2021	0.257	<0.001	0.01	0.352
2022	0.11	0.052	−0.074	0.766
2023	0.146	0.007	−0.067	0.732
2024	0.121	0.036	−0.072	0.73
2025	0.018	0.302	0.017	0.32

Moran's I was calculated for model residuals using symmetric four-nearest-neighbor spatial weights. Before spatial adjustment, residuals were obtained from the negative binomial model including year fixed effects. After spatial adjustment, residuals were obtained from the negative binomial generalized additive model incorporating a two-dimensional smooth of prefectural longitude and latitude and year fixed effects. Significant residual spatial autocorrelation was observed in 10 of 13 years before spatial adjustment and in 3 of 13 years after spatial adjustment.