

Supplementary Material: Current environments and evolutionary history shape forest temporal assembly

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Table S1: Summary output from a phylogenetic Bayesian model in which species are partially pooled and phylogeny is included on the intercept. The model includes photoperiod and site as dummy variables, while the forcing and chilling effects are included as continuous, with the predictors z-scored to allow comparisons across cues. Parameter estimates were used to estimate day of budburst for sites under low cue conditions and for Smithers only when relevant.

	mean	sd	5%	95%	n_eff	Rhat
Intercept	12.51	3.14	7.40	17.60	3183.32	1.00
Phylogenetic effect	0.79	0.12	0.60	0.90	2156.20	1.00
Forcing	-9.55	0.74	-10.70	-8.30	1391.78	1.00
Photoperiod	-3.62	0.41	-4.30	-3.00	3089.29	1.00
Chilling	-15.21	1.25	-17.30	-13.20	2142.42	1.00
Manning Park	2.09	0.36	1.50	2.70	4061.13	1.00
Harvard Forest	-6.04	1.03	-7.80	-4.40	486.95	1.01
St. Hippolyte	-8.71	0.97	-10.30	-7.10	485.37	1.01
Forcing x photoperiod	0.23	0.71	-1.00	1.40	3698.87	1.00
Forcing x chilling	9.06	0.90	7.60	10.50	3005.09	1.00
Photoperiod x chilling	-0.67	0.90	-2.20	0.80	2690.36	1.00
Forcing x Manning Park	-1.76	0.77	-3.00	-0.50	3836.43	1.00
Photoperiod x Manning Park	0.58	0.79	-0.70	1.90	3375.92	1.00
Chilling x Manning Park	-0.36	1.60	-3.00	2.20	1714.08	1.00
Forcing x Harvard Forest	3.81	1.22	1.80	5.80	1752.75	1.00
Photoperiod x Harvard Forest	-1.96	0.86	-3.30	-0.60	2877.96	1.00
Chilling x Harvard Forest	9.97	2.03	6.60	13.40	911.46	1.01
Forcing x St. Hippolyte	5.25	1.19	3.20	7.20	1659.45	1.00
Photoperiod x St. Hippolyte	-2.13	0.84	-3.50	-0.70	2606.20	1.00
Chilling x St. Hippolyte	8.65	1.70	5.90	11.50	1021.36	1.01

Table S2: Approximate chill units from our two western sites, E.C. Manning Park and Smithers B.C., Canada, and our two eastern sites, Harvard Forest, USA and St. Hippolyte, Canada. Weather data was obtained from the Hope Slide weather station for our E.C. Manning Park estimates and the Smithers airport weather station for our Smithers communities. For our eastern communities, weather data was obtained from weather stations at Harvard Forest and in St. Hippolyte.

Population	Chilling treatment	Chill hours	Utah model	Chill portions
Harvard forest	Field chilling	892	814.50	56.62
Harvard forest	Field chilling + 30 d at 4°C	2140	2062.50	94.06
St. Hippolyte	Field chilling	682	599.50	44.63
St. Hippolyte	Field chilling + 30 d at 4°C	1930	1847.50	82.06
Smithers	Field chilling + 30 d at 4°C	1317	1368.00	54.95
Smithers	Field chilling + 70 d at 4°C	1965	2016.00	74.67
Manning Park	Field chilling + 30 d at 4°C	1213	1377.00	55.09
Manning Park	Field chilling + 70 d at 4°C	1861	2025.00	75.33

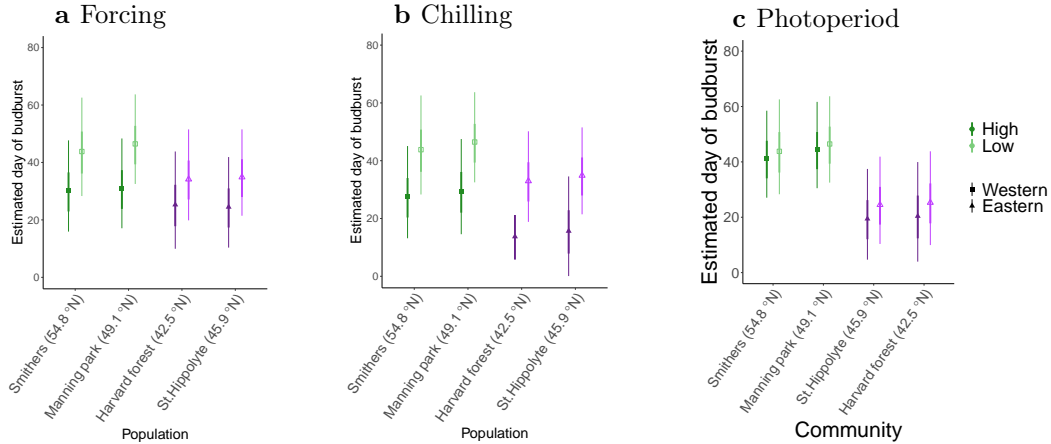


Figure S1: Estimated day of budburst in response to **a**, forcing across populations under low chilling and short photoperiods, **b**, chilling across populations under low forcing and short photoperiods, and **c**, across photoperiods under low forcing and chilling for species sampled from our four populations. The thin error bars represent the 90% uncertainty interval, while the thicker error bars represent the 50% uncertainty interval, and symbols the mean.

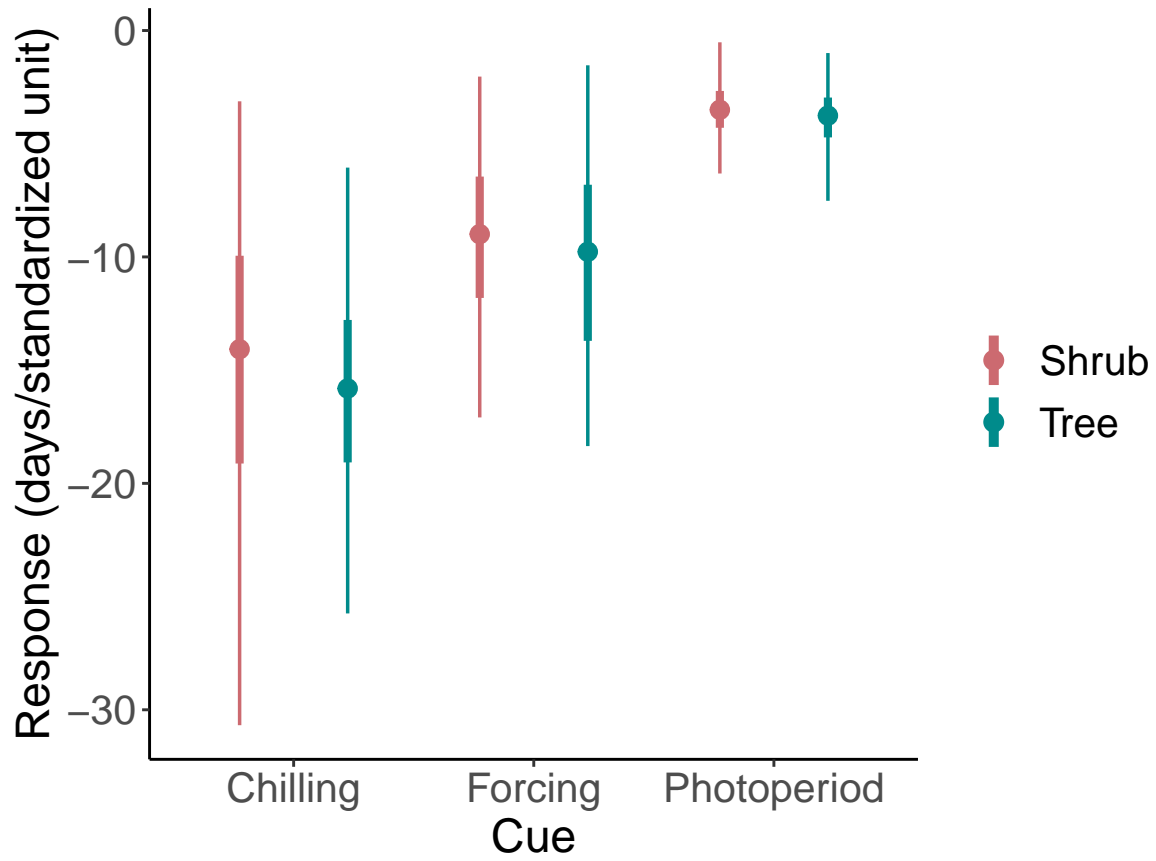


Figure S2: Comparisons of posterior distributions for cues estimates between shrub and tree species. Black circles represent the median cues, while the thinner black line the 90% quantile interval. The coloured distribution is the posterior density of cues responses for all species within a given architectural type. The y-axis spans the entire range of the data.

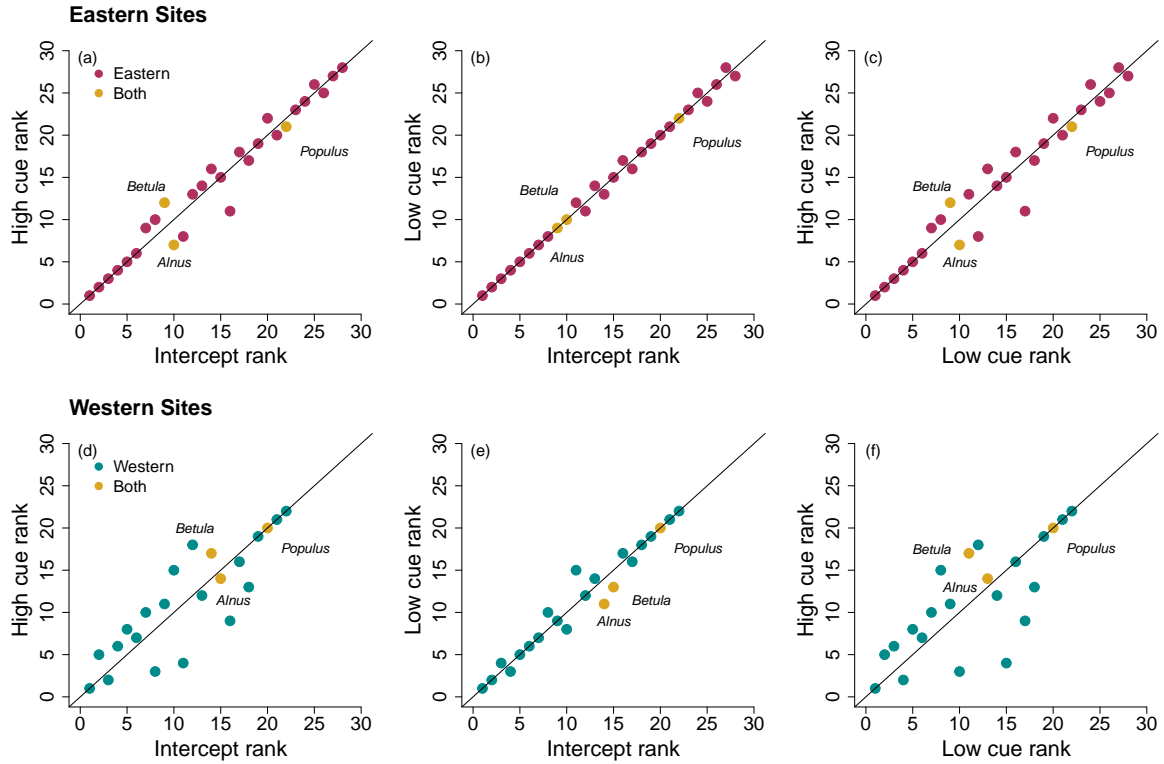


Figure S3: Estimated changes in species ranked budburst order, **a** & **d** compared between species level effects (species intercept) and under high cues, species level effects and under low cues, **b** & **e**, and ranked order under low and high cues, **c** & **f**, for our eastern species in red (**a-c**) and western species in blue (**d-f**). For the three species that occur in both transect, shown in yellow, *Alnus incana* exhibited the greatest rank change with a difference of three, while *Betula papyrifera* had a rank difference of two and *Populus tremuloides* a rank difference of one.

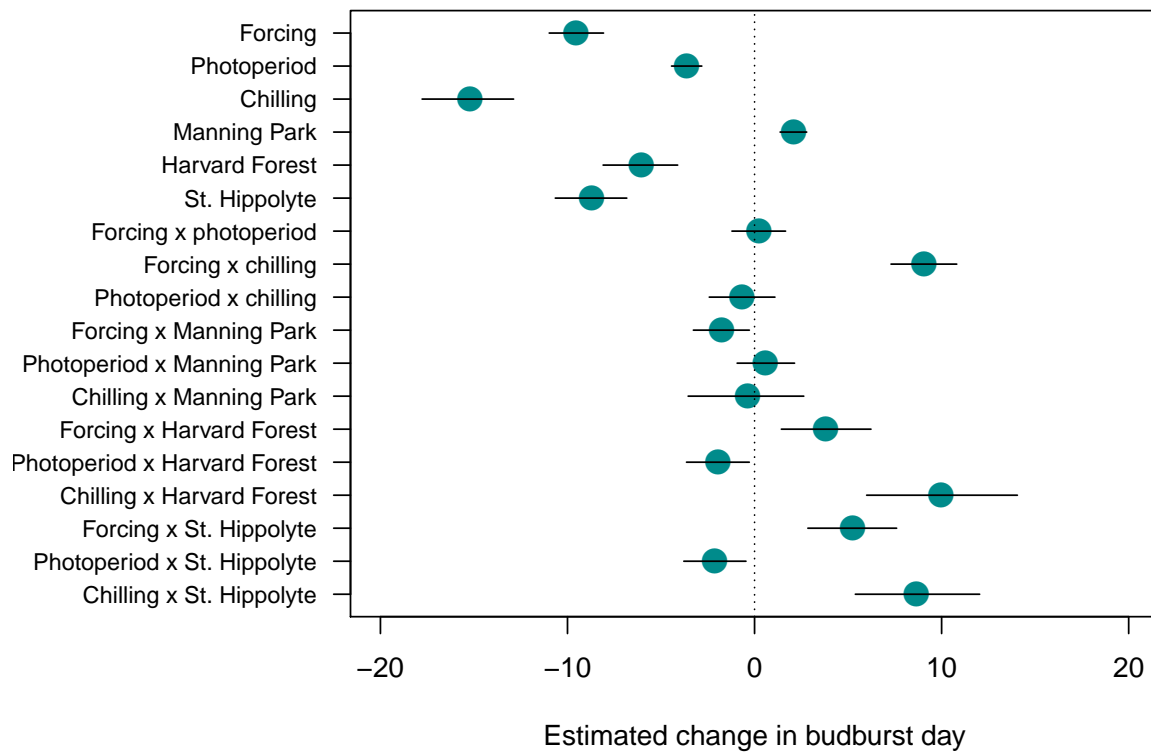


Figure S4: Estimated mean responses in budburst date of first bud to varying forcing, chilling, and photoperiod cues for 47 deciduous woody species across North America S1. Points represent mean posterior estimates, while bars depict the 90% uncertainty interval. Negative responses represent advances in budburst, while positive values represent delaying effects.



Figure S5: Species differences were accounted for by including phylogenetic effects on the species intercept in a model estimating days to budburst after the start of forcing treatments. We pruned to our species subset an existing phylogeny for flowering plants developed by Smith and Brown (2018).

Table S3: Mean budburst dates across all treatments from raw data for 47 species at our two western sites, E.C. Manning Park and Smithers B.C., Canada, and our two eastern sites, Harvard Forest, USA and St. Hippolyte, Canada.

Species	Harvard Forest	St. Hippolyte	Manning Park	Smithers
<i>Acer glabrum</i>			36	39
<i>Acer pensylvanicum</i>	16	18		
<i>Acer rubrum</i>	22	25		
<i>Acer saccharum</i>	45	36		
<i>Alnus incana</i>			28	30
<i>Alnus incana</i>	33	25		
<i>Alnus viridis</i>			44	43
<i>Amelanchier alnifolia</i>			19	18
<i>Aronia melanocarpa</i>	14			
<i>Betula alleghaniensis</i>	20	21		
<i>Betula lenta</i>	30			
<i>Betula papyrifera</i>				31
<i>Betula papyrifera</i>	17	18		
<i>Corylus cornuta</i>	25	19		
<i>Cornus stolonifera</i>			15	17
<i>Fagus grandifolia</i>	42	43		
<i>Fraxinus nigra</i>	38	38		
<i>Hamamelis virginiana</i>	44			
<i>Ilex mucronata</i>	16	15		
<i>Kalmia angustifolia</i>	30	32		
<i>Lonicera canadensis</i>	17	16		
<i>Lonicera involucrata</i>			22	20
<i>Lyonia ligustrina</i>	31			
<i>Menziesia ferruginea</i>			43	46
<i>Nyssa sylvatica</i>	32			
<i>Populus balsamifera</i>			30	31
<i>Populus grandidentata</i>	33	31		
<i>Populus tremuloides</i>			46	35
<i>Prunus pensylvanica</i>	18	16		
<i>Quercus alba</i>	45			
<i>Quercus rubra</i>	36	34		
<i>Quercus velutina</i>	52			
<i>Rhamnus frangula</i>	32			
<i>Rhododendron albiflorum</i>			19	
<i>Rhododendron prinophyllum</i>	29			
<i>Ribes lacustre</i>			29	23
<i>Rubus parviflorus</i>			28	30
<i>Sambucus racemosa</i>			33	
<i>Shepherdia canadensis</i>			25	24
<i>Sorbus scopulina</i>			21	19
<i>Spiraea alba</i>	18	20		
<i>Spiraea betulifolia</i>			24	18
<i>Spiraea pyramidata</i>			26	22
<i>Symphoricarpos albus</i>			27	32
<i>Vaccinium membranaceum</i>			22	23
<i>Vaccinium myrtilloides</i>	13	17		
<i>Viburnum cassinoides</i>	15	18		
<i>Viburnum edule</i>			19	8
<i>Viburnum lantanoides</i>	31	28		

Table S4: Proportion of surviving samples per species for which budburst was observed in our western controlled environment study. See Flynn and Wolkovich (2018) for survival in our eastern study.

Species name	Proportion budburst	Plant type
<i>Acer glabrum</i>	0.83	tree
<i>Alnus incana</i>	1.00	shrub
<i>Alnus viridis</i>	0.92	shrub
<i>Amelanchier alnifolia</i>	0.99	shrub
<i>Betula papyrifera</i>	1.00	tree
<i>Cornus stolonifera</i>	0.99	shrub
<i>Lonicera involucrata</i>	0.87	shrub
<i>Menziesia ferruginea</i>	0.80	shrub
<i>Populus balsamifera</i>	0.98	tree
<i>Populus tremuloides</i>	0.90	tree
<i>Rhododendron albiflorum</i>	1.00	shrub
<i>Ribes lacustre</i>	0.82	shrub
<i>Rubus parviflorus</i>	0.94	shrub
<i>Sambucus racemosa</i>	0.95	shrub
<i>Shepherdia canadensis</i>	1.00	shrub
<i>Sorbus scopulina</i>	0.99	shrub
<i>Spiraea betulifolia</i>	0.94	shrub
<i>Spiraea pyramidata</i>	0.92	shrub
<i>Symphoricarpos albus</i>	0.84	shrub
<i>Vaccinium membranaceum</i>	0.90	shrub
<i>Viburnum edule</i>	1.00	shrub