

1 Supplementary Material - Species differences in cue responses  
2 in woody plants of North America

3 Deirdre Loughnan<sup>1</sup> and E M Wolkovich<sup>1</sup>

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Table S1: 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 degree C	2140	2062.50	94.06
St. Hippolyte	Field chilling	682	599.50	44.63
St. Hippolyte	Field chilling + 30 d at 4 degree C	1930	1847.50	82.06
Smithers	Field chilling + 30 d at 4 degree C	1317	1368.00	54.95
Smithers	Field chilling + 70 d at 4 degree C	1965	2016.00	74.67
Manning Park	Field chilling + 30 d at 4 degree C	1213	1377.00	55.09
Manning Park	Field chilling + 70 d at 4 degree C	1861	2025.00	75.33

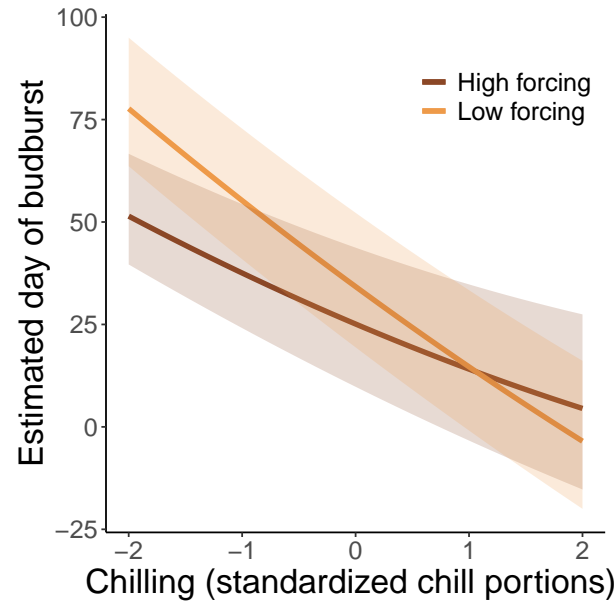


Figure S1: Estimated day of budburst of first bud in response to chill portions and forcing, estimated for our defined baseline conditions. We found a positive interaction between chilling and forcing cues, with high forcing compensating for low chilling to produce earlier budburst, while budburst occurred earlier under low forcing following high chilling. In our analysis, we standardized predictors, (here specifically chilling) via  $z$ -scores, using two standard deviations, see methods for further details.

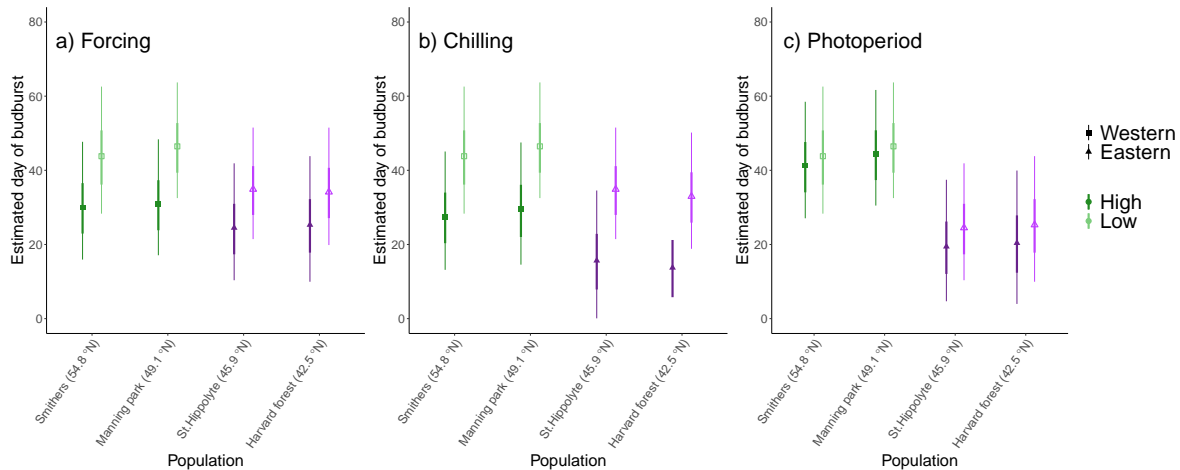


Figure S2: Estimated day of budburst of first bud in response to (a) forcing across populations under low chilling conditions and short photoperiods, (b) chilling across populations under low forcing and short photoperiods, and (c) across photoperiods under our baseline forcing and chilling conditions 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.

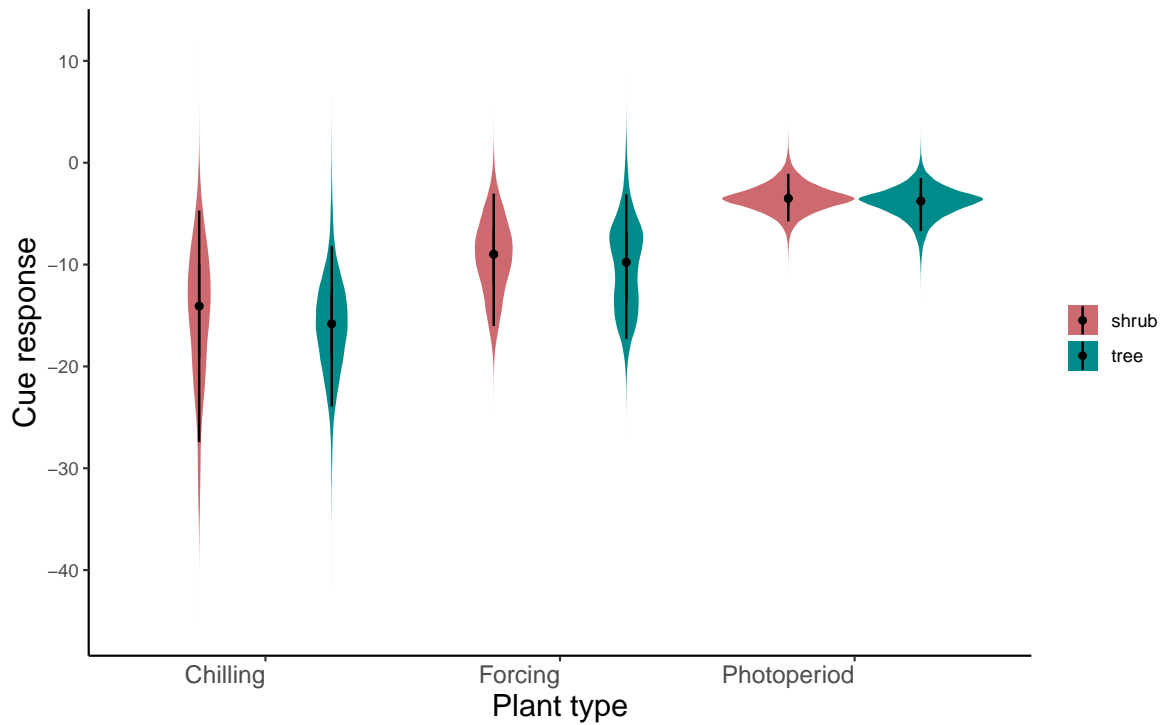


Figure S3: Comparisons of posterior distributions for cues estimates between shrub and tree species. Black circles represent the median cues, while the thinner black line the 90% quantile interval. The coloured distribution is the the posterior density of the posteriors of the cues for all species within a given architectural type. The y-axis spans the entire range of the data.

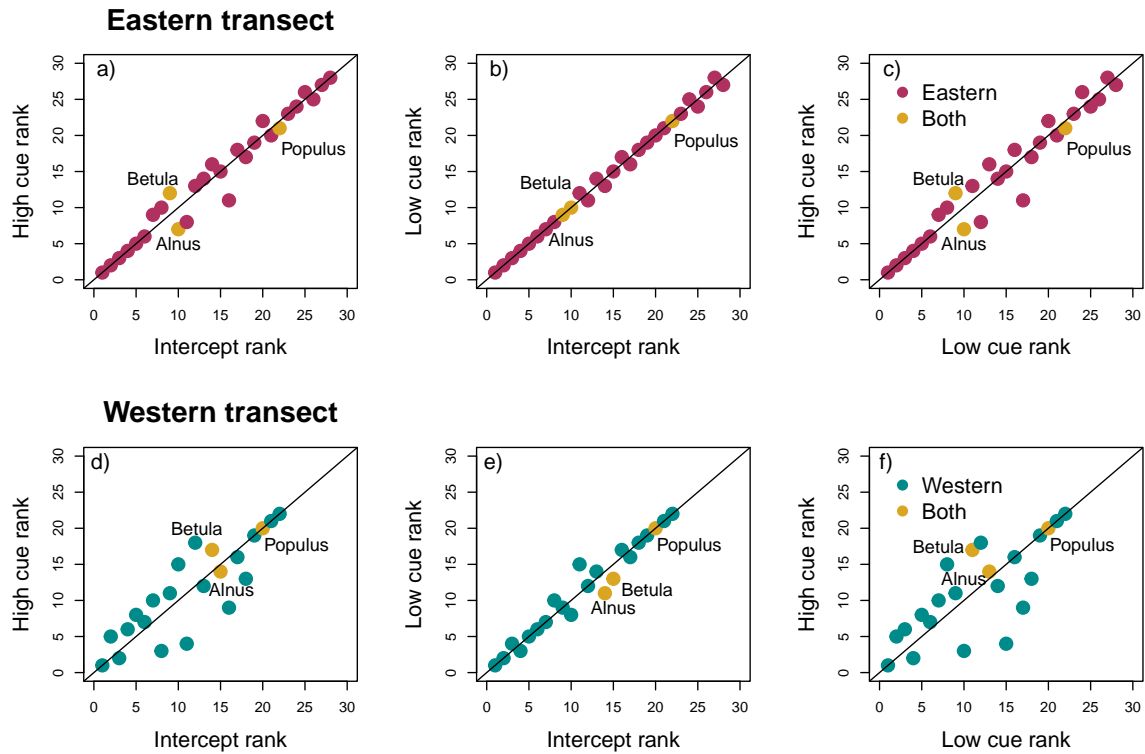


Figure S4: Estimated changes in species ranked budburst order, compared between species level effects (species intercept) and under high cue conditions (a and d), species level effects and under low cue condition (b and e), and ranked order under low and high cue conditions (c and f) for our eastern 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.

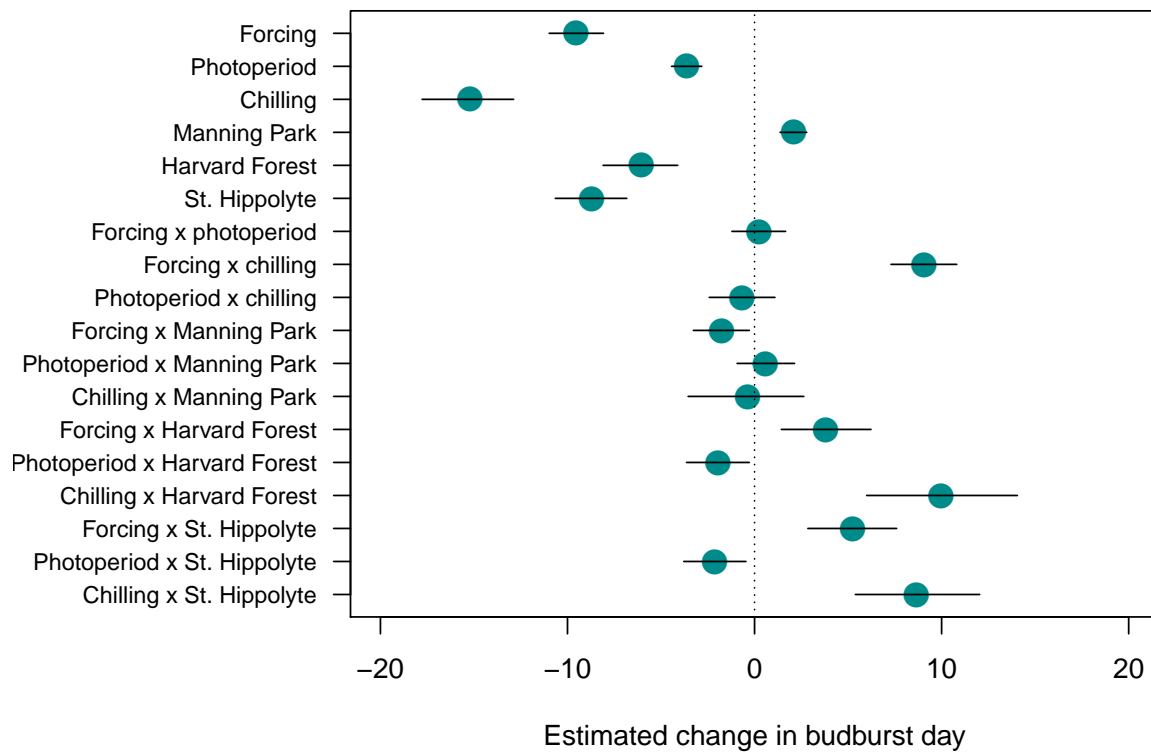


Figure S5: Estimated mean responses in budburst date of first bud to varying forcing, chilling, and photoperiod cues for 47 deciduous woody species across North America. Points represent mean posterior estimate, while bars depict the 95% uncertainty interval. Negative responses represent advances budburst, while positive values represent delaying effects.



Figure S6: 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 S2: Mean budburst dates across all treatments from raw data for 47 species at our two western sites, E.C. Manning Park (MP) and Smithers B.C.(SM) Canada, and our two eastern sites, Harvard Forest (HF) USA and St. Hippolyte (SH) Canada.

Species	Harvard Forest	St. Hippolyte	Manning Park	Smithers
<i>Acer glabrum</i>			36.00	39.00
<i>Acer pensylvanicum</i>	16.00	18.00		
<i>Acer rubrum</i>	22.00	25.00		
<i>Acer saccharum</i>	45.00	36.00		
<i>Alnus incana</i>			28.00	30.00
<i>Alnus incana</i>	33.00	25.00		
<i>Alnus viridis</i>			44.00	43.00
<i>Amelanchier alnifolia</i>			19.00	18.00
<i>Aronia melanocarpa</i>	14.00			
<i>Betula alleghaniensis</i>	20.00	21.00		
<i>Betula lenta</i>	30.00			
<i>Betula papyrifera</i>				31.00
<i>Betula papyrifera</i>	17.00	18.00		
<i>Corylus cornuta</i>	25.00	19.00		
<i>Cornus stolonifera</i>			15.00	17.00
<i>Fagus grandifolia</i>	42.00	43.00		
<i>Fraxinus nigra</i>	38.00	38.00		
<i>Hamamelis virginiana</i>	44.00			
<i>Ilex mucronata</i>	16.00	15.00		
<i>Kalmia angustifolia</i>	30.00	32.00		
<i>Lonicera canadensis</i>	17.00	16.00		
<i>Lonicera involucrata</i>			22.00	20.00
<i>Lyonia ligustrina</i>	31.00			
<i>Menziesia ferruginea</i>			43.00	46.00
<i>Nyssa sylvatica</i>	32.00			
<i>Populus balsamifera</i>			30.00	31.00
<i>Populus grandidentata</i>	33.00	31.00		
<i>Populus tremuloides</i>			46.00	35.00
<i>Prunus pensylvanica</i>	18.00	16.00		
<i>Quercus alba</i>	45.00			
<i>Quercus rubra</i>	36.00	34.00		
<i>Quercus velutina</i>	52.00			
<i>Rhamnus frangula</i>	32.00			
<i>Rhododendron albiflorum</i>			19.00	
<i>Rhododendron prinophyllum</i>	29.00			
<i>Ribes lacustre</i>			29.00	23.00
<i>Rubus parviflorus</i>			28.00	30.00
<i>Sambucus racemosa</i>			33.00	
<i>Shepherdia canadensis</i>			25.00	24.00
<i>Sorbus scopulina</i>			21.00	19.00
<i>Spiraea alba</i>	18.00	20.00		
<i>Spiraea betulifolia</i>			24.00	18.00
<i>Spiraea pyramidata</i>			26.00	22.00
<i>Symphoricarpos albus</i>			27.00	32.00
<i>Vaccinium membranaceum</i>			22.00	23.00
<i>Vaccinium myrtilloides</i>	13.00	17.00		
<i>Viburnum cassinoides</i>	15.00	18.00		
<i>Viburnum edule</i>			19.00	8.00
<i>Viburnum lantanoides</i>	31.00	28.00		

Table S3: Proportion of samples per species for which budburst was observed.

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