

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

Deirdre Loughnan¹ and E M Wolkovich¹

May 16, 2023

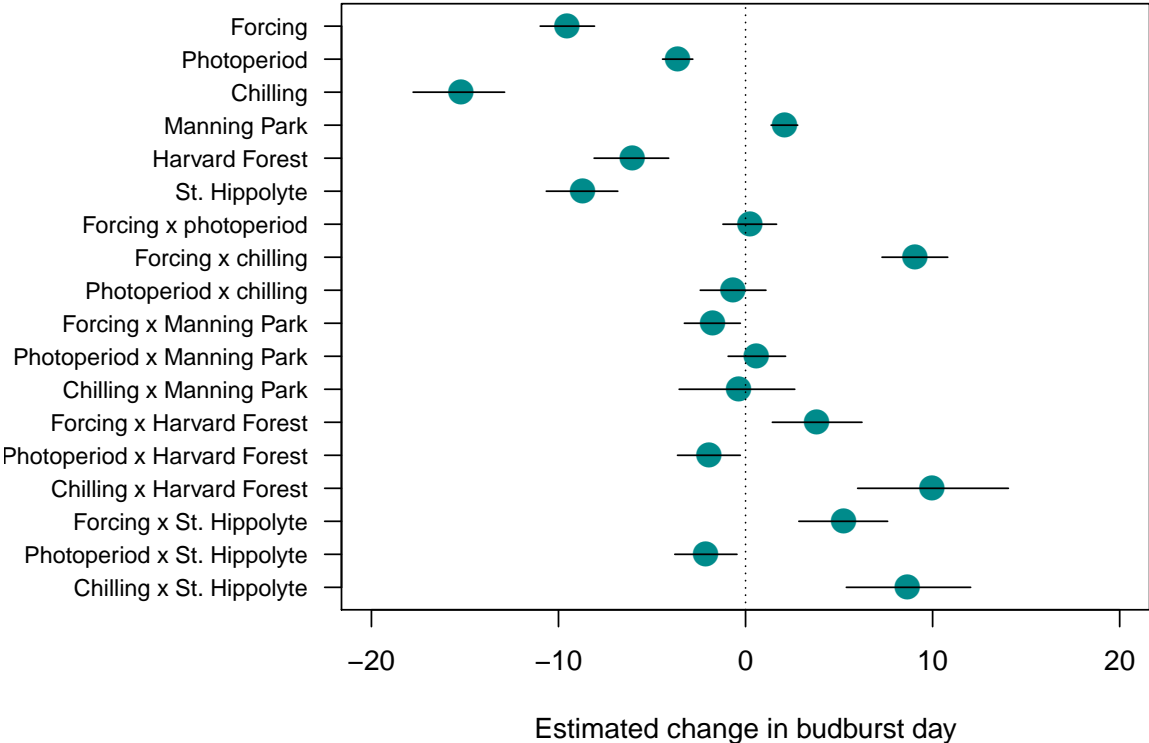


Figure S1: Estimated mean responses in budburst date of first bud to varying forcing, chilling, and photoperiod cues for 47 deciduous woody species across North America. Points represent mean posterior estimate, while bars depict the 95% uncertainty interval. Negative responses represent advances budburst, while positive values represent delaying effects.

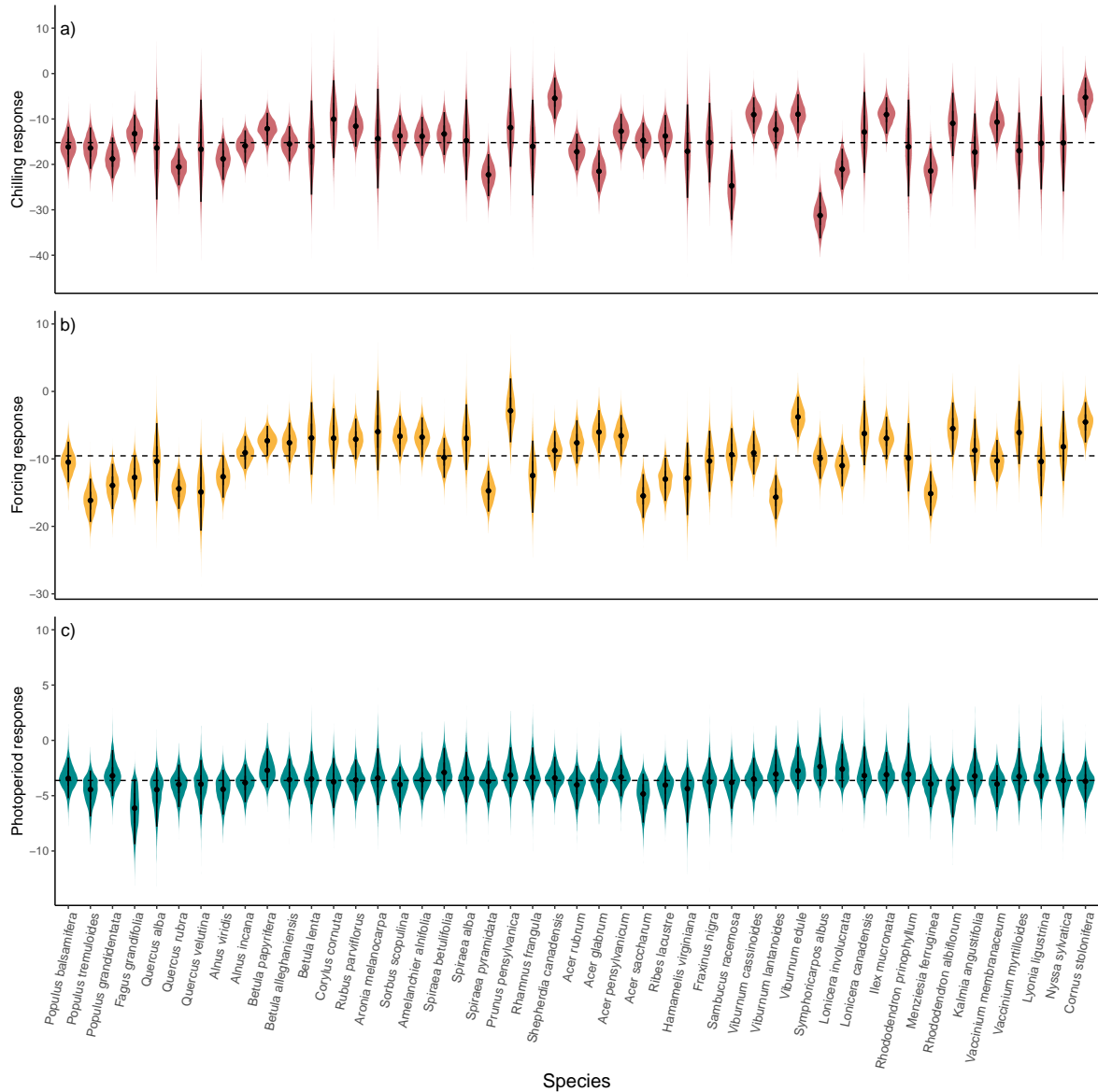


Figure S2: Species differences in cue estimate posterior distributions, comparing species differences across chilling (a), forcing (b), and photoperiod (c) cues. Species are ordered according to their phylogenetic relatedness. The median cue response is illustrated by the black circle, while the 90% quantile interval is illustrated by the black line. The coloured distribution depicts the shape of the posterior density for all samples of a given species. Species are ordered alphabetically, with differing y-axes to best depict species differences.

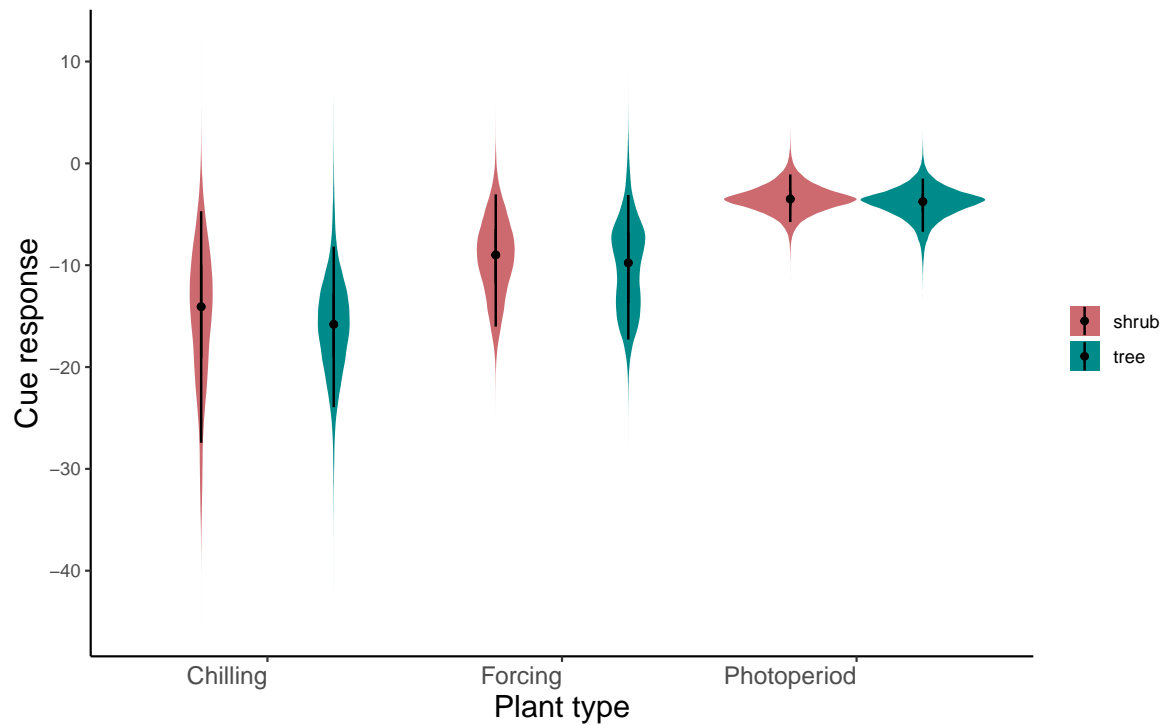


Figure S3: Comparisons of posterior distributions for cues estimates between shrub and tree species. Black circles represent the median cue response, while the thinner black line the 90% quantile interval. The coloured distribution is the the posterior density of the posteriors of the cue responses for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

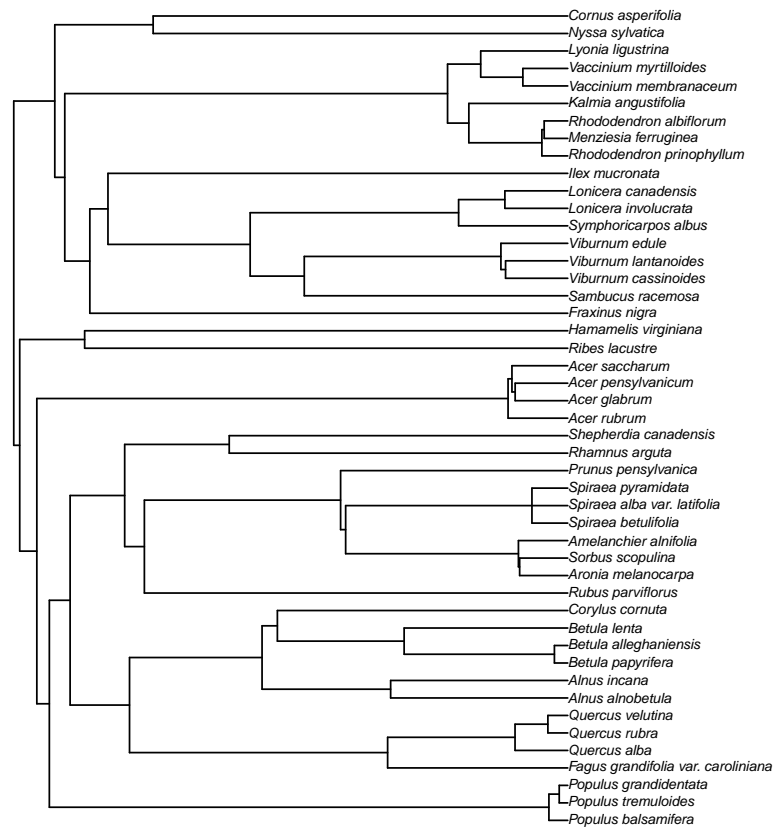


Figure S4: Species differences were accounted for by including phylogenetic effects on the species intercept. The phylogeny was obtained by pruning the existing tree for flowering plants developed by Smith and Brown (2018)

Table S1: 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 S2: Chill units from 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.

Population	Chilling.treatment	Chilling.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
Harvard forest	Field chilling + 30 d at 1.5 degree C	2140	1702.50	91.17
St. Hippolyte	Field chilling	682	599.50	44.63
St. Hippolyte	Field chilling + 30 d at 4 degree C	1930	1847.50	82.06
St. Hippolyte	Field chilling + 30 d at 1.5 degree C	1930	1487.50	79.18
Smithers	Field chilling + 30 d at 4 degree C	1965	2016.00	74.67
Smithers	Field chilling + 70 d at 4 degree C	1317	1368.00	54.95
Manning Park	Field chilling + 30 d at 4 degree C	1861	2025.00	75.33
Manning Park	Field chilling + 70 d at 4 degree C	1213	1377.00	55.09

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

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