Ant Climate Project

Path analysis using PCA - Regional using conditional averaging

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Contents

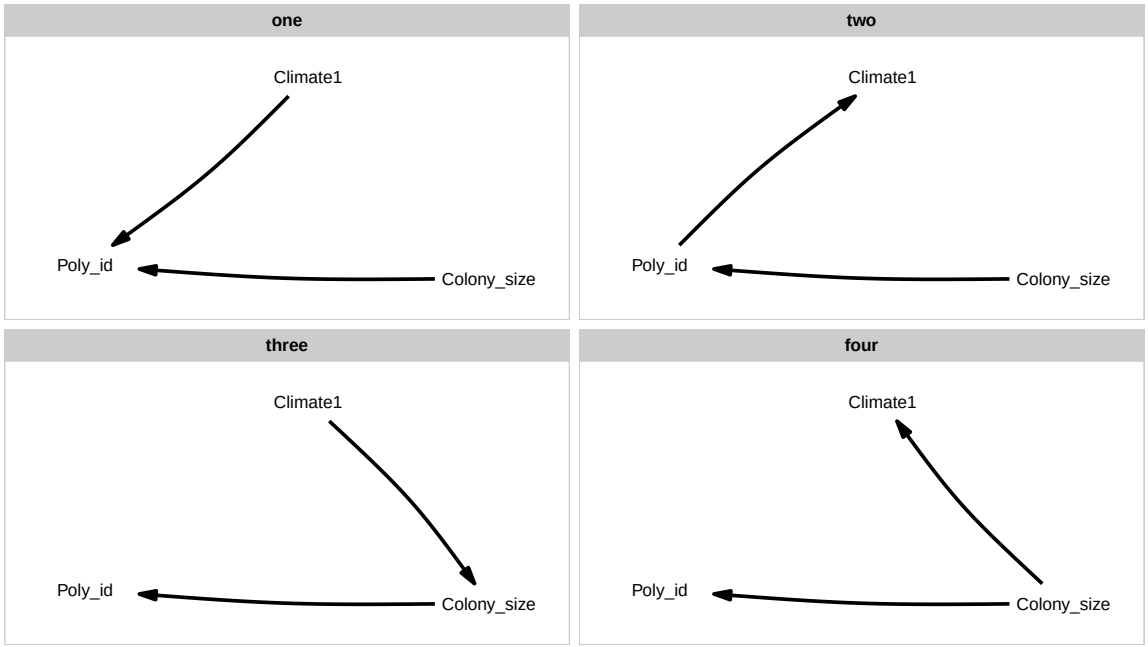
1 Initial comments

- Read in the ant data and prepare the variables for path analysis. There are 474 species for which data is available for colony size and climatic variables, excluding special ants. Process repeated on the 4 different PCA datasets created using the 4 different MCC trees.
- We use PCA for phylogenetic path analysis as path analysis with both temperature and rainfall variables in the same models were always rejected, unless causal paths were drawn between climatic variables. This is likely because of the correlation between climatic variables. Path analaysis with PCA allows us to analyse both temperature and rainfall in the same causal models.
- The potential model set is reduced to just four models for each analysis, assuming that colony size has a direct effect on the number of worker castes (Bell-Roberts et al., 2023).

2 Summary

- Greater colony size favours both greater worker size variation and allows invasion into drier regions. Both path coefficients are significant.

3 Create alternative causal models

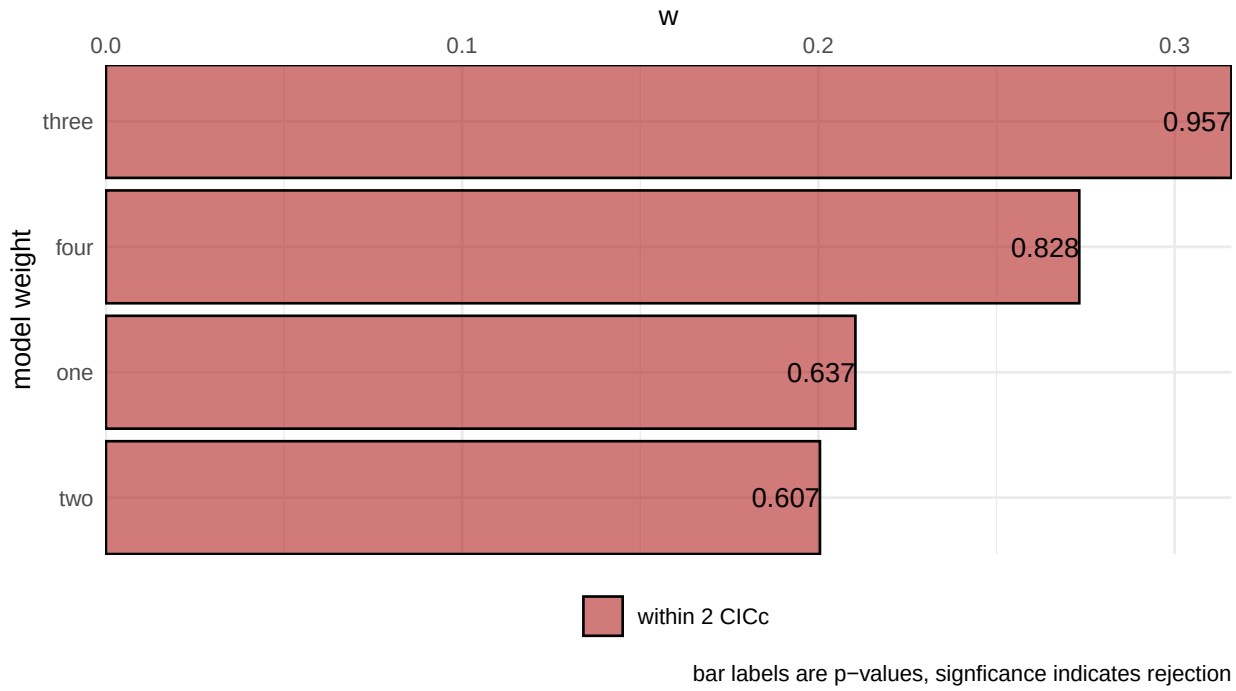


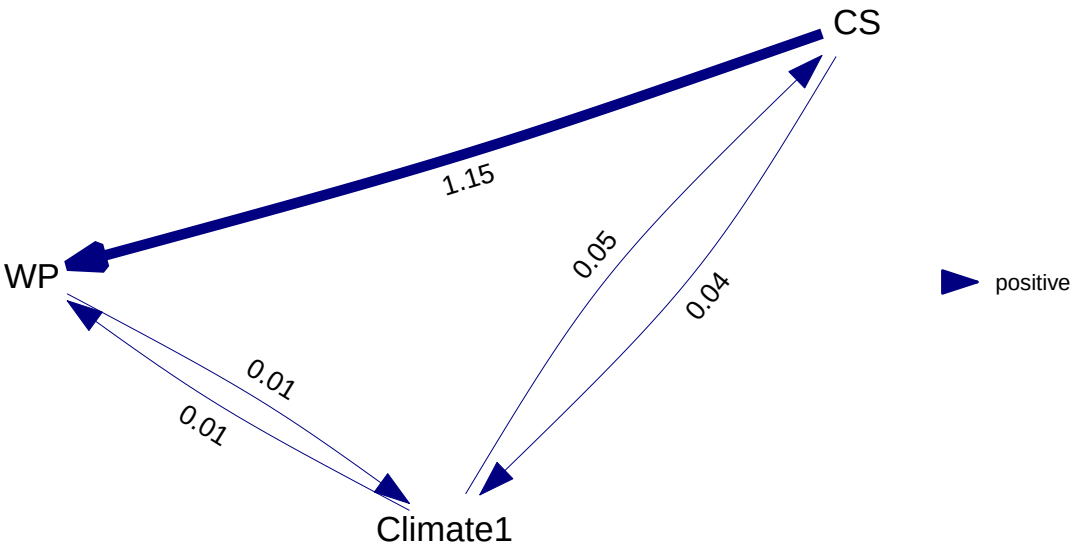
4 Path analysis

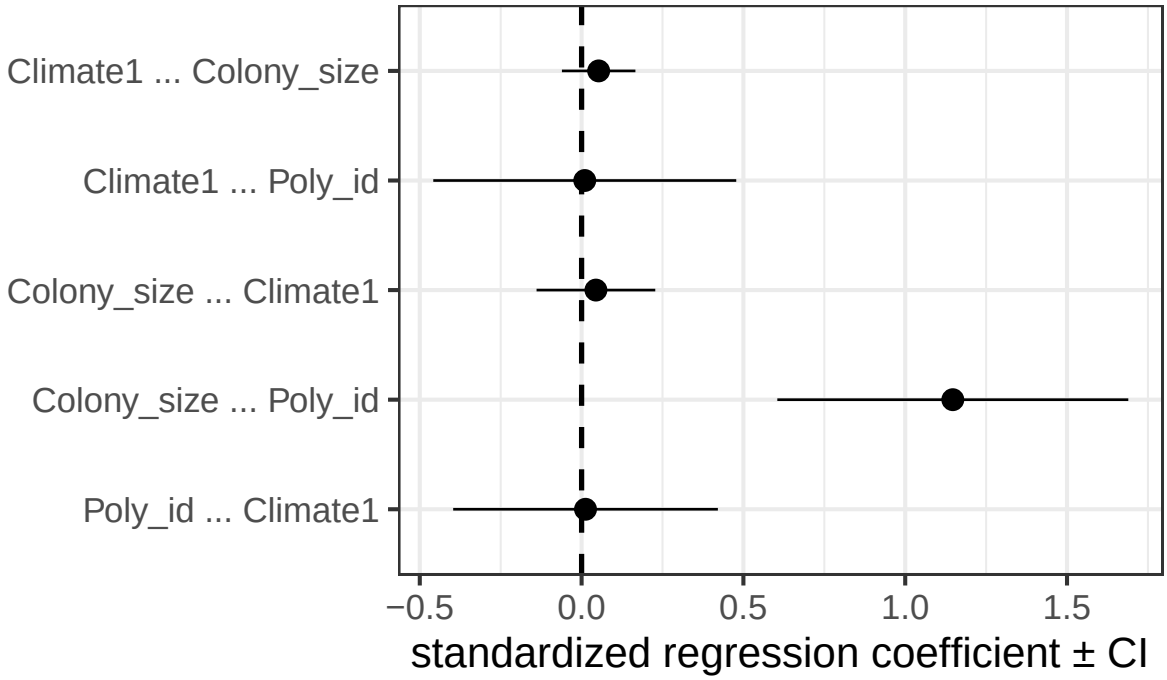
4.1 Tropical

4.1.1 NCuniform stem tree

Factor loading PC1: TMP: negative; PRE: negative

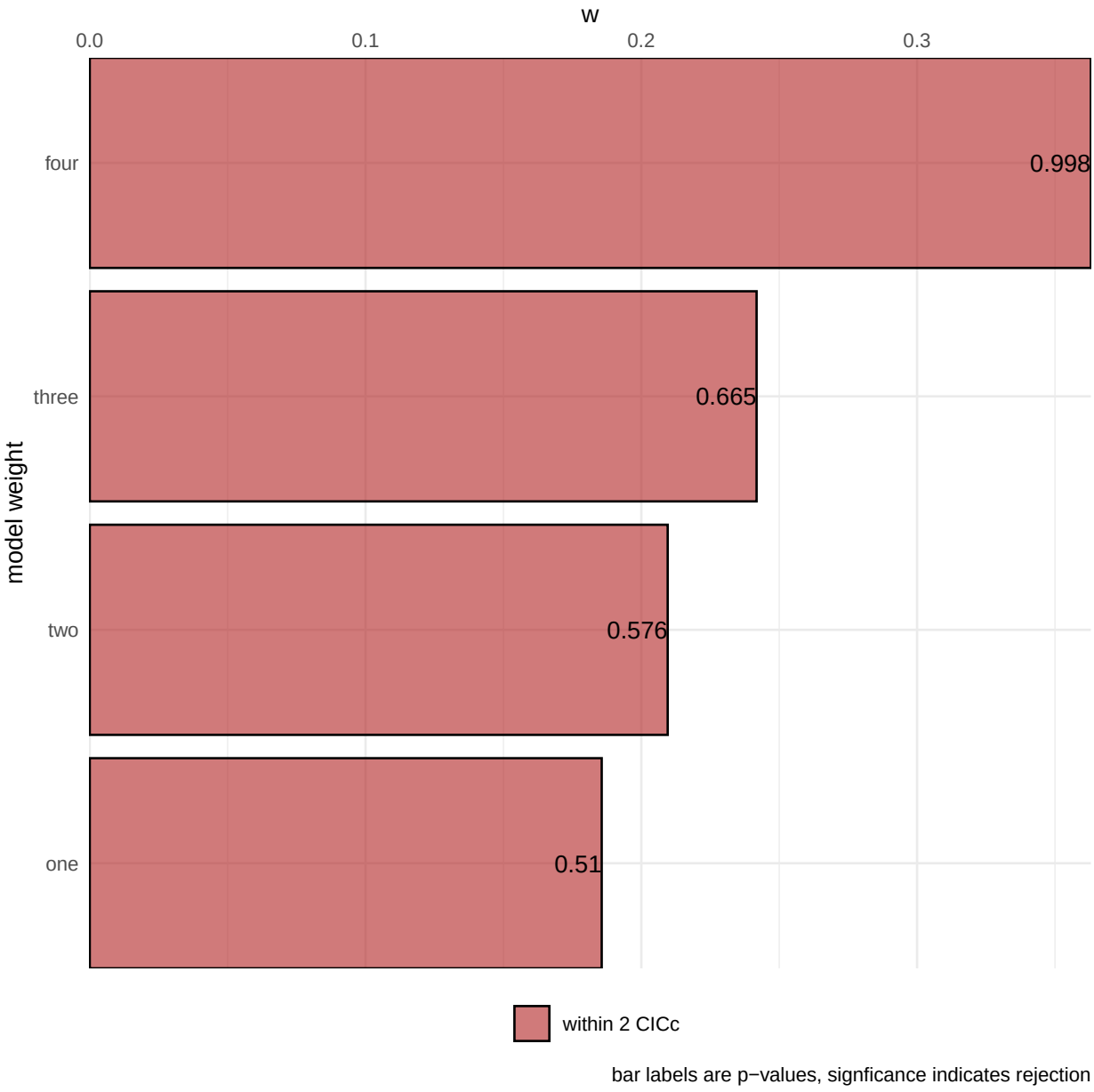


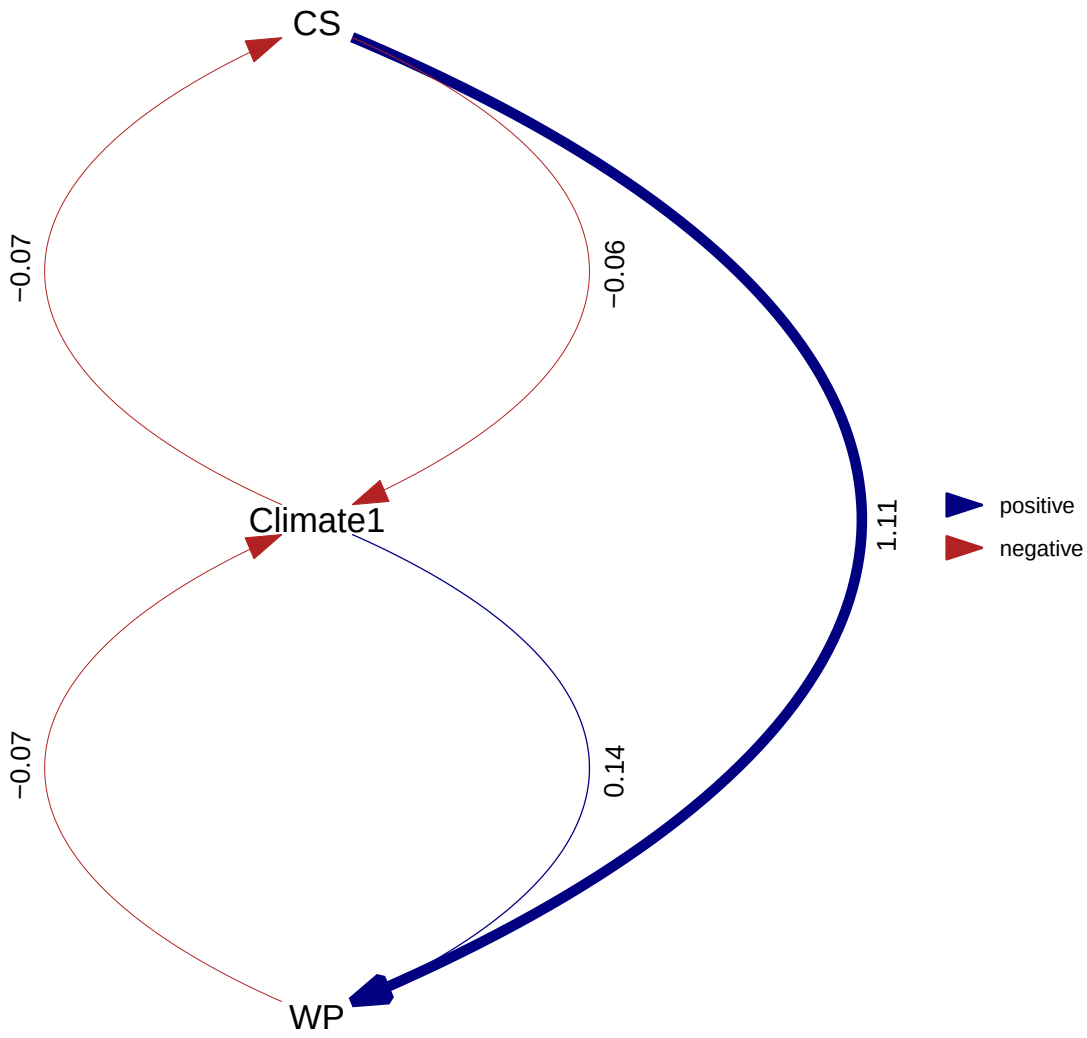


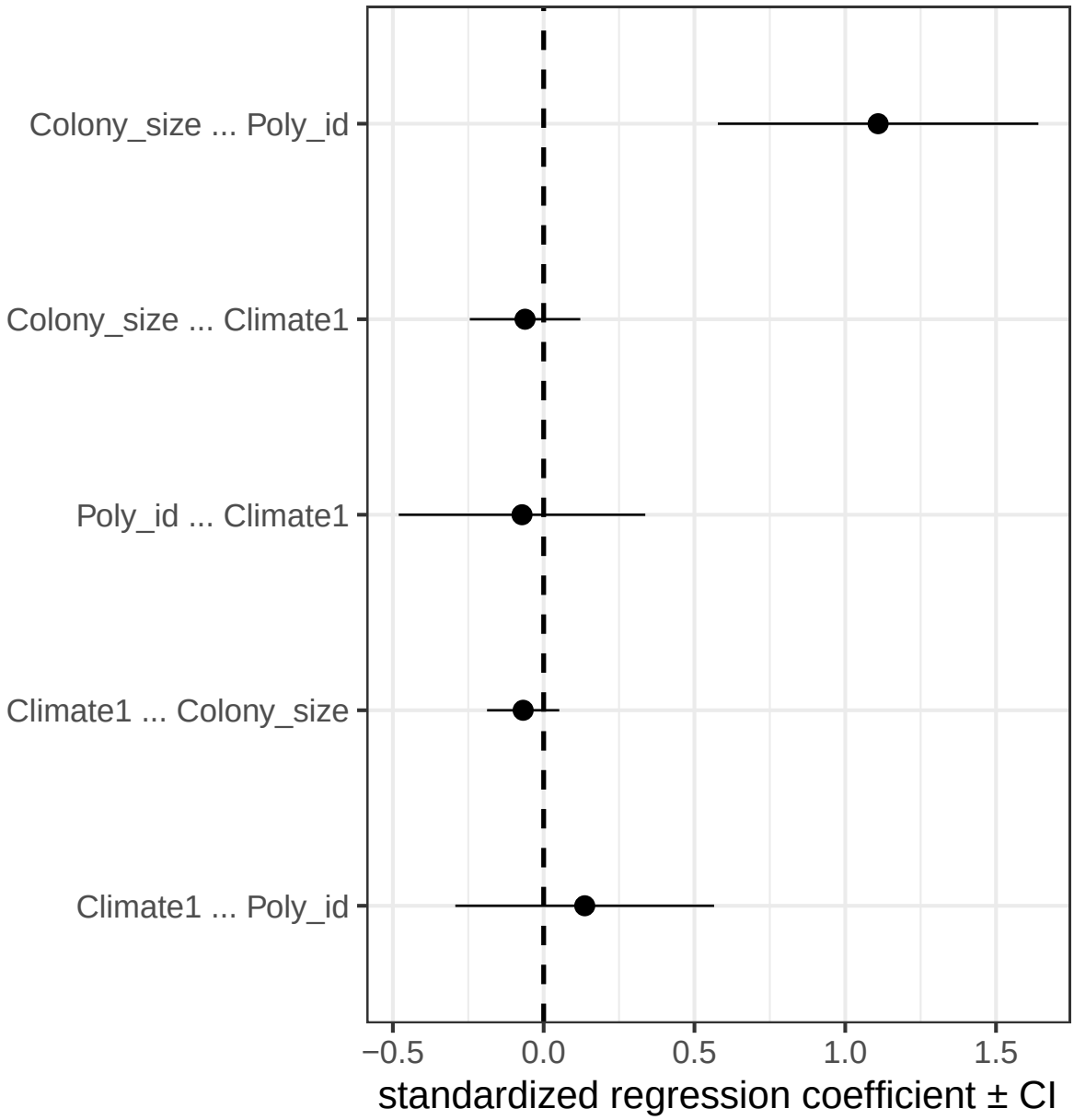


4.1.2 NCuniform crown tree

Factor loading PC1: TMP: positive; PRE: positive

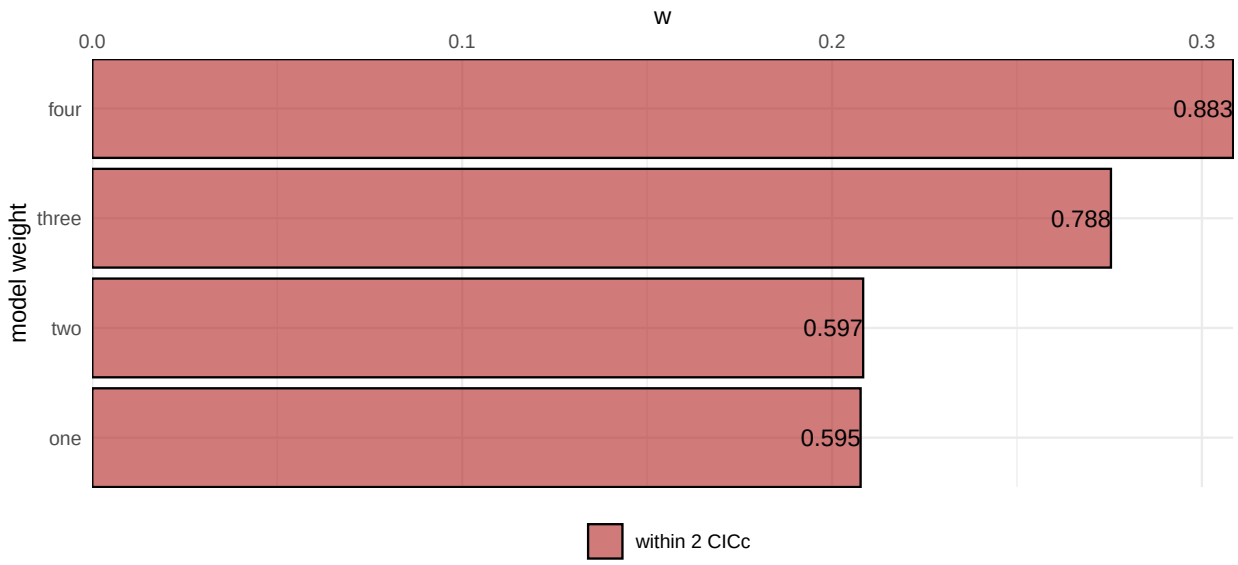

w
0.0
0.1
0.2
0.3
four
three
two
one
model weight
0.998
0.665
0.576
0.51
within 2 CICc
bar labels are p−values, signficance indicates rejection


CS
Climate1
WP
−0.07
−0.06
1.11
−0.07
0.14
positive
negative



4.1.3 FBD stem tree

Factor loading PC1: TMP: negative; PRE: negative


w
0.0
0.1
0.2
0.3
four
three
two
one
model weight
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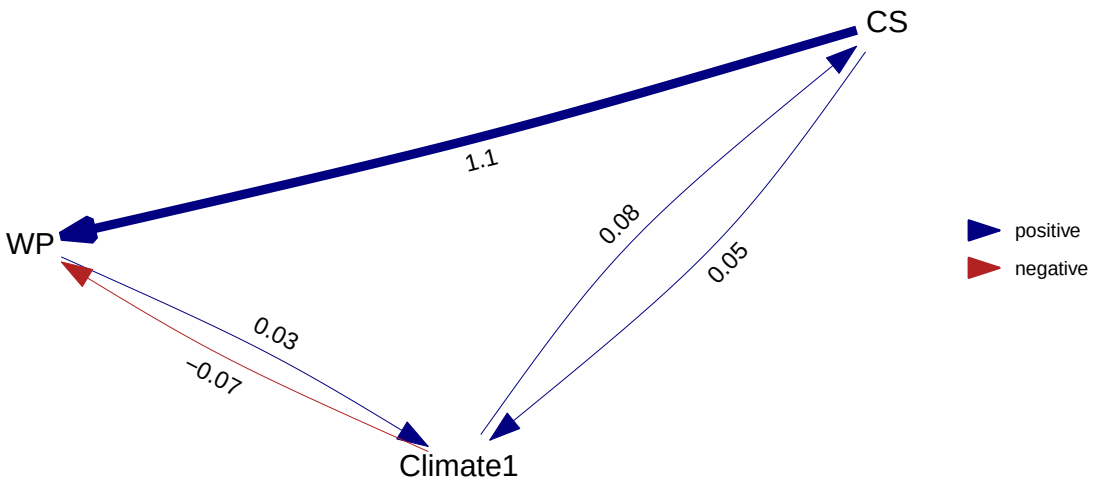
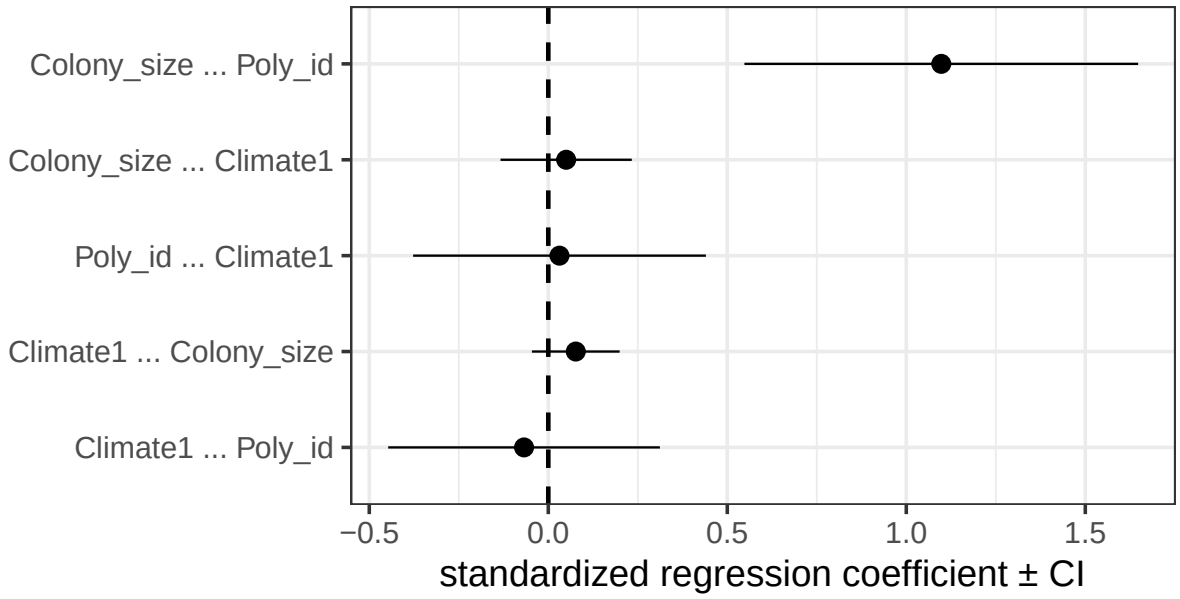
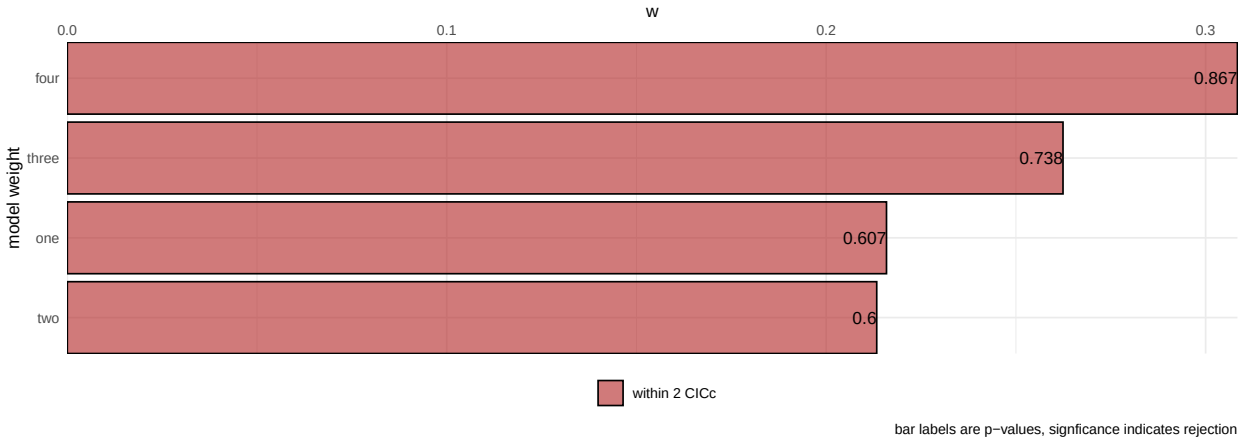
0.788
0.597
0.595
within 2 CICc
bar labels are p−values, signficance indicates rejection

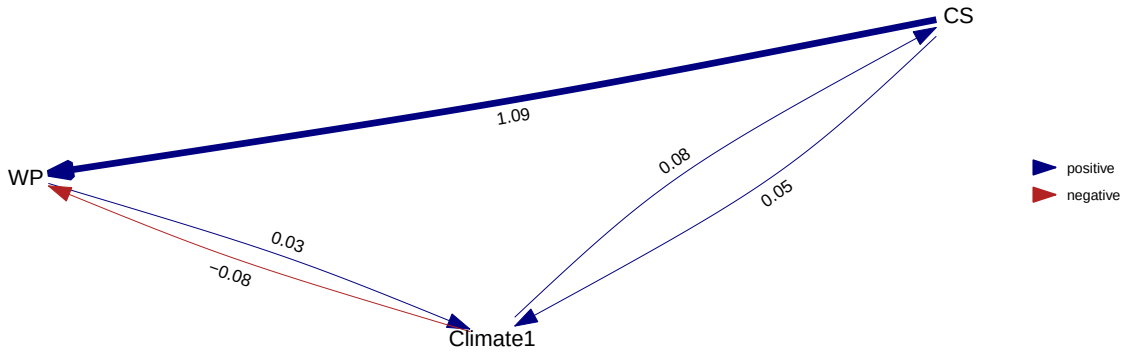

CS
WP
Climate1
1.1
0.08
0.05
0.03
−0.07
positive
negative

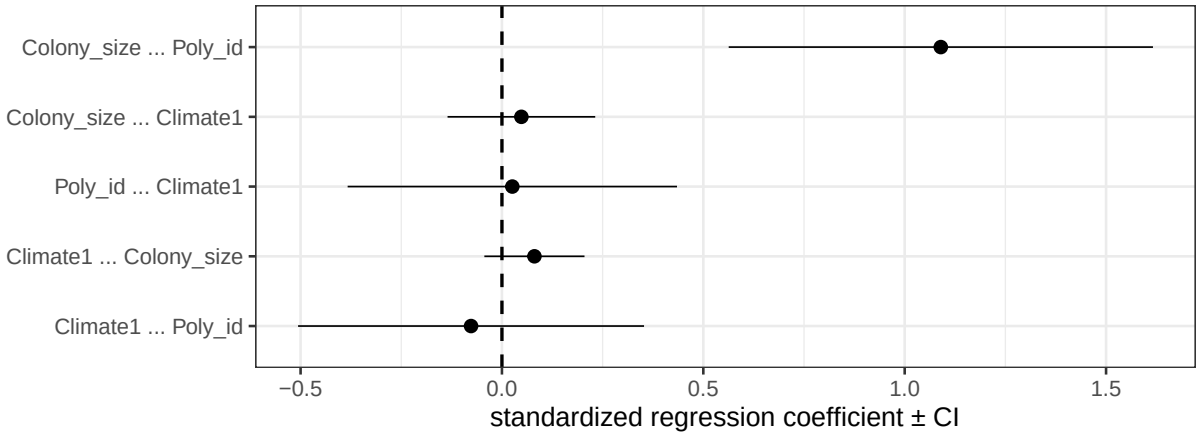


4.1.4 FBD crown tree

Factor loading PC1: TMP: negative; PRE: negative



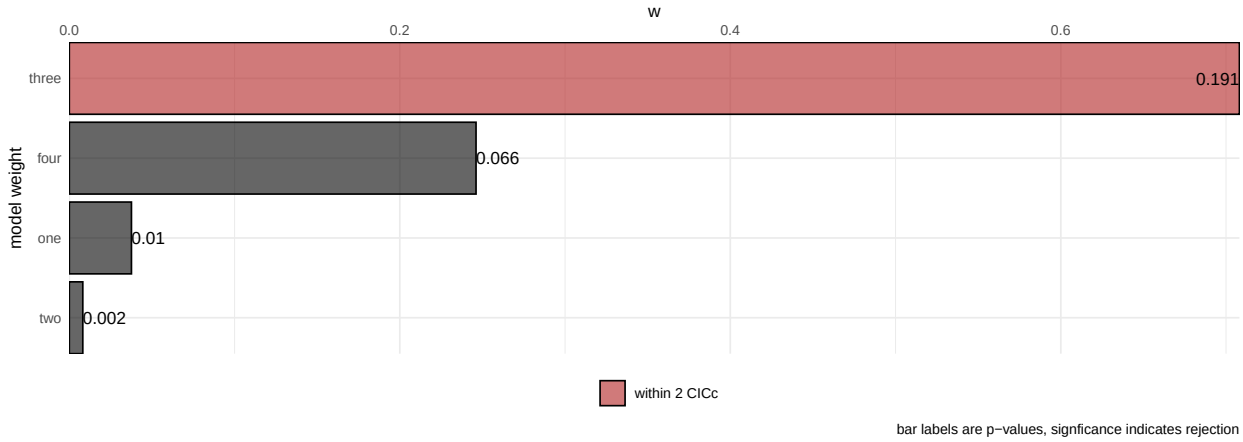


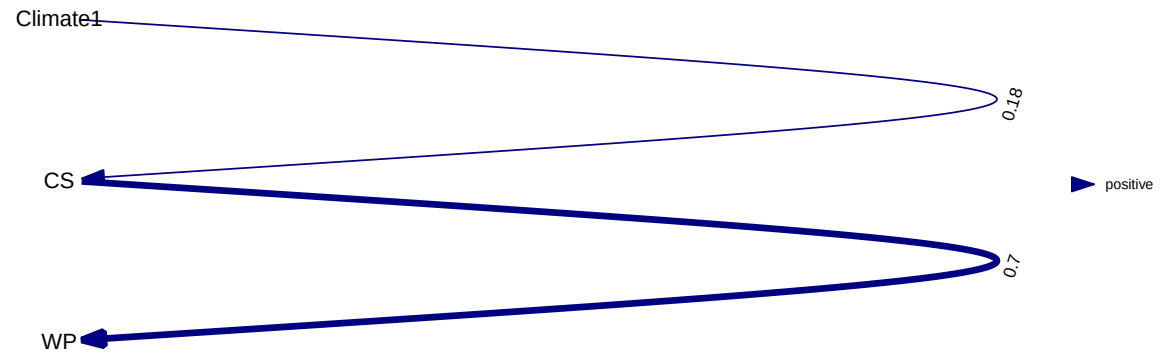


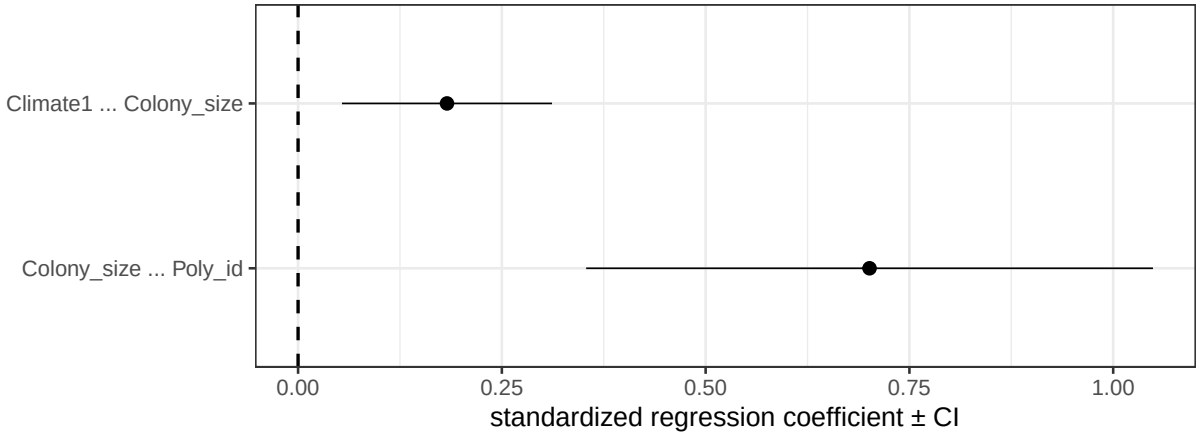
4.2 Temperate

4.2.1 NCuniform stem tree

Factor loading PC1: TMP: negative; PRE: negative

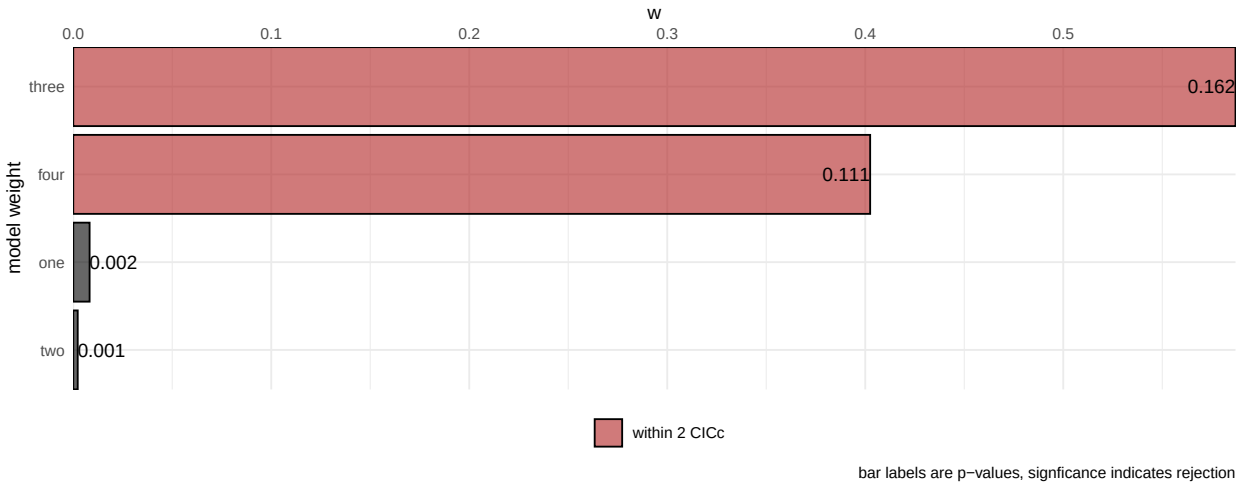


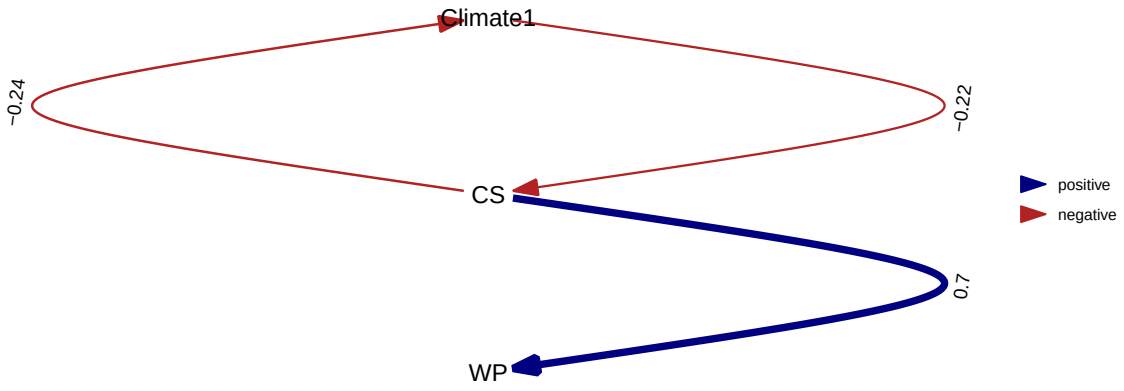


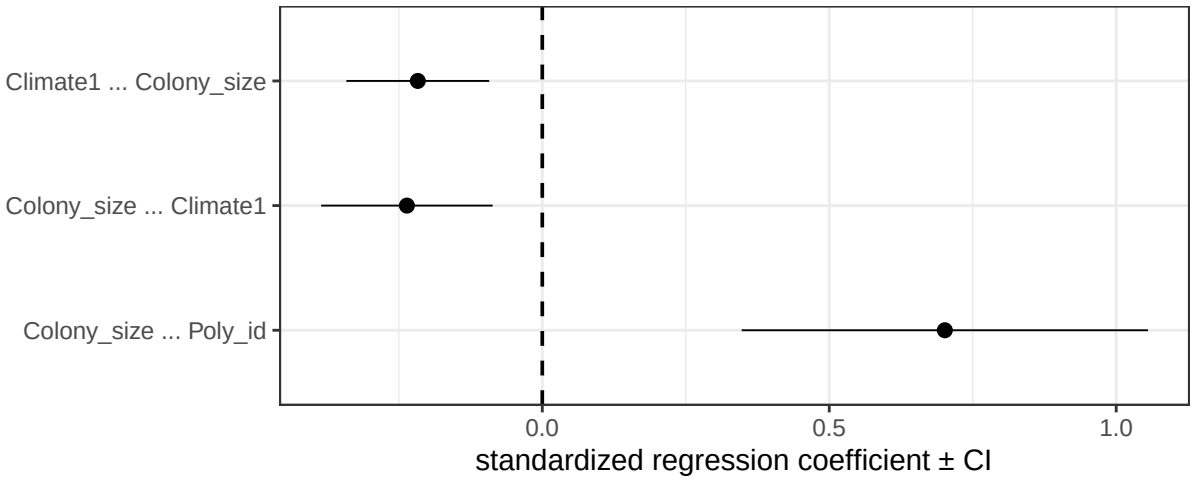


4.2.2 NCuniform crown tree

Factor loading PC1: TMP: positive; PRE: positive

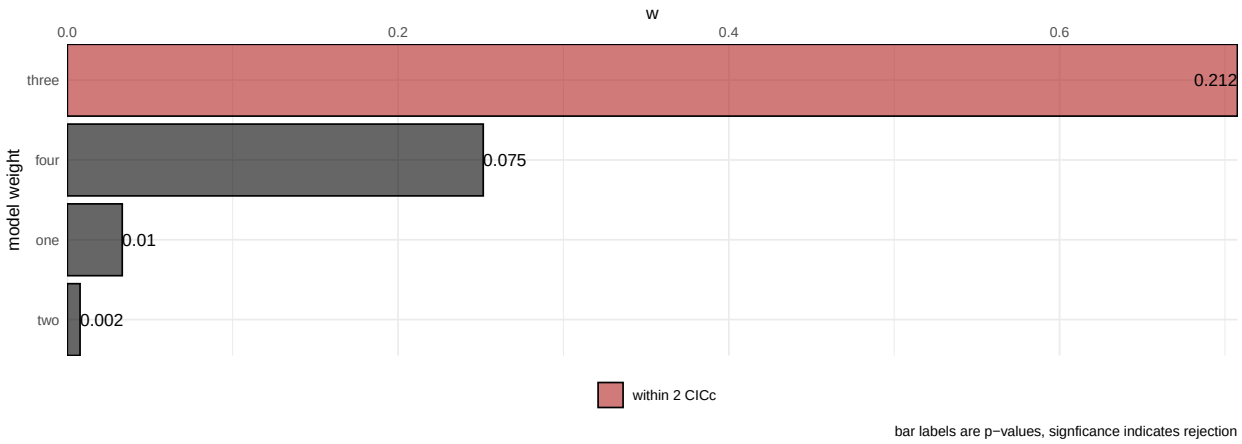


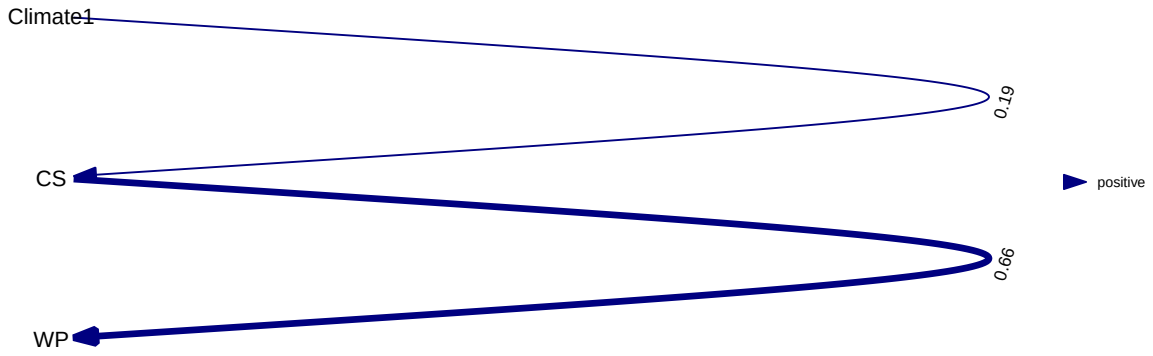


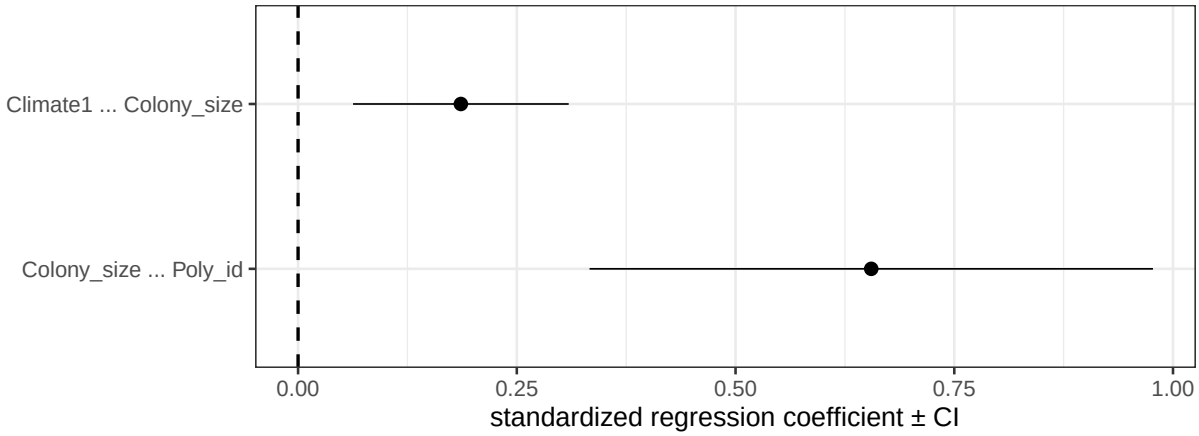


4.2.3 FBD stem tree

Factor loading PC1: TMP: negative; PRE: negative

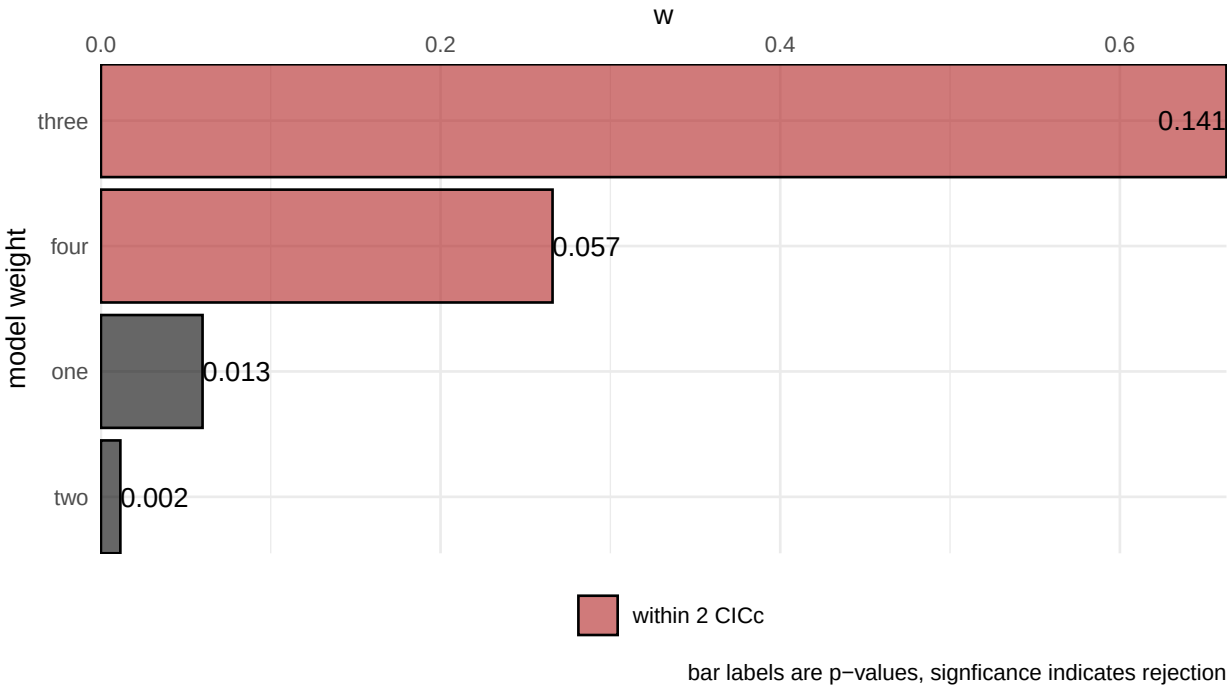


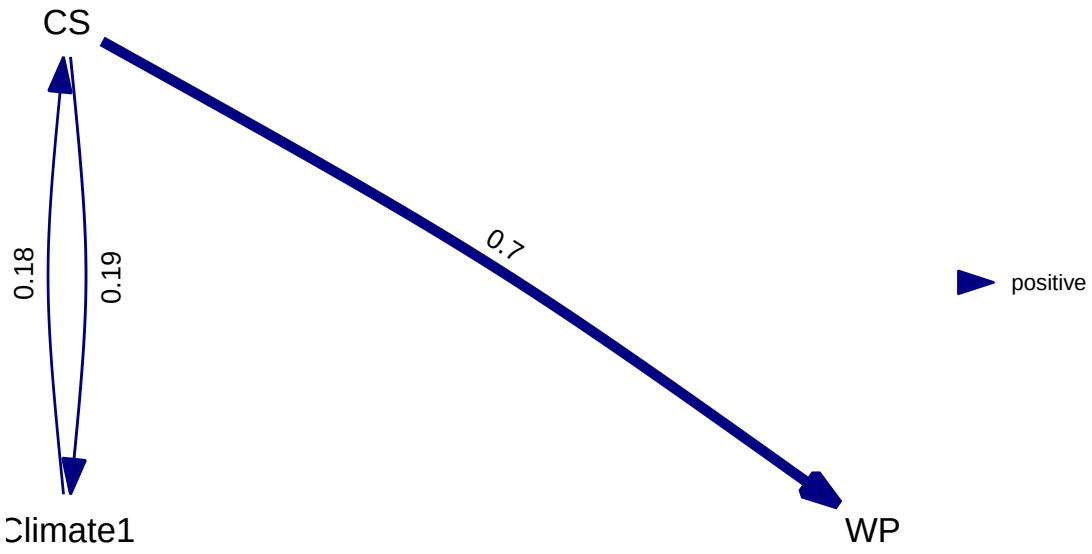


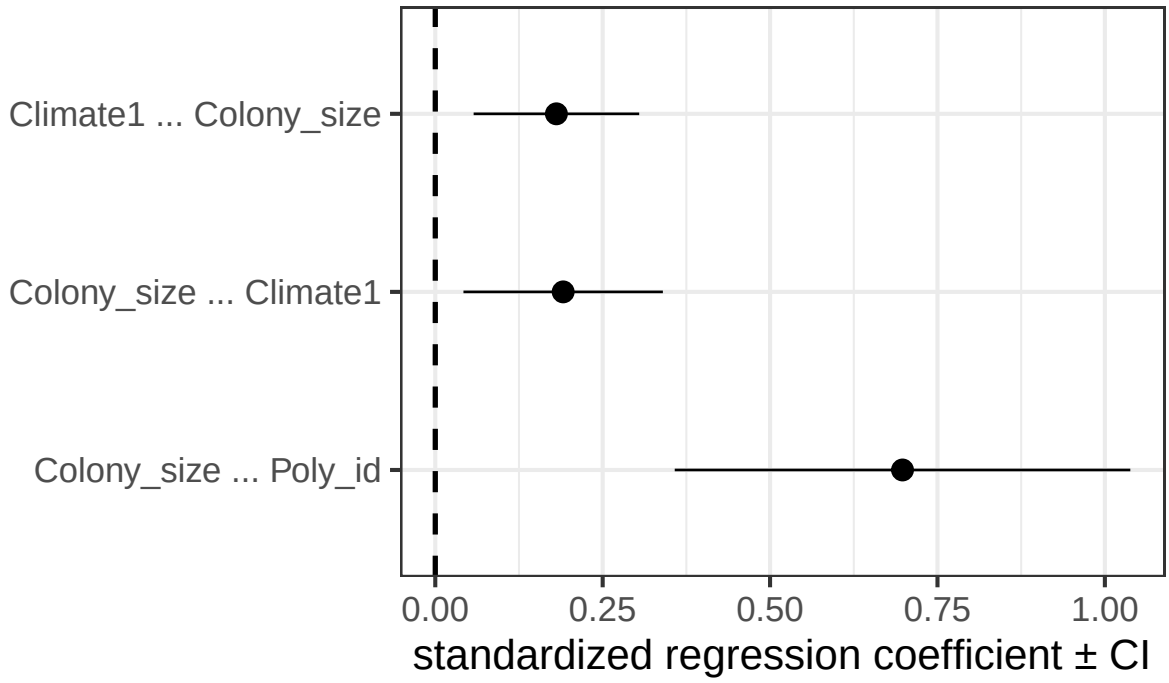


4.2.4 FBD crown tree

Factor loading PC1: TMP: negative; PRE: negative


w
0.0
0.2
0.4
0.6
three
four
one
two
model weight
0.141
0.057
0.013
0.002
within 2 CICc
bar labels are p−values, signficance indicates rejection

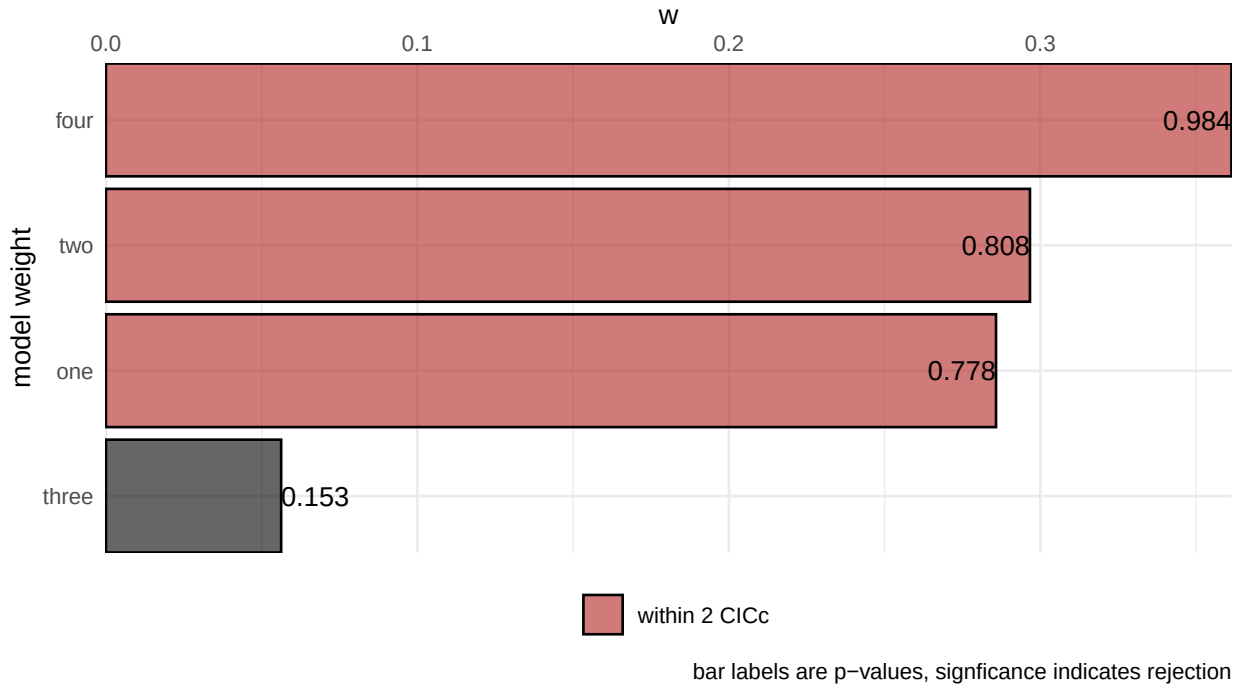

CS
0.18
0.19
0.7
Climate1
WP
positive

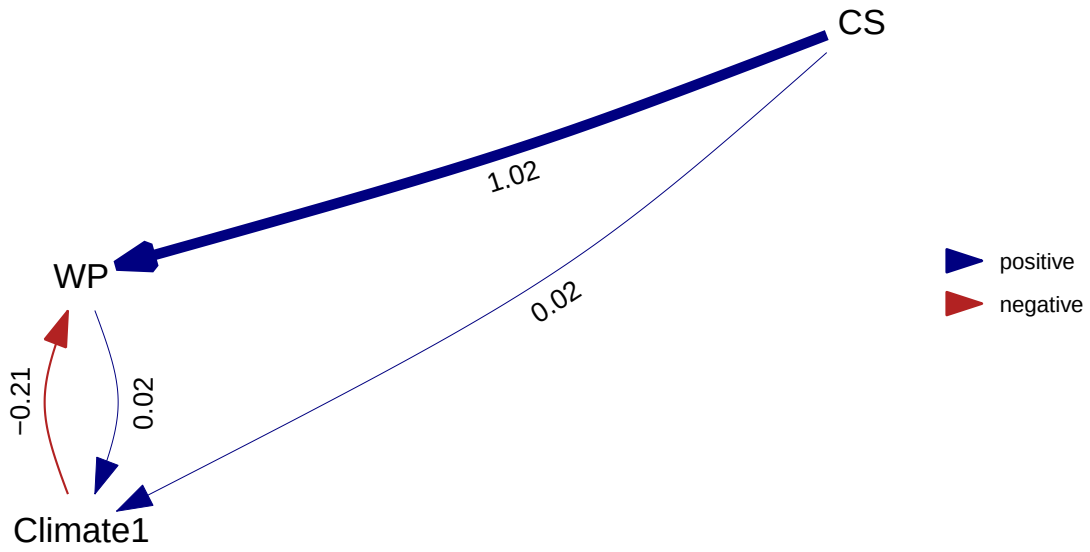


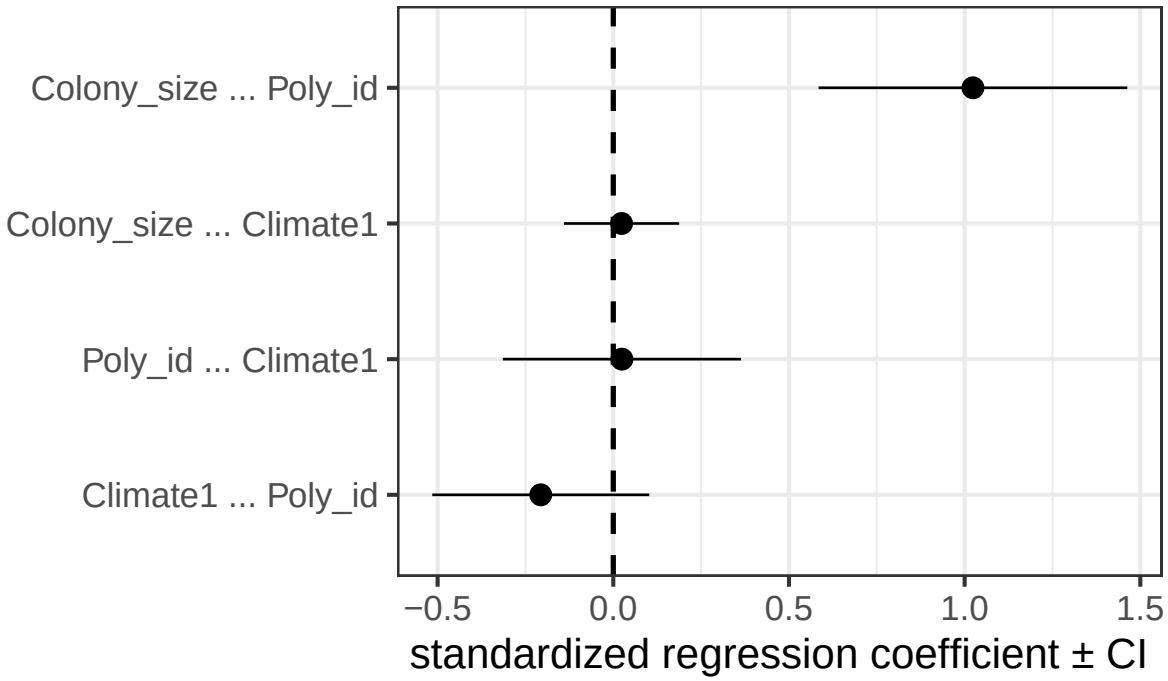
4.3 Both

4.3.1 NCuniform stem tree

Factor loading PC1: TMP: negative; PRE: negative

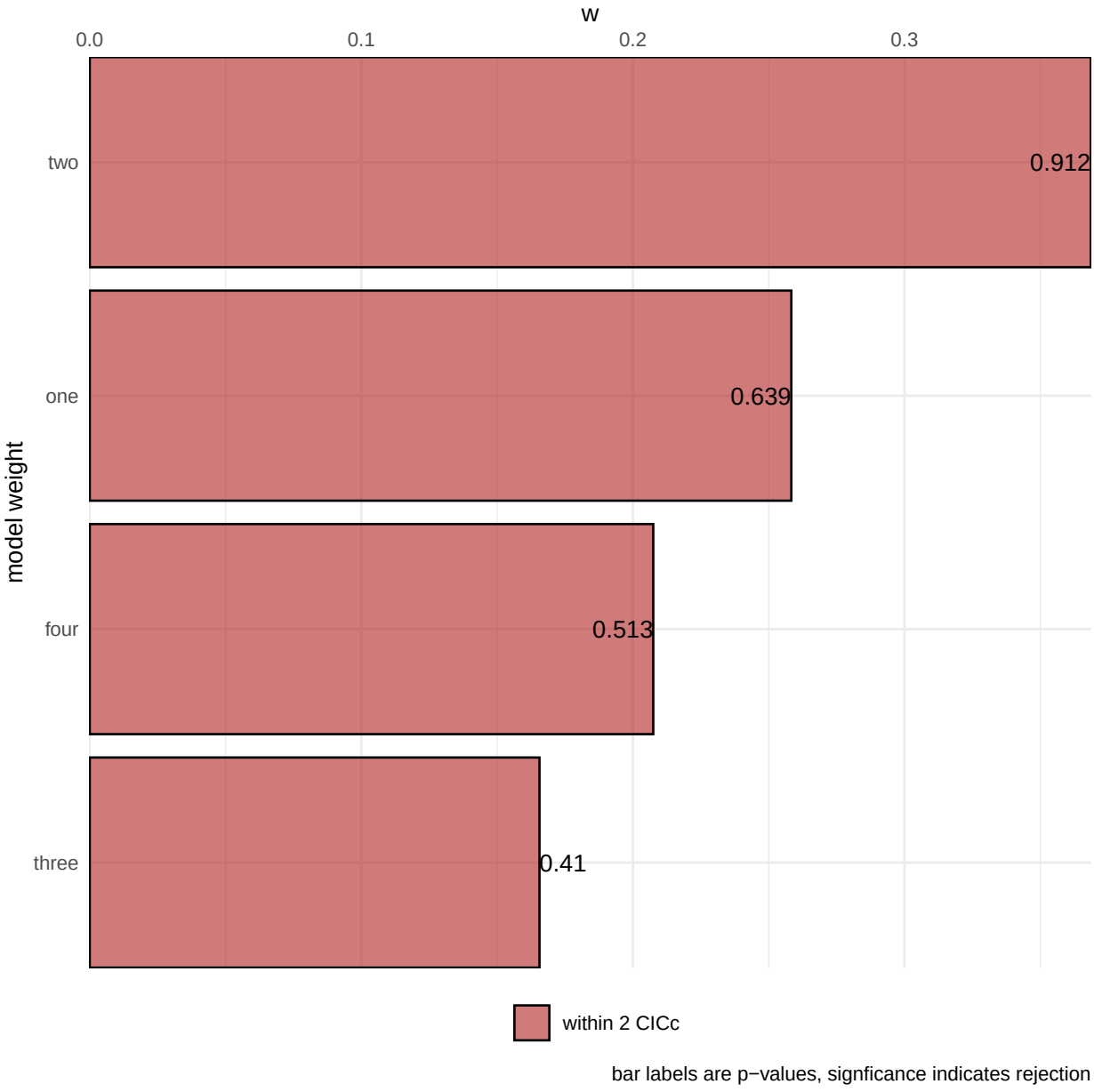


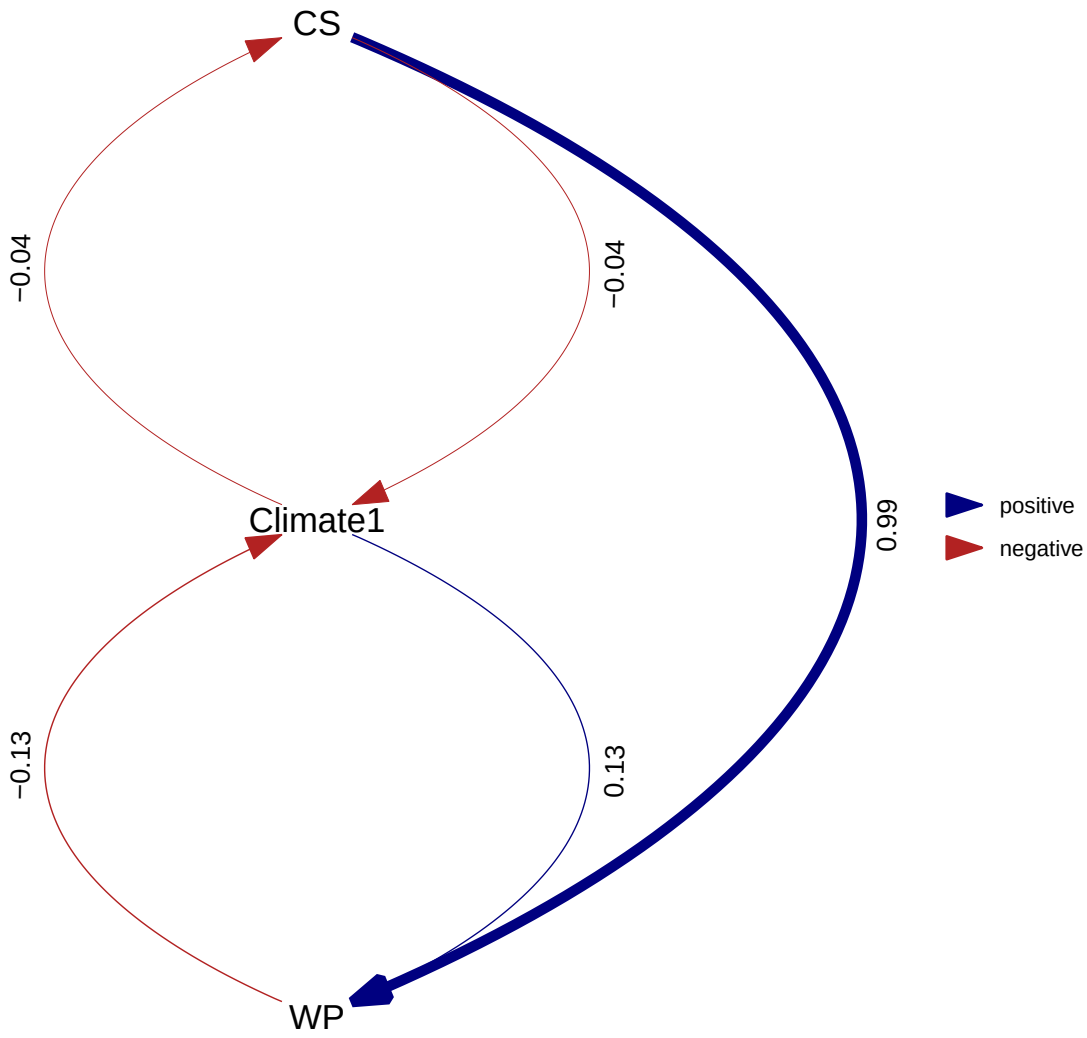


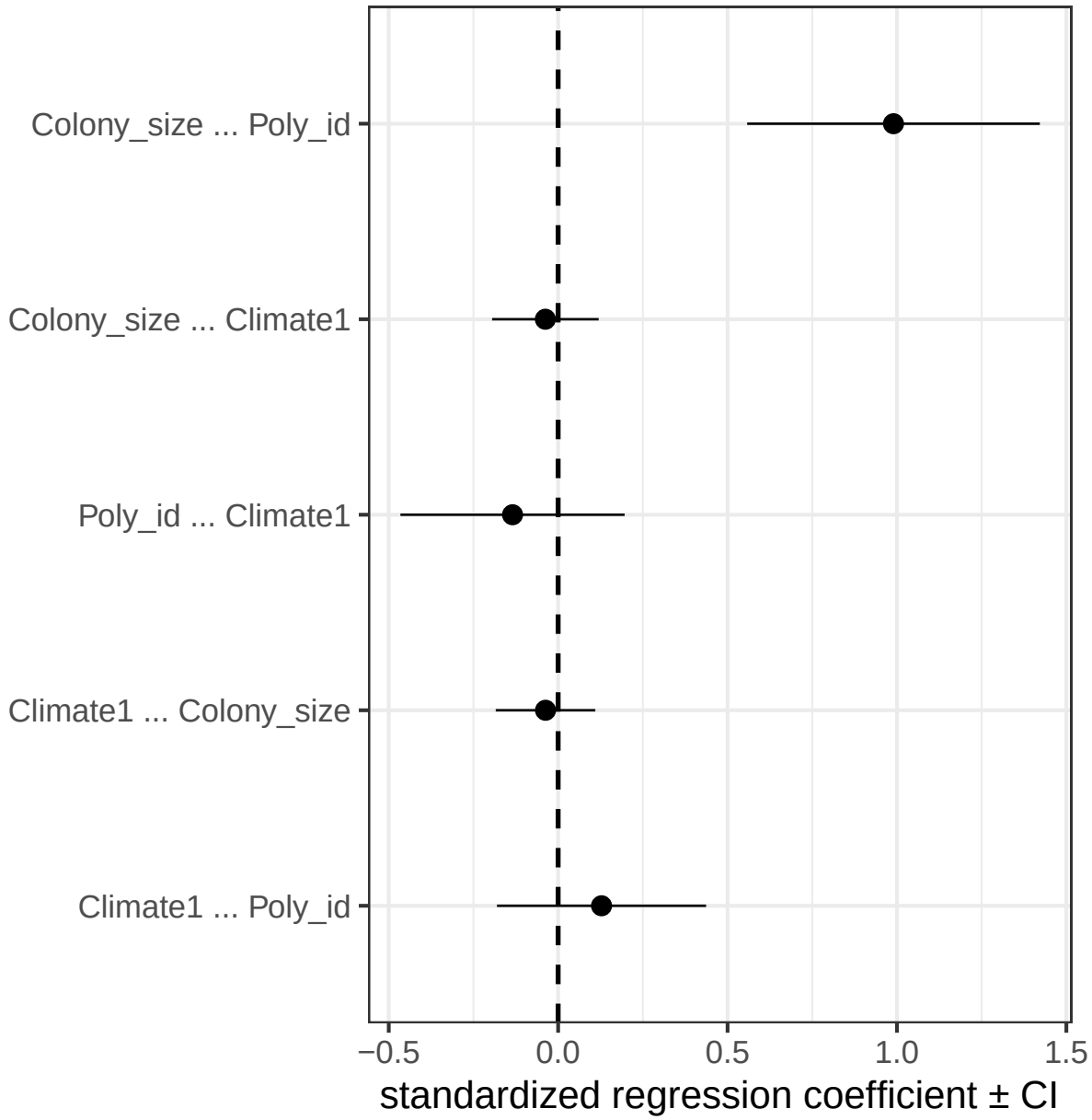


4.3.2 NCuniform crown tree

Factor loading PC1: TMP: positive; PRE: positive

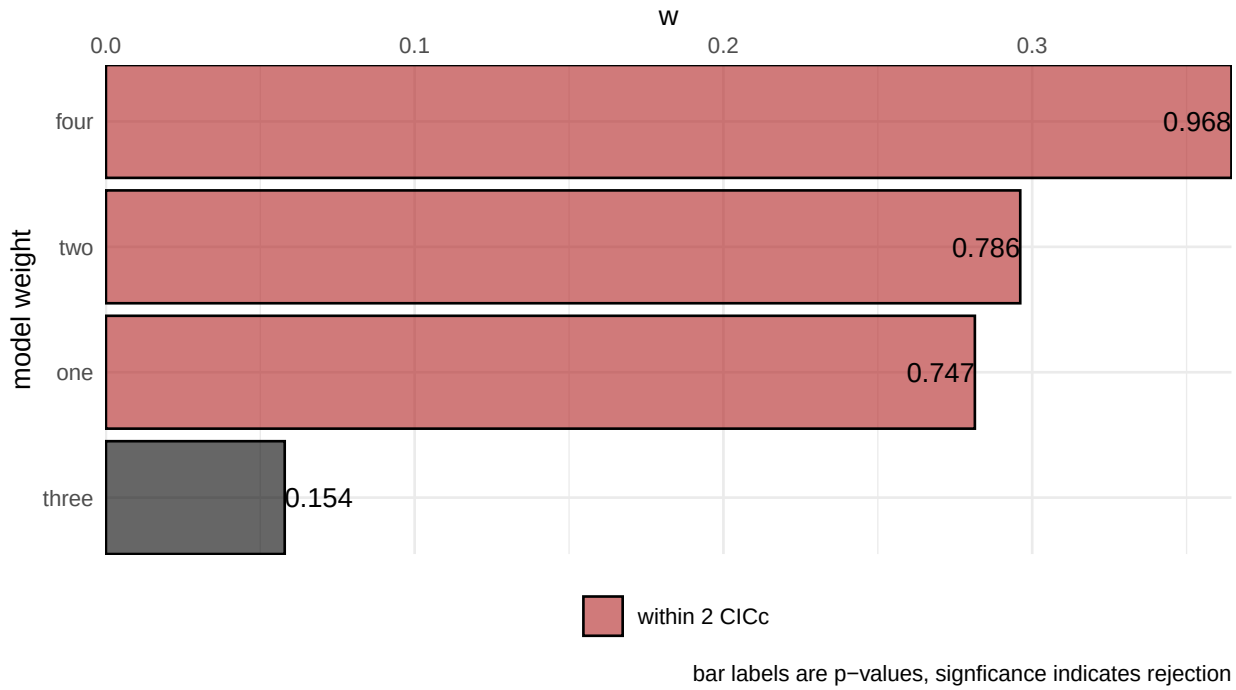

w
0.0
0.1
0.2
0.3
model weight
two
one
four
three
0.912
0.639
0.513
0.41
within 2 CICc
bar labels are p−values, signficance indicates rejection

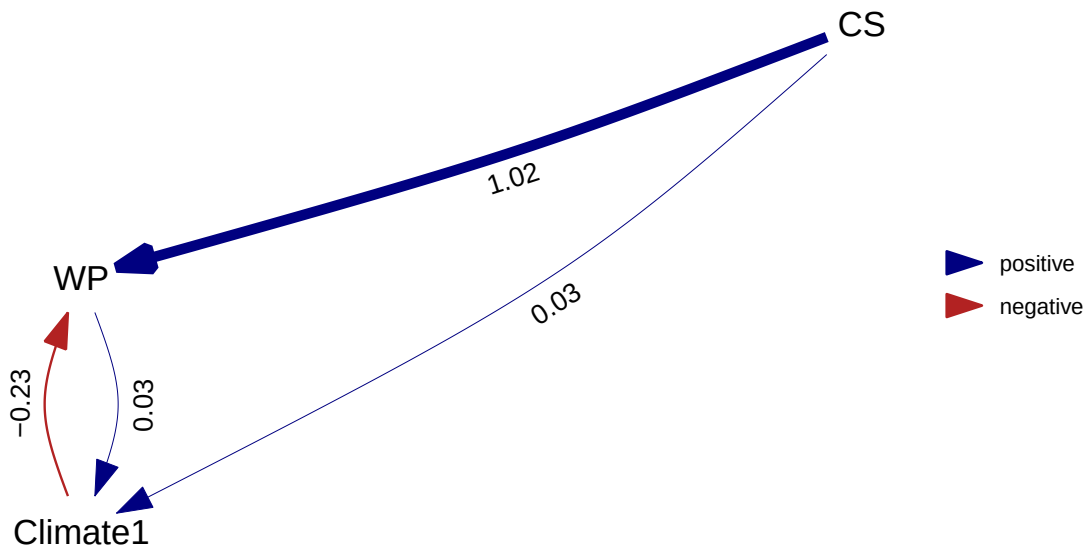

CS
Climate1
WP
−0.04
−0.04
0.99
−0.13
0.13
positive
negative

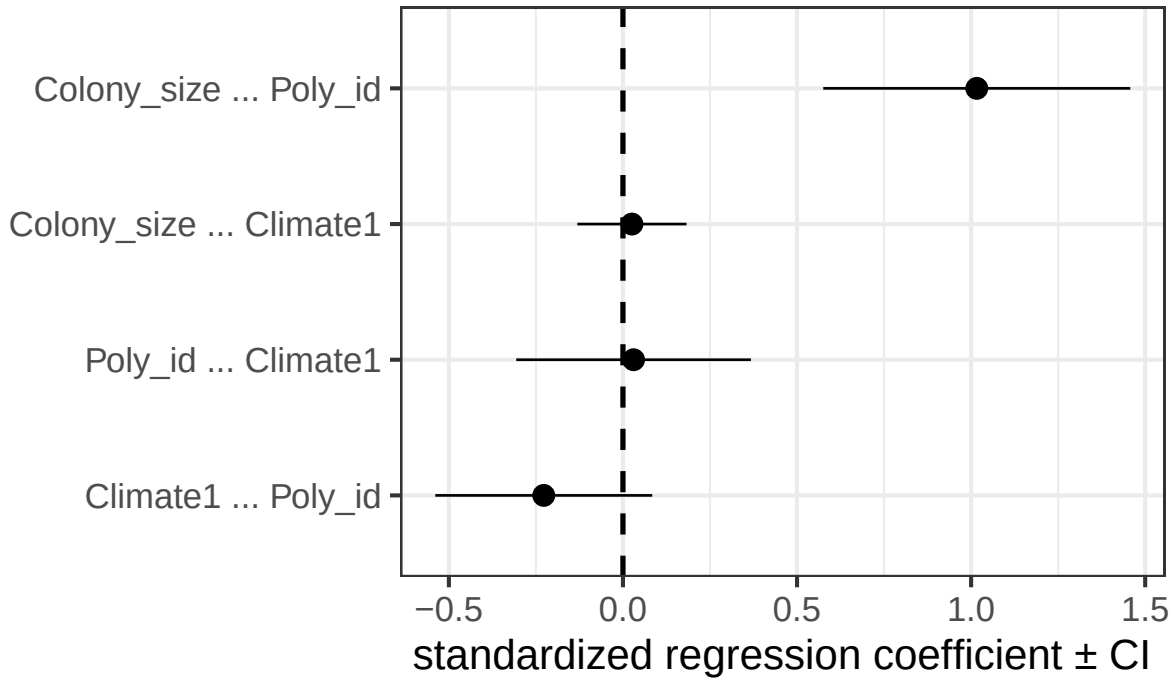


4.3.3 FBD stem tree

Factor loading PC1: TMP: negative; PRE: negative

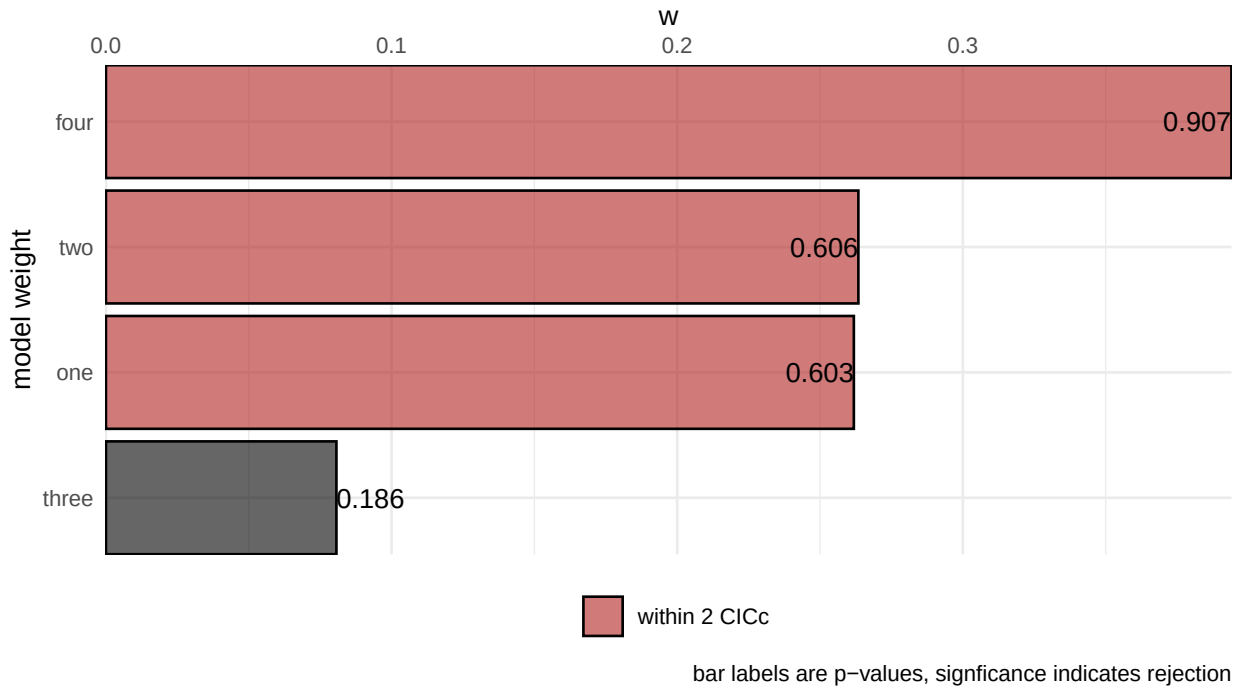

w
0.0
0.1
0.2
0.3
four
two
one
three
model weight
0.968
0.786
0.747
0.154
within 2 CICc
bar labels are p−values, signficance indicates rejection

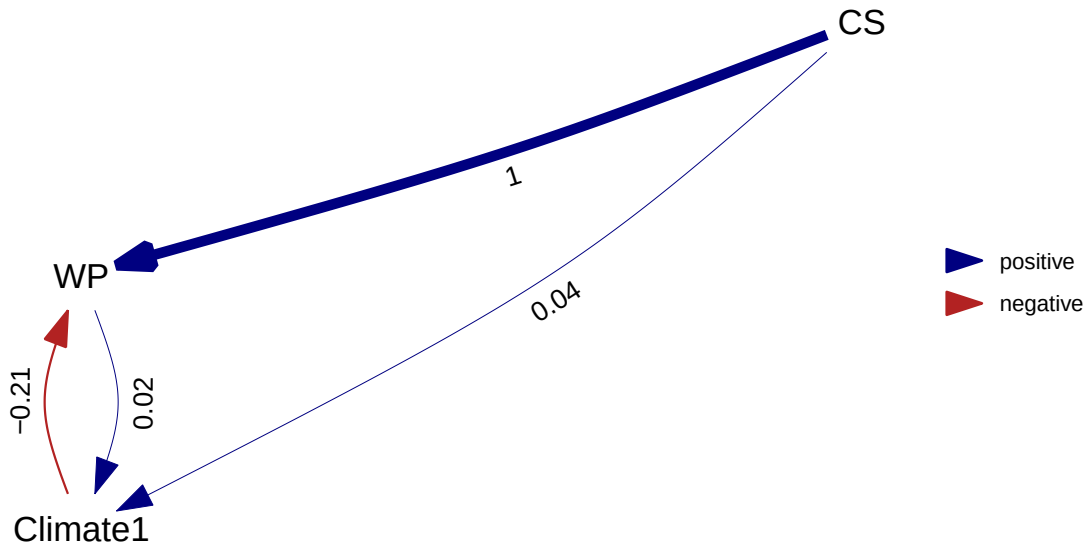

CS
1.02
WP
0.03
−0.23
0.03
Climate1
positive
negative

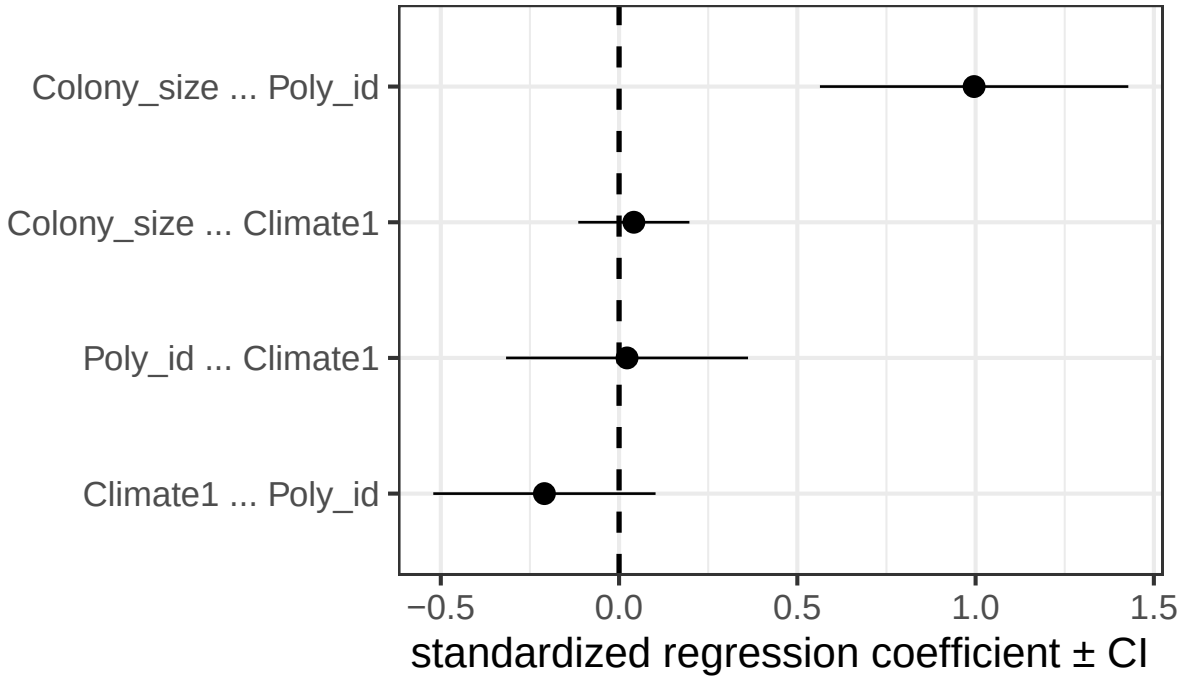


4.3.4 FBD crown tree

Factor loading PC1: TMP: negative; PRE: negative







5 Panel plots

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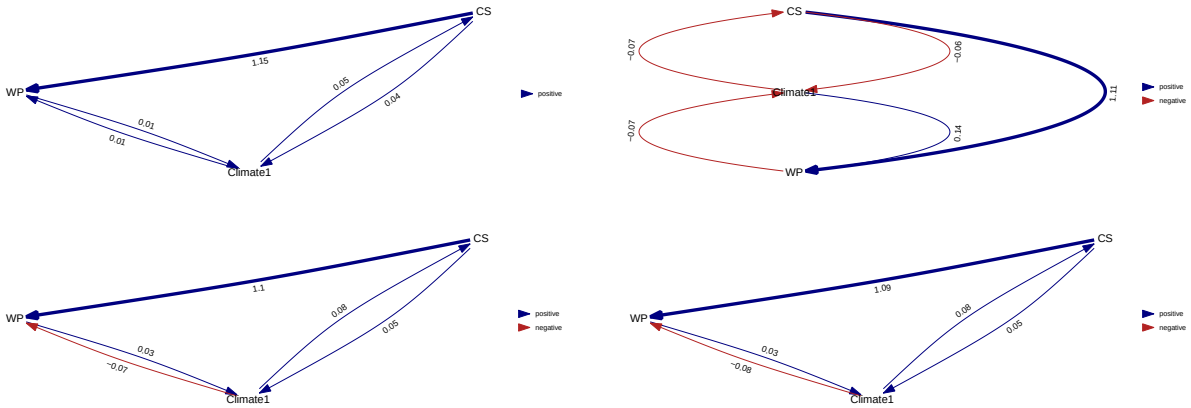
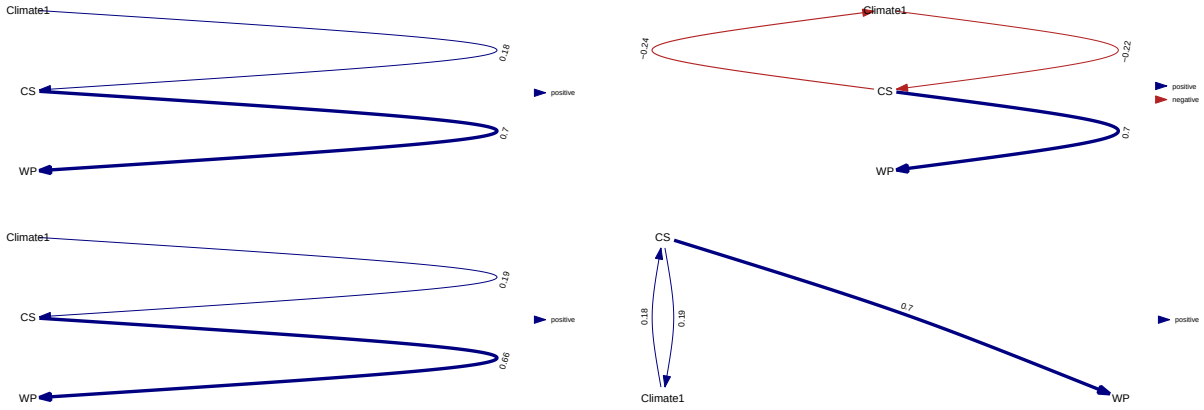
## pdf
##   2
```


CS
WP
Climate1
1.15
0.01
0.01
0.05
0.04
positive
CS
Climate1
WP
−0.07
−0.06
−0.07
1.11
0.14
positive
negative
CS
WP
Climate1
1.1
0.03
−0.07
0.08
0.05
positive
negative
CS
WP
Climate1
1.09
0.03
−0.09
0.08
0.05
positive
negative

pdf
2


Climate1
CS
WP
0.18
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positive
Climate1
CS
WP
−0.24
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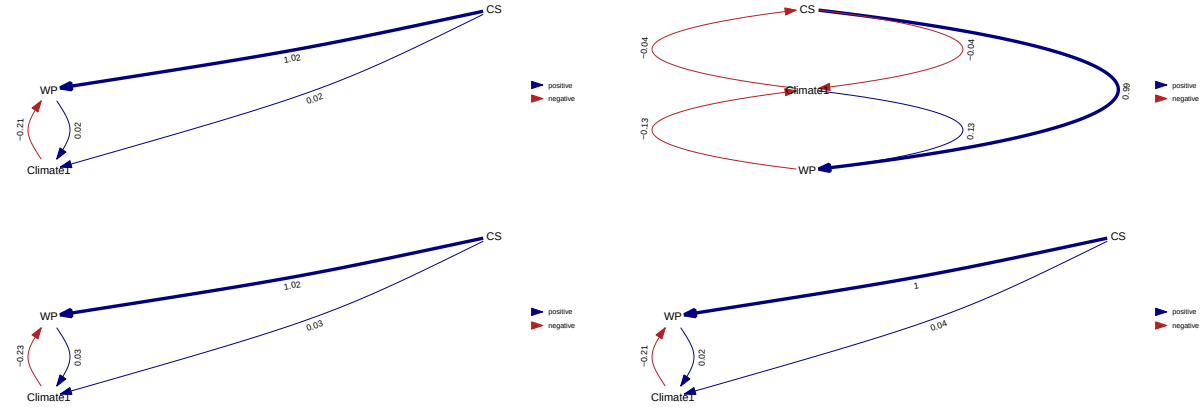
0.7
positive
negative
Climate1
CS
WP
0.19
0.66
positive
CS
Climate1
WP
0.18
0.19
0.7
positive

pdf
2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WP
Climate1
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negative
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0.99
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negative
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Climate1
1.02
0.03
−0.23
0.03
positive
negative
CS
WP
Climate1
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0.04
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0.02
positive
negative