

## Degree-day model for *Photuris frontalis*

Coleoptera: Lampyridae

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*P. frontalis* is a species of synchronous lightning bug common in some parts of the Eastern U.S. including Congaree National Park, S. Carolina

Goal: develop a working degree-day predictive model for this species. Note that there are many other species so this will not likely predict timing of activity for other species or regions.

Approach: try a few lower thresholds, begin dates, and calculation methods to find a combination that give low error in predicting activity

Abbrev: phofr



*Photuris frontalis* adult



*Photuris* spp. Larva

### Phenology model summary for synchronous firefly species *Photuris frontalis* at the Congaree Nat. Park, S. Carolina

Abbreviation for model: phofr  
Start Date: Calendar date: Mar. 1  
Calculation method: Single Sine (default used by UC Davis IPM program)

	<u>Deg. F</u>	<u>Deg. C</u>	<u>DD (F)</u>	<u>DD (C)</u>
Lower temperature threshold:	50	10		
Upper temperature threshold:	100	37.8		

#### Event:

Approx. begin calling/flashing activity	1087	604
Approx. peak calling/flashing activity	1197	665
Approx. end of calling/flashing activity	1412	784

**Source 1. Data from C. Van Delden, Chief of Resource Stewardship & Science, Congaree National Park, 3/29/24**

Data include: three years of collected observations of activity (begin, peak, end). Dates range from mid to late May.

Station GDNS1, Congaree, SC

	SS54Mar1	SS52Mar1	SS50Mar1	GDD50Jan1	GDDMar1
<b>Begin Peak activ.</b>					
05/19/21	905	1066	1156	1505	1235
05/21/22	1033	1165	1243	1762	1375
05/21/23	963	1092	1193	1837	1294
avg	967	1108	<b>1197</b>	1701	1301
sd	64	51	44	174	70
CV	6.63	4.63	3.65	10.23	5.40
<b>First activity</b>					
05/13/21		934	1053		
05/11/22		928	1046		
05/17/23		1035	1161		
avg		966	<b>1087</b>		
sd		60	64		
CV		6.23	5.93		
<b>Last activity</b>					
05/31/21		1247	1453		
05/29/22		1362	1516		
05/23/23		1130	1268		
avg		1246	<b>1412</b>		
sd		116	129		
CV		9.31	9.13		

**Results: Single sine method Tlow of 50F and starting date of March 1st works well enough for peak and first activity. Range of predicted calling activity is 1087-1412 SS50Mar1 Dds.**

**Source 2. Data from Faust, L.F., and P. A. Weston. 2009. Degree-Day prediction of adult emergence of *Photinus carolinus* (Coleoptera: Lampyridae) Environ. Entomol. 38:1505-1512**

From Table 3: *Photinus frontalis* adult activity from Mid to late June, 1,429-1,814 mGDD (same thing as corn GDD, Mar. 1 start date, 50F Tlow) GSMNP (Great Smokey Mountains National Park) weather stations

Approach: exact dates and years are not available so this is just a check to see how well the Congaree data match up with estimates from this publication and some available weather data in the GSMNP.

Station IGGT1 Indian Graves RAWS elev 2700 ft data starting 2007

Station COWN7 Cow Mntn NC elev 2390 Data starting 2007

Station K1A5 Franklin Macon Co Apt NC elev 2021 Data starting 2007

		mGDD (CDD50 start date 3/1)		SS50Mar1 (single sine degree-days 50F lower threshold Mar 1 start date)								Averages	
		06/15/07	06/30/07	06/15/07	06/30/07	06/15/08	06/30/08	06/15/09	06/30/09	06/15/10	06/30/10	6/15/xx	6/30/xx
P. frontalis	IGGT1	1632	2028	1593	1988	1286	1622	1228	1605	1609	2030	1429	1811
1429-1814	COWN7	1490	1820	1396	1726	1241	1540	1208	1562	1340	1732	1296	1640
mGDD	K1A5	1509	1904	1386	1781	1304	1610	1111	1469	1184	1567	1246	1607
	Avg	1544	1917	1458	1832	1277	1591	1182	1545	1378	1776	1324	1686
	Avg SS 2007-2010			1324	1686								

**Results: The COWN7 station provides a good match to published mGDD range of 1429-1814 mGDD. Using this station and SS50Mar1 Dds, the average range (2007-10) is 1296-1640 DDs which is ca. 200 DD more than found for the Congaree data. However, while this analysis is not very precise, it may point to the likelihood that the model for *P. frontalis* at Congaree will not necessarily work at all for other regions including GSMNP.**