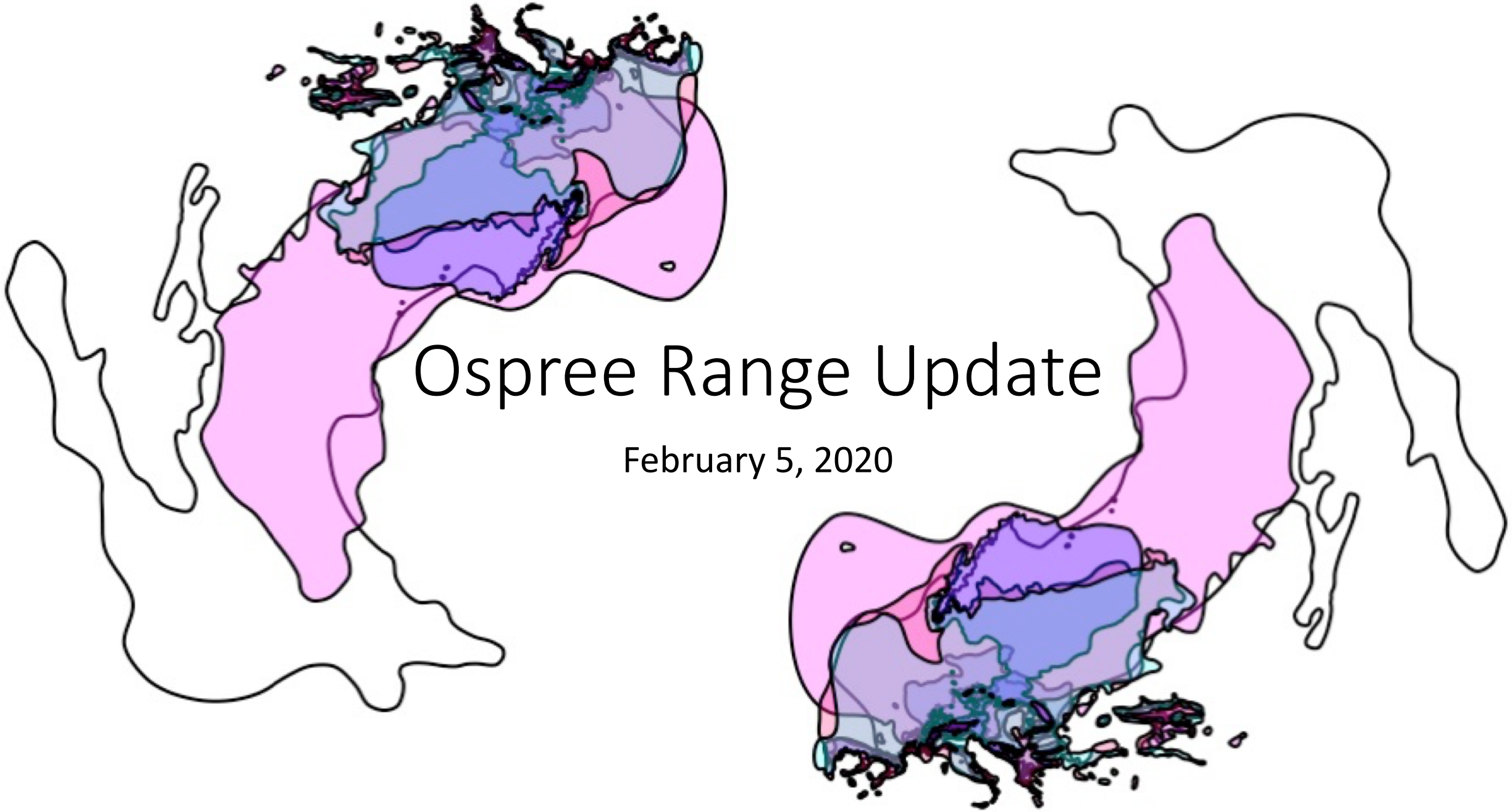


Ospree Range Update

February 5, 2020

Justification

- Phenology is a major determinant of species ranges
- Phenological responses to multiple cues are integrated to interpret the optimum environment. eg chilling requirement prevents budbreak during a unseasonable warm December.
- Generally speaking, spring phenology is plastic (not locally adapted) therefore we expect cue integration to match the overall climate characteristics of a species range.
- Given this, and that there is high inter-specific variation in sensitivity to particular cues, we should be able to predict the strength of a cue response give the climate characteristics of species ranges.

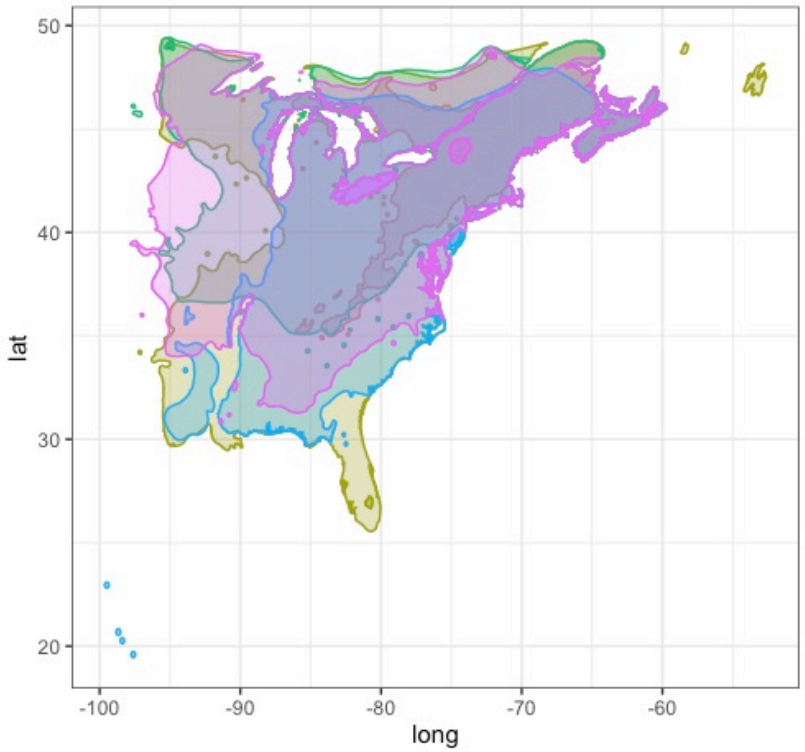
Justification

- Thanks to OSPREE, we have estimates of species level sensitivity to the three main temperate phenological cues; forcing, chilling and photoperiod.
- We can also (semi-) readily obtain climate data for each species' range.
- Combining these, we can see how well the climate space of the a species range relates to our posterior estimates of cue sensitivity.

Hypotheses (from github)

- Chilling
  - High inter-annual variability in chilling across much of range then expect high chilling (low variability should be low chilling)*
  - High interannual variability in forcing across much of range then expect high chilling (low variability should be low chilling)
- Photoperiod
  - Species with large north-south ranges (span a lot of latitude) should have higher photoperiod response

Data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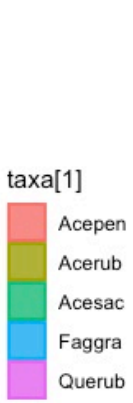
-80
-70
-60
long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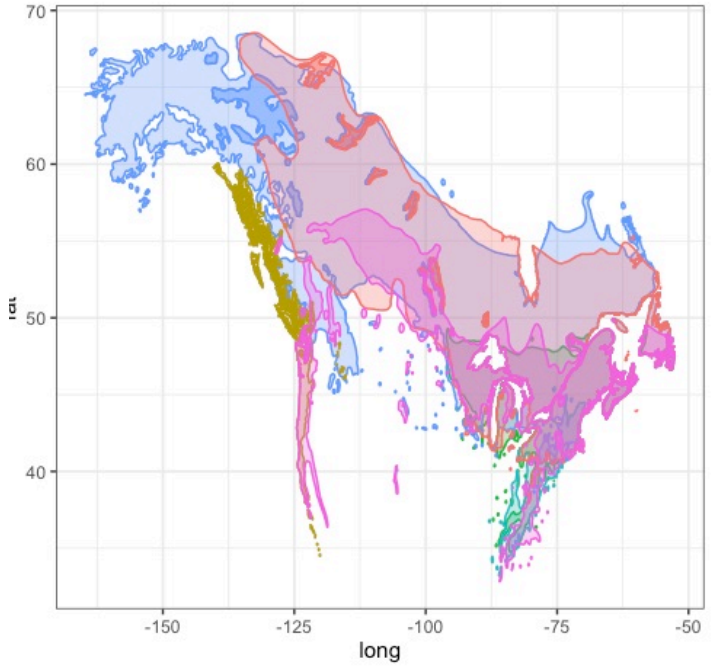
Acerub
Acesac
Faggra
Querub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50
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-150
-125
-100
-75
-50
long


tax2[1]
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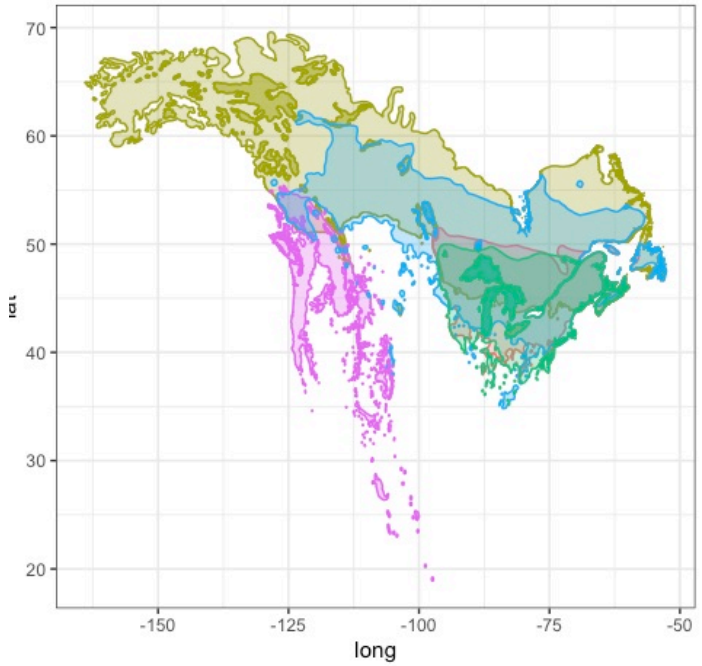
Alnrub
Betall
Betlen
Betpap
Corcor


70
60
50
40
30
20
-150
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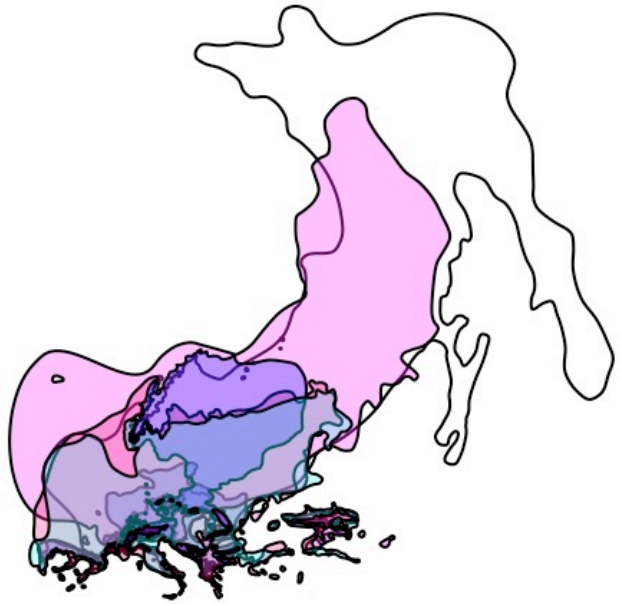
-100
-75
-50
long


tax3[1]
Franig
Picglau
Popgra
Prupen
Psumen



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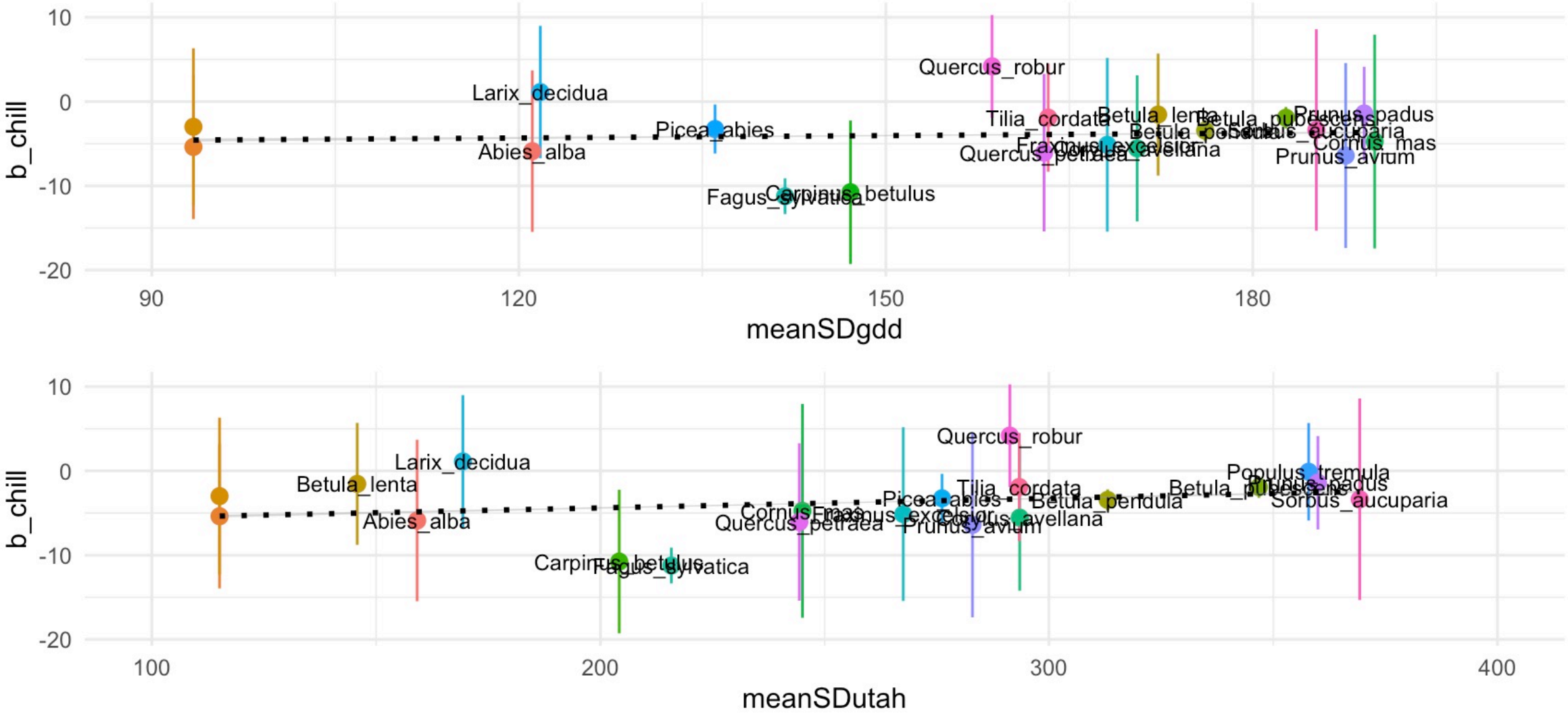
b_chill
meanSDgdd
Larix_decidua
Abies_alba
Picea_abies
Fagus_sylvatica
Carpinus_betulus
Quercus_robur
Tilia_cordata
Betula_lenta
Betula_pendula
Quercus_petraea
Prunus_avium
Prunus_padus
Sorbus_aucuparia
Cornus_mas
b_chill
meanSDutah
Betula_lenta
Larix_decidua
Abies_alba
Carpinus_betulus
Fagus_sylvatica
Quercus_robur
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Betula_pendula
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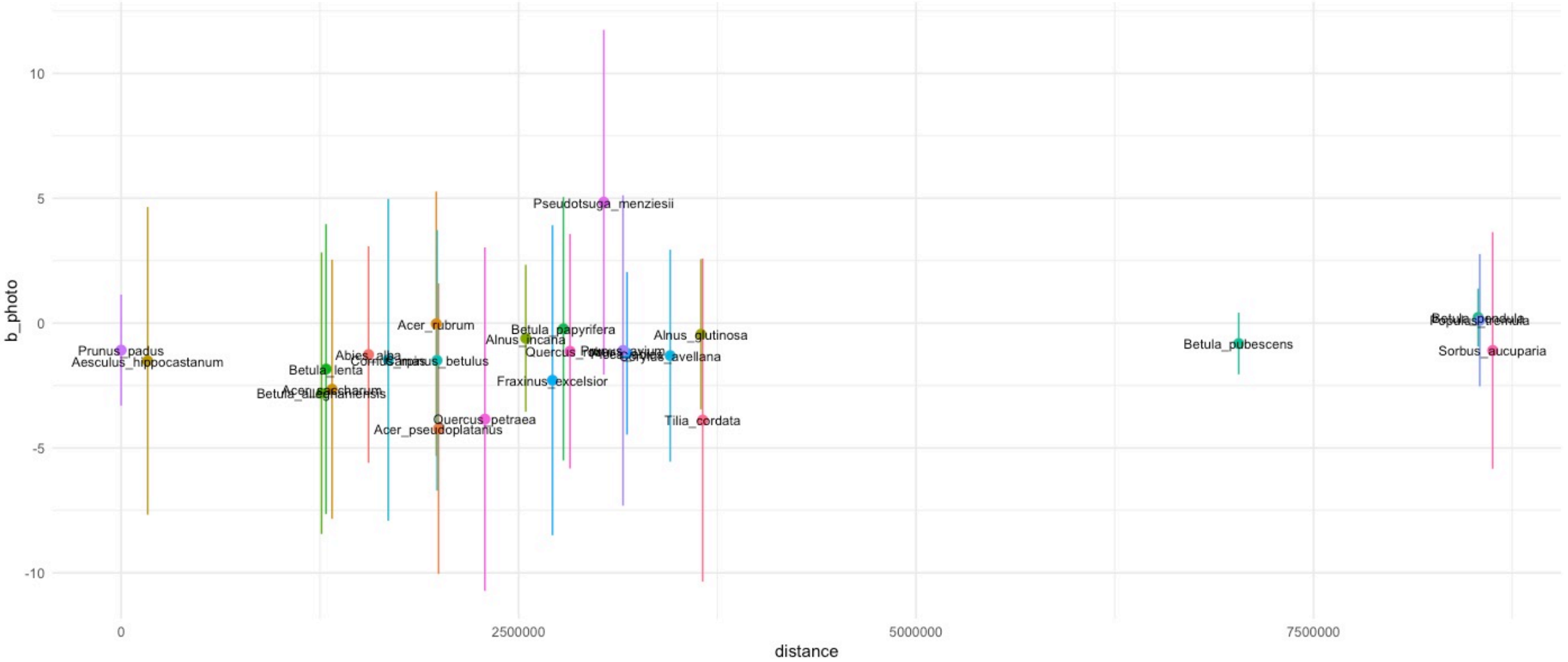
Prunus_avium
Populus_tremula
Sorbus_aucuparia

Data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-10
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5000000
7500000
distance
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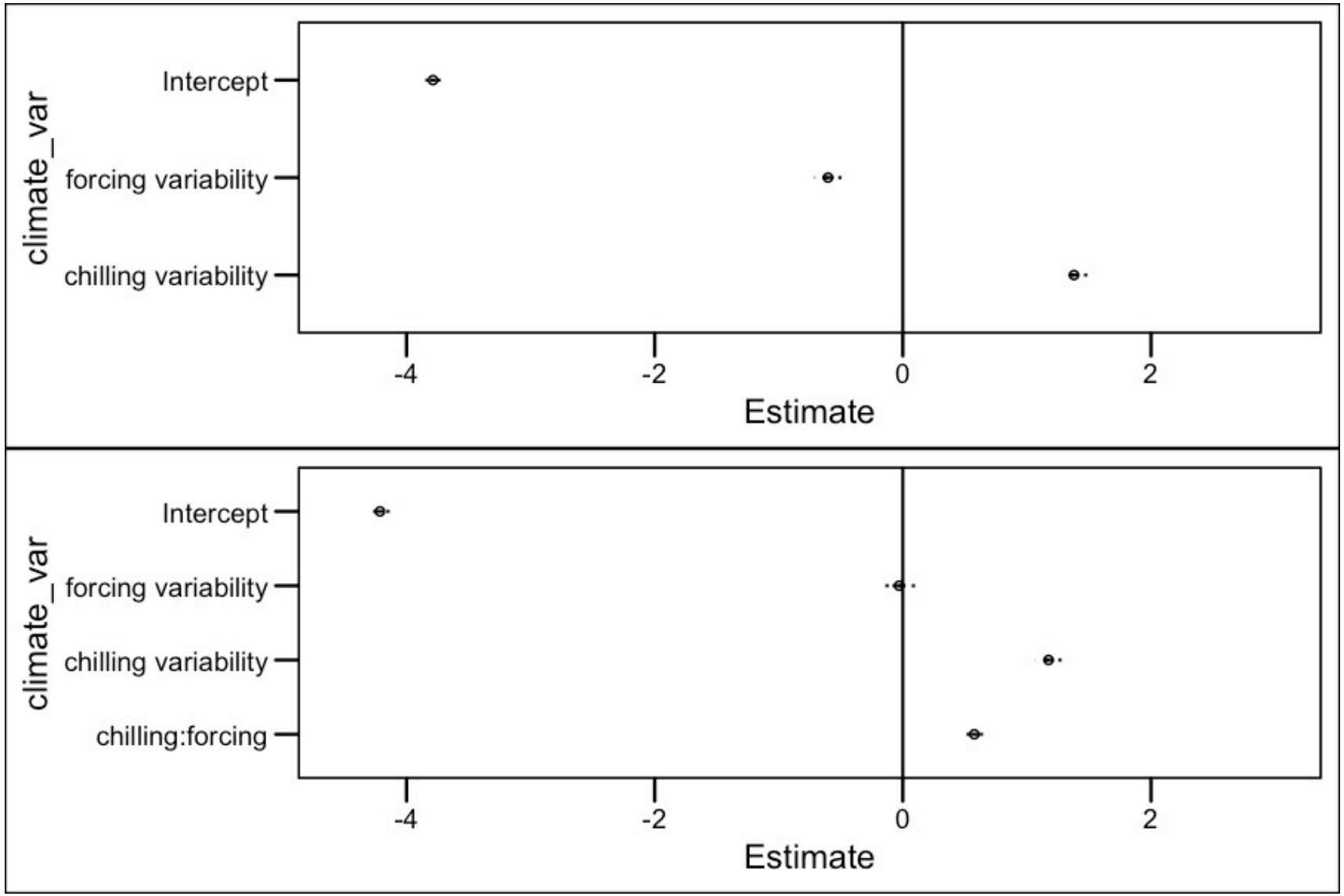
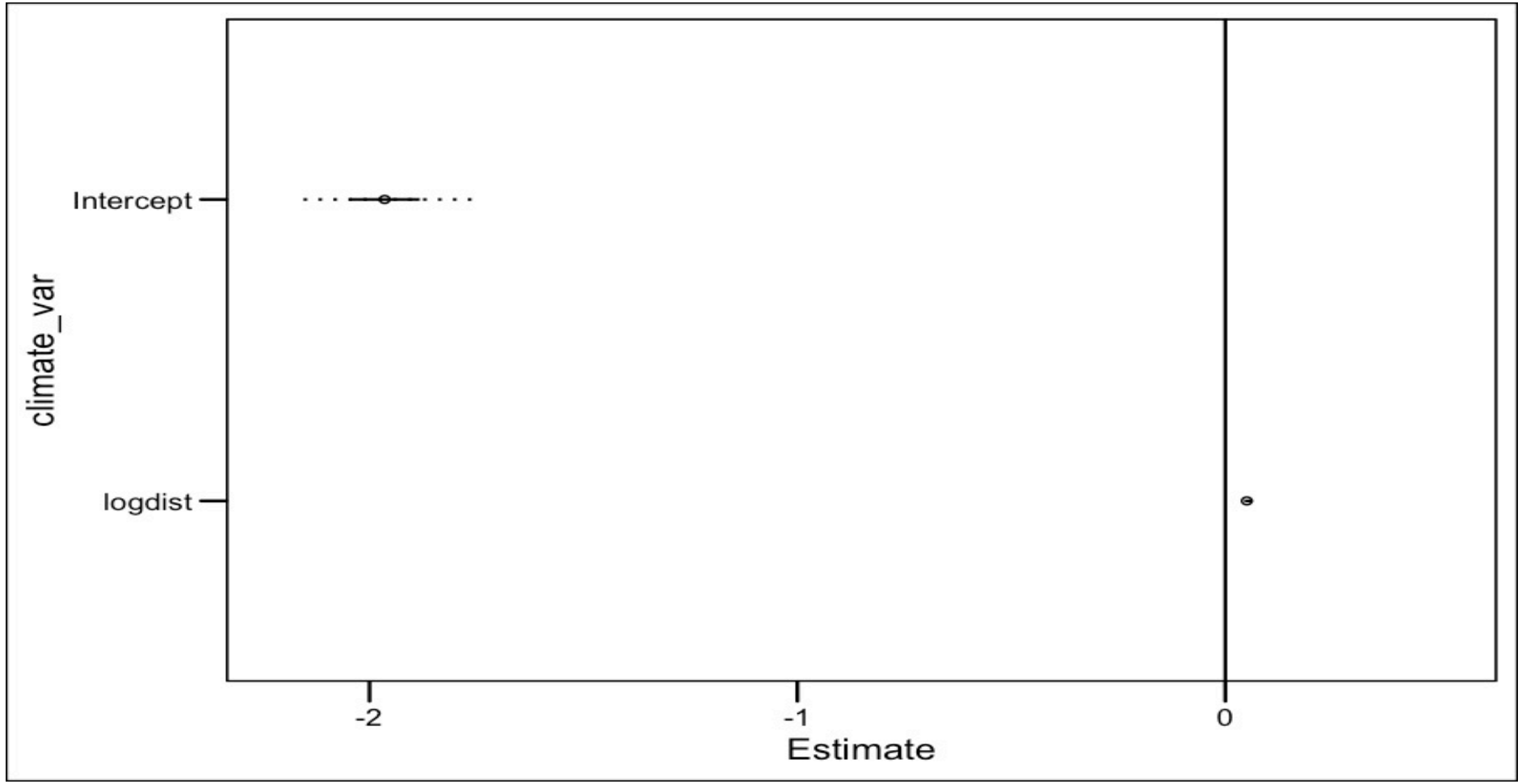
Acer_rubrum
Betula_papyrifera
Alnus_incana
Alnus_glutinosa
Prunus_padus
Aesculus_hippocastanum
Betula_lenta
Fraxinus_excelsior
Corylus_avellana
Betula_pubescens
Sorbus_aucuparia
Quercus_petraea
Acer_pseudoplatanus
Tilia_cordata

Model I: b_chill~sdGDD*sdChill (European species+*Betula lenta*)



Model II: b_photo~log(range_extent)(All species – 4 European)



Next steps:

- Add North American species to climate variability models
- Trouble shoot photoperiod species
- Literature exploration about hypotheses
- Interpret results in light of the hypotheses
- New models?
- Other?