A general framework to run analyses in Santos et al.xxxxx

2025-05-16 (20:28:55)

Table of Contents

# 0 - Setting

## 0.1. SessionInfo and package versions

sessionInfo()

## R version 4.4.1 (2024-06-14 ucrt)  
## Platform: x86\_64-w64-mingw32/x64  
## Running under: Windows 11 x64 (build 22631)  
##   
## Matrix products: default  
##   
##   
## locale:  
## [1] LC\_COLLATE=Portuguese\_Brazil.utf8 LC\_CTYPE=Portuguese\_Brazil.utf8   
## [3] LC\_MONETARY=Portuguese\_Brazil.utf8 LC\_NUMERIC=C   
## [5] LC\_TIME=Portuguese\_Brazil.utf8   
##   
## time zone: America/Sao\_Paulo  
## tzcode source: internal  
##   
## attached base packages:  
## [1] stats graphics grDevices utils datasets methods base   
##   
## other attached packages:  
## [1] MCMCglmm\_2.36 ape\_5.8 coda\_0.19-4.1 Matrix\_1.7-0   
## [5] ggtree\_3.14.0 treeio\_1.30.0 tidybayes\_3.0.7 rstatix\_0.7.2   
## [9] vegan\_2.6-8 lattice\_0.22-6 permute\_0.9-7 Rage\_1.6.0   
## [13] Rcompadre\_1.3.0 factoextra\_1.0.7 FactoMineR\_2.11 viridis\_0.6.5   
## [17] viridisLite\_0.4.2 scales\_1.3.0 popdemo\_1.3-1 popbio\_2.8   
## [21] lubridate\_1.9.3 forcats\_1.0.0 stringr\_1.5.1 dplyr\_1.1.4   
## [25] purrr\_1.0.2 readr\_2.1.5 tidyr\_1.3.1 tibble\_3.2.1   
## [29] ggplot2\_3.5.1 tidyverse\_2.0.0   
##   
## loaded via a namespace (and not attached):  
## [1] gridExtra\_2.3 sandwich\_3.1-1 rlang\_1.1.4   
## [4] magrittr\_2.0.3 multcomp\_1.4-26 compiler\_4.4.1   
## [7] mgcv\_1.9-1 vctrs\_0.6.5 pkgconfig\_2.0.3   
## [10] arrayhelpers\_1.1-0 fastmap\_1.2.0 backports\_1.5.0   
## [13] utf8\_1.2.4 rmarkdown\_2.29 tzdb\_0.4.0   
## [16] xfun\_0.49 aplot\_0.2.3 jsonlite\_1.8.8   
## [19] flashClust\_1.01-2 broom\_1.0.7 parallel\_4.4.1   
## [22] cluster\_2.1.6 R6\_2.5.1 stringi\_1.8.4   
## [25] RColorBrewer\_1.1-3 car\_3.1-3 estimability\_1.5.1   
## [28] Rcpp\_1.0.13 knitr\_1.49 zoo\_1.8-12   
## [31] splines\_4.4.1 timechange\_0.3.0 tidyselect\_1.2.1   
## [34] rstudioapi\_0.17.1 abind\_1.4-8 yaml\_2.3.10   
## [37] codetools\_0.2-20 withr\_3.0.2 posterior\_1.6.0   
## [40] evaluate\_1.0.1 gridGraphics\_0.5-1 survival\_3.6-4   
## [43] ggdist\_3.3.2 pillar\_1.9.0 carData\_3.0-5   
## [46] DiagrammeR\_1.0.11 tensorA\_0.36.2.1 checkmate\_2.3.2   
## [49] DT\_0.33 ggfun\_0.1.7 distributional\_0.5.0  
## [52] generics\_0.1.3 hms\_1.1.3 tidytree\_0.4.6   
## [55] munsell\_0.5.1 xtable\_1.8-4 leaps\_3.2   
## [58] glue\_1.7.0 cubature\_2.1.1 lazyeval\_0.2.2   
## [61] emmeans\_1.10.5 scatterplot3d\_0.3-44 tools\_4.4.1   
## [64] fs\_1.6.5 visNetwork\_2.1.2 mvtnorm\_1.2-5   
## [67] grid\_4.4.1 colorspace\_2.1-1 patchwork\_1.2.0   
## [70] nlme\_3.1-165 Formula\_1.2-5 cli\_3.6.3   
## [73] fansi\_1.0.6 expm\_0.999-9 svUnit\_1.0.6   
## [76] corpcor\_1.6.10 gtable\_0.3.6 yulab.utils\_0.1.8   
## [79] digest\_0.6.36 ggplotify\_0.1.2 ggrepel\_0.9.5   
## [82] TH.data\_1.1-2 htmlwidgets\_1.6.4 htmltools\_0.5.8.1   
## [85] lifecycle\_1.0.4 multcompView\_0.1-10 MASS\_7.3-61

#Check package versions  
#cbind(unlist(loadedNamespaces()),  
# unlist(lapply(  
# lapply(loadedNamespaces(),packageVersion),  
# as.character)))%>%  
# data.frame()%>%arrange(-desc(X1))%>%as\_tibble()

# 1. Readme

The following script provide the general framework used to analyse demographic buffering continuum in Santos et al. (*in review*). Population responses to environmental stochasticity are primarily driven by survival-reproduction trade-offs and mediated by aridity

* Intermediary code and data steps are sourced along the framework
* Intermediary code and data include:
  + 1 - Data cleaning and selection and its intermediary data
  + 2 - Life history traits calculation and its intermediary data
  + 3 - Climatic variables calculation
  + 4 - Analyses with MCMCglmm
    - It includes a separate model selection analyses to decide the most plausible model to use along the analyses
  + 5 - Core function: Stochastic elasticities of variance

# 2. Data selection and cleaning - load population models & phylogenetic information

* Script avaliable in “1 - Data cleaning and selection.R”

file.edit("1 - Data cleaning and selection.R")

* Produce two datasets:
  + CleanData.RDS: Filter matrix singularity, presence of fecundity,individual matrices only
  + supertree.RDS: extract supertree from MOSAIC database (Bernard et al. (2023))

# Load cleaned data  
CleanData<-readRDS("Data/CleanData.RDS")  
supertree<-readRDS("Data/supertree.RDS")  
  
Metadata<-CleanData$Metadata  
MetadataClean<-CleanData$MetadataClean  
  
#Reduce data to improve redability  
MedatadaFinal<-MetadataClean%>%select(-c(lambda,Ecoregion,Binomial))  
MedatadaFinal<-MedatadaFinal%>%  
 left\_join(.,  
 Metadata%>%select(ID,StudyStart, StudyDuration, StudyEnd)%>%distinct(),  
 by="ID")  
  
rm(CleanData) #Remove non-used data to improve memory usage

# 3. Life history traits (Calculate life history traits)

Script available in “2 - Life history traits calculation.R”

file.edit("2 - Life history traits calculation.R")

* Produces dataset LHtraits.RDS:
* Calculate life history traits and detect outliers
* Life history traits include:
  + D: Reproductive window ()
    - Temporal spread of reproduction throughout life span as quantified by Demetrius (1974) ’s entropy ().
      * High/low values correspond to iteroparous/semelparous populations
  + La: Mean age at first reproduction ()
    - Average amount of time from birth to reproduction
  + LaProp: Probability of an individual become reproductive along their lifetime ()
  + e: Mean life expectancy ()
  + growth: individual development ()
  + H: Distribution of mortality risk along the life cycle ()
* **mahal.dist** The mahalanobis distance
* is.outlier: TRUE or FALSE to indicate outliers detected with Mahalanobis distance

LHtraits<-readRDS("Data/LHtraits.RDS")  
LHtraits

## ID La LaProb e D  
## 1 Drc2.151\_550 -0.1380041113 1.086110513 -0.05901093 0.670785792  
## 2 Drc2.151\_548 -0.1120904829 -0.198418968 -0.05907052 0.494801325  
## 3 Drc2.151\_546 -0.0797205365 -0.941194722 -0.05923442 0.683458564  
## 4 Drc2.151\_547 -0.0742251260 -0.944478284 -0.05923672 0.740478128  
## 5 Pnx2.399\_1046 -0.1249452534 -0.704693154 -0.05920869 -0.384237106  
## 6 Prm4.582\_1157 -0.0871013034 0.339904139 -0.05843889 -0.101927419  
## 7 Trll.304\_1438 -0.0712299164 -0.802265318 -0.05893404 0.880116693  
## 8 Trll.304\_1442 -0.1192825597 -0.890646306 -0.05913522 0.840366358  
## 9 Trll.304\_1445 -0.1019075599 -0.922024551 -0.05907916 0.788866557  
## 10 Trll.304\_1446 -0.0952340710 -0.941512053 -0.05905617 0.781769435  
## 11 Trll.304\_1443 -0.0356065599 -0.683587487 -0.05879205 0.874264260  
## 12 Trll.304\_1437 -0.0326354300 -0.858014220 -0.05880436 0.825899908  
## 13 Trll.304\_1435 -0.1075783119 -0.926552371 -0.05907917 0.891351612  
## 14 Trll.304\_1439 -0.0823720096 -0.921123132 -0.05899872 0.815616187  
## 15 Trll.304\_1441 -0.1070046589 -0.933335247 -0.05909717 0.793383112  
## 16 Trll.304\_1444 -0.0781299964 -0.818548613 -0.05897730 0.832988230  
## 17 Grcl.173\_696 -0.1124764824 -0.797688162 -0.05908080 0.980535266  
## 18 Grcl.173\_695 -0.0952310644 -0.732436761 -0.05902468 0.905406684  
## 19 Andr.152\_83 -0.0446132797 -0.911234268 -0.05923574 -0.217622204  
## 20 Arnr.152\_129 -0.0960914317 -0.364341627 -0.05888691 -0.636401589  
## 21 Clln.286\_450 -0.1095820446 -0.253272099 -0.05906957 -0.015872850  
## 22 Myst.152\_983 -0.1860750425 3.183154991 -0.05897231 0.917081879  
## 23 Sxfr.152\_1302 -0.1860750425 3.183154991 -0.05915766 0.399007314  
## 24 Ccrb.457\_472 -0.1706326892 1.709132996 -0.05906999 0.514817636  
## 25 Ccrb.457\_473 -0.1690446005 1.218306880 -0.05908854 -0.020978271  
## 26 Ctps.143\_328 -0.0442124369 -0.792440377 -0.05915029 0.608983973  
## 27 Ctps.625\_329 -0.0184795471 -0.629422647 -0.05910830 0.302457458  
## 28 Tlln.385\_1404 -0.0804904028 -0.809988075 -0.05915751 0.976233750  
## 29 Tlln.625\_1405 -0.0785428729 -0.851361446 -0.05918180 0.609868852  
## 30 Tlln.625\_1407 -0.1033570065 0.460180420 -0.05905239 1.079947259  
## 31 Tll2.579\_1409 -0.0529625390 -0.912064121 -0.05921268 -0.161311822  
## 32 Tll2.579\_1411 -0.0659088714 -0.691292939 -0.05913411 0.739798325  
## 33 Tlln.593\_1412 -0.1497364060 -0.580933205 -0.05924532 -0.600968692  
## 34 Aspl.74\_164 0.0414428932 -0.757022261 -0.05880298 -2.162836494  
## 35 Aspl.74\_162 -0.1706326892 -0.532866845 -0.05923026 -2.287091916  
## 36 Aspl.74\_163 -0.1448398196 -0.690558253 -0.05921747 -0.273792958  
## 37 Actl.367\_25 -0.1334072494 -0.865803115 -0.05918809 0.566892595  
## 38 Acts.204\_27 -0.1376009175 0.936540482 -0.05903905 0.732031700  
## 39 Acts.204\_28 -0.1355762686 -0.245366077 -0.05915388 0.845107911  
## 40 Agrm.300\_46 -0.1126481743 0.592257363 -0.05887972 0.366335293  
## 41 Agrp.242\_47 0.5011671805 -0.910664532 -0.05901238 -1.176083204  
## 42 All4.185\_57 -0.0872742006 0.113144169 -0.05869065 -0.216077221  
## 43 All4.185\_58 -0.0637579004 -0.002778226 -0.05879534 -0.042665884  
## 44 All4.185\_56 -0.0949345645 0.167793226 -0.05786475 -0.389712043  
## 45 All4.185\_61 -0.1237295818 1.340248836 -0.05710243 0.276358857  
## 46 All4.185\_62 -0.1551903359 0.402037061 -0.05917357 0.311533381  
## 47 All4.185\_55 -0.1422128821 1.519294344 -0.05819287 0.375217528  
## 48 All4.185\_59 -0.0225941638 -0.805775555 -0.05872115 0.957942157  
## 49 All4.185\_65 -0.1216375597 1.630391680 -0.05885407 1.038414695  
## 50 All4.185\_63 -0.1406475372 -0.913688932 -0.05921963 0.779003003  
## 51 Allm.402\_69 -0.0534427693 -0.823842614 -0.05921317 -0.625413868  
## 52 Anth.97\_90 0.4325961565 -0.887943318 -0.05808859 -0.201024811  
## 53 Anth.97\_96 -0.1607181406 0.667840083 -0.05917507 0.744289621  
## 54 Anth.97\_95 -0.1637272085 0.163650728 -0.05906402 -0.485371500  
## 55 Anth.97\_91 1.1113131141 -0.938367753 -0.05916868 -1.914380774  
## 56 Anth.97\_92 -0.1662494949 -0.257266299 -0.05925146 1.224931962  
## 57 Ant..355\_100 -0.1676594904 -0.595597430 -0.05926127 1.004815126  
## 58 Armr.208\_139 -0.1087596361 -0.346280613 -0.05879944 -1.063097430  
## 59 Armr.267\_142 -0.0962858818 -0.378702152 -0.05910800 -0.527647460  
## 60 Armr.267\_143 -0.0158174910 0.543891133 -0.05856200 0.562983244  
## 61 Artm.355\_146 -0.1608011419 2.054630447 -0.05911144 0.791611005  
## 62 Asrm.131\_148 -0.0860305384 0.905133942 -0.05875288 1.101307710  
## 63 Astr.409\_177 0.1101373707 0.416783180 -0.05778012 0.182314219  
## 64 Astr.358\_187 -0.1551903359 -0.367710319 -0.05907213 -0.691080493  
## 65 Astr.326\_188 -0.1266813760 2.786144111 -0.05732253 0.583271612  
## 66 Astr.326\_189 -0.0608149408 -0.026133603 -0.05899388 0.397535234  
## 67 Astr.267\_196 -0.1689363418 -0.813490492 -0.05926472 1.733238993  
## 68 Clch.192\_286 -0.1656092731 0.805298983 -0.05920967 1.060329851  
## 69 Clch.382\_287 -0.1661351315 1.921378088 -0.05918179 1.300815575  
## 70 Clch.192\_290 -0.0926538856 -0.471896666 -0.05897343 0.570877456  
## 71 Clch.192\_292 -0.1211666392 -0.428822687 -0.05912485 1.429840489  
## 72 Crl2.284\_312 -0.1246705018 0.008276466 -0.05912113 1.541611694  
## 73 Crl2.284\_313 -0.1153506726 0.396868959 -0.05914586 1.353373430  
## 74 Crl2.284\_314 -0.1146131694 0.126906464 -0.05915231 0.712932753  
## 75 Crl2.284\_315 -0.1360435257 -0.794799052 -0.05923811 0.507120175  
## 76 Crmc.301\_320 -0.1049755794 0.225027246 -0.05910660 0.932212145  
## 77 Crmc.301\_319 -0.1442438615 0.179459476 -0.05920679 1.157669076  
## 78 Crmc.301\_318 -0.0757725190 3.183154991 -0.05884982 0.975053961  
## 79 Cntr.282\_346 -0.1165399971 0.421537741 -0.05917215 1.174818154  
## 80 Cntr.282\_347 -0.0545209196 -0.544692554 -0.05916426 -0.009428161  
## 81 Chrl.267\_374 -0.0756587005 -0.486785538 -0.05916467 0.230022191  
## 82 Crsm.283\_383 0.1073685636 -0.941264697 -0.05922072 -1.852758862  
## 83 Crsm.283\_384 -0.1412152807 1.731497942 -0.05915001 2.423814624  
## 84 Crsm.283\_386 -0.1177357565 0.512109262 -0.05914133 1.061833917  
## 85 Crsm.474\_389 -0.1172910322 0.873089585 -0.05913320 1.802217278  
## 86 Crs3.41\_395 -0.1172449963 -0.826298792 -0.05922303 0.410883509  
## 87 Crs5.166\_400 -0.1301482696 -0.845875087 -0.05922515 0.619162438  
## 88 Crsm.129\_409 -0.1278507513 -0.824571575 -0.05922728 1.085630402  
## 89 Cyp3.211\_478 0.2276928803 -0.898935527 -0.05908725 -1.296868915  
## 90 Cypr.576\_483 0.0147155700 -0.487690175 -0.05877978 -0.670100913  
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## 93 Dnth.384\_499 0.1287393895 -0.827316158 -0.05879514 -1.614046597  
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## 99 Drc2.151\_549 -0.1024121884 0.175660010 -0.05891968 0.221329162  
## 100 Echn.129\_555 -0.1069608700 0.340439351 -0.05886873 0.197975508  
## 101 Ech2.263\_557 -0.0823139496 0.240998440 -0.05887278 0.391706381  
## 102 Ech2.263\_556 -0.1263805175 -0.894950598 -0.05918748 0.602863374  
## 103 Erdm.267\_599 -0.0408315562 -0.240726854 -0.05894440 0.535182583  
## 104 Erdm.267\_598 -0.0481563829 -0.165475363 -0.05897617 0.515696695  
## 105 Eryn.127\_608 0.0035453730 -0.221521119 -0.05880655 0.225635846  
## 106 Gntn.423\_679 0.6717584494 -0.850436545 -0.05893686 -1.754763347  
## 107 Gmrv.300\_693 1.0369444959 -0.863627752 -0.05870800 -1.272804001  
## 108 Hlnt.267\_711 0.5399870233 -0.539781576 -0.05744130 -1.112495105  
## 109 Hlnt.267\_712 0.0526640243 0.370875624 -0.05815746 -0.121722374  
## 110 Hlcn.72\_716 16.5937150526 1.121961914 16.91163166 -3.661576232  
## 111 Hlrm.601\_725 -0.1686588546 0.823776047 -0.05913819 -1.298202874  
## 112 Hypr.463\_756 -0.1294638868 -0.897601954 -0.05917590 -0.426216000  
## 113 Hypc.282\_760 -0.1342977403 -0.926606513 -0.05914864 0.381072579  
## 114 Hypc.282\_759 -0.1317629128 -0.849586871 -0.05912951 -2.269312279  
## 115 Hyp2.284\_766 -0.1334272035 -0.778686592 -0.05917634 -1.207489107  
## 116 Hyp2.284\_765 -0.1315010975 -0.907452995 -0.05918707 0.075479611  
## 117 Hyp2.284\_767 -0.1609246300 0.348730083 -0.05919673 0.723461541  
## 118 Hyp2.284\_764 -0.1064217539 0.391793833 -0.05878011 0.161077723  
## 119 Jrnf.267\_786 -0.1139350378 0.742846940 -0.05850775 0.130427701  
## 120 Ltrs.166\_862 -0.1559436215 1.759183480 -0.05872549 0.536443879  
## 121 Lmnm.267\_871 -0.1706326892 2.245891706 -0.05829930 0.357316791  
## 122 Lmnm.267\_872 -0.1706326892 1.124478894 -0.05890620 -0.211887267  
## 123 Lmnm.267\_873 0.0269319239 -0.819226461 -0.05877981 0.040259462  
## 124 Lnmf.395\_880 -0.1553491506 -0.107305037 -0.05921401 -0.049736156  
## 125 Lnmt.395\_881 0.1499749059 -0.124444056 -0.05818572 -0.438983327  
## 126 Ltsr.267\_895 0.7969542229 -0.944157760 -0.05915767 -0.888265816  
## 127 Lpn..55\_899 -0.1633643134 0.098176766 -0.05921265 0.526854299  
## 128 Lpns.132\_902 -0.0361488106 -0.664522661 -0.05914579 -0.755607927  
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## 131 Orch.273\_1029 -0.1099839969 -0.940590237 -0.05914876 0.776649407  
## 132 Oxyt.267\_1036 -0.1659153124 0.748569560 -0.05919888 0.804919254  
## 133 Pnxq.598\_1044 -0.1670303939 -0.057190183 -0.05921845 -0.454652147  
## 134 Prln.267\_1064 -0.1491655696 -0.896588933 -0.05925818 0.430088292  
## 135 Prny.129\_1065 -0.1446771167 -0.245737987 -0.05917325 0.207446678  
## 136 Pngc.298\_1099 -0.1554466346 -0.416895990 -0.05923717 0.459567951  
## 137 Pln2.608\_1122 -0.1494802721 -0.914777214 -0.05926656 -0.159137299  
## 138 Pln2.608\_1123 -0.1063643458 -0.759938645 -0.05919595 0.144888836  
## 139 Pln2.608\_1124 -0.0941849608 -0.608932635 -0.05916359 0.025240961  
## 140 Pln2.608\_1125 -0.1062214295 -0.936634218 -0.05911244 0.780532634  
## 141 Pln2.608\_1127 -0.1457028770 0.751683913 -0.05912761 0.887063456  
## 142 Pln2.608\_1128 -0.1655835971 -0.036257652 -0.05858766 -0.762976734  
## 143 Pln2.608\_1130 -0.0696560151 -0.943454293 -0.05901261 0.777778082  
## 144 Pln2.608\_1129 -0.0382395011 -0.942285968 -0.05890916 0.778070236  
## 145 Pln2.608\_1126 -0.1616486691 0.926033218 -0.05914970 0.550037267  
## 146 Plnt.178\_1133 -0.1414881423 0.471192289 -0.05908711 0.268456024  
## 147 Plpn.355\_1136 -0.1436119485 -0.519501160 -0.05921770 -0.424651347  
## 148 Ptnt.180\_1147 -0.1548751859 -0.792398529 -0.05926004 -1.698827737  
## 149 Prml.272\_1153 -0.1535748364 -0.003486067 -0.05919500 0.255477362  
## 150 Prml.332\_1155 -0.1588040237 -0.154279362 -0.05917082 -0.446531419  
## 151 Prm4.171\_1163 -0.1860750425 3.183154991 -0.05927142 -0.746273892  
## 152 Prm5.73\_1164 -0.1292970889 -0.106991331 -0.05911160 0.813608353  
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## 134 0.876872674 0.458438286 3.474 FALSE  
## 135 0.337361964 0.405043779 0.602 FALSE  
## 136 0.893812294 0.347302750 1.856 FALSE  
## 137 -0.802608364 1.229058545 5.548 FALSE  
## 138 0.243989817 -0.223470543 1.209 FALSE  
## 139 -0.348983819 -0.044674013 0.681 FALSE  
## 140 0.396692202 -0.108315200 2.931 FALSE  
## 141 -1.057804082 0.850807780 4.797 FALSE  
## 142 -0.103042062 0.911546856 2.539 FALSE  
## 143 0.646063758 -0.207379050 3.465 FALSE  
## 144 0.427546363 -0.040832962 3.231 FALSE  
## 145 -0.549322393 0.334228981 2.533 FALSE  
## 146 0.558030072 0.583803536 0.480 FALSE  
## 147 -0.702392031 0.180388838 1.647 FALSE  
## 148 1.320069059 0.952560077 10.066 FALSE  
## 149 0.782266788 0.400342696 0.828 FALSE  
## 150 1.446306449 0.790150673 4.030 FALSE  
## 151 1.384584804 -0.529974320 21.974 FALSE  
## 152 1.210744338 0.993047415 3.390 FALSE  
## 153 1.640451149 0.430584386 4.029 FALSE  
## 154 1.909935318 0.524408274 4.080 FALSE  
## 155 0.881020512 0.907806116 1.352 FALSE  
## 156 0.475251658 0.064074739 0.632 FALSE  
## 157 2.768051172 0.974013672 9.774 FALSE  
## 158 -0.297458756 0.972925410 6.870 FALSE  
## 159 -1.035834263 0.136106058 2.563 FALSE  
## 160 0.234403984 0.305907851 1.770 FALSE  
## 161 -1.150586394 -2.399124871 8.476 FALSE  
## 162 -0.740984216 -2.010889978 8.091 FALSE  
## 163 -0.555305341 -0.352682689 2.582 FALSE  
## 164 -0.075227927 0.249472567 1.254 FALSE  
## 165 -0.667171966 -2.488059793 11.303 FALSE  
## 166 -0.798209864 -1.120209880 4.274 FALSE  
## 167 -0.013378246 -0.080735335 8.702 FALSE  
## 168 -0.877489162 -2.828314205 16.270 FALSE  
## 169 -1.292245024 -2.806127590 12.222 FALSE  
## 170 -1.211978569 -2.463084206 8.042 FALSE  
## 171 -1.340143451 -2.259929071 9.617 FALSE  
## 172 -1.211978569 -2.463084206 8.042 FALSE  
## 173 -1.292341531 -2.806979975 12.226 FALSE  
## 174 -1.332644542 -2.276051141 9.659 FALSE  
## 175 -1.118355906 0.773165658 4.817 FALSE  
## 176 0.659619205 0.276973897 1.436 FALSE  
## 177 1.366487900 0.563084157 1.964 FALSE  
## 178 1.433363886 0.436437687 2.736 FALSE  
## 179 0.626350598 0.505833224 1.496 FALSE  
## 180 0.152388625 0.612121850 2.025 FALSE  
## 181 2.564282420 0.423889390 8.096 FALSE  
## 182 0.291513755 -0.055609478 1.610 FALSE  
## 183 1.629315106 0.809612276 3.219 FALSE  
## 184 1.168865192 0.731222130 2.096 FALSE  
## 185 0.228267645 0.718204117 1.554 FALSE  
## 186 0.363414802 0.154802007 0.699 FALSE  
## 187 0.524750483 0.664439185 1.069 FALSE  
## 188 0.028378923 0.355882758 2.485 FALSE  
## 189 0.178240048 0.810133591 3.420 FALSE  
## 190 -1.272903865 -2.623477245 34.650 TRUE  
## 191 0.351057854 -1.570616175 10.853 FALSE  
## 192 -0.577270533 -0.738815799 1.747 FALSE  
## 193 1.058864402 0.839137236 4.855 FALSE  
## 194 0.909145750 0.231216049 0.992 FALSE  
## 195 -1.151985429 -1.017178911 2.929 FALSE  
## 196 -0.857446466 -0.776004306 2.952 FALSE  
## 197 -0.028574491 -1.486589131 3.959 FALSE  
## 198 1.589725221 0.211502577 6.240 FALSE  
## 199 0.430968528 -0.619651567 3.310 FALSE  
## 200 0.688070341 0.369176521 3.795 FALSE  
## 201 0.865277970 0.820739674 1.299 FALSE  
## 202 0.447197223 0.729080868 3.937 FALSE  
## 203 0.961563854 0.816367859 1.446 FALSE  
## 204 0.761267796 0.813302161 1.686 FALSE  
## 205 0.423396584 0.755489675 0.888 FALSE  
## 206 1.098287024 0.835249959 3.228 FALSE  
## 207 -1.050574536 -1.215579980 3.630 FALSE  
## 208 2.740055610 0.964425285 11.473 FALSE  
## 209 -1.209126524 0.574922729 7.000 FALSE  
## 210 -0.927138490 -2.157119177 9.380 FALSE  
## 211 -0.609794404 0.916041024 12.076 FALSE  
## 212 -0.295669554 0.753235211 3.567 FALSE  
## 213 0.061757501 -1.557357503 5.984 FALSE  
## 214 0.013418695 -1.311416763 3.953 FALSE  
## 215 -0.318838254 -0.551924353 2.952 FALSE  
## 216 -0.054634461 0.281832726 9.110 FALSE  
## 217 -0.307773852 0.320629284 1.417 FALSE  
## 218 0.886923103 0.963258083 4.641 FALSE  
## 219 0.854178198 0.957210685 4.988 FALSE  
## 220 0.966187392 0.732241221 2.535 FALSE  
## 221 -0.307773852 -0.055150922 1.265 FALSE  
## 222 -0.699001148 -0.128744458 2.072 FALSE  
## 223 -0.285156977 0.809842509 1.790 FALSE  
## 224 0.839527946 0.651691694 1.331 FALSE  
## 225 1.136550800 1.124892779 3.767 FALSE  
## 226 0.469672277 0.841271144 1.154 FALSE  
## 227 -0.244151393 0.687891954 1.213 FALSE  
## 228 0.269305936 0.761966681 1.632 FALSE  
## 229 -0.186859356 0.868806077 2.769 FALSE  
## 230 0.865804149 0.470816573 1.108 FALSE  
## 231 1.304876066 0.461778692 1.800 FALSE  
## 232 0.364821009 0.772154089 1.978 FALSE  
## 233 -0.725504973 0.520877731 2.031 FALSE  
## 234 0.751125083 0.823391342 1.511 FALSE  
## 235 0.234852049 0.860210477 1.475 FALSE  
## 236 1.859401441 0.853298746 4.714 FALSE  
## 237 -0.067604131 0.566873630 2.854 FALSE  
## 238 -0.731767889 0.719158346 2.405 FALSE  
## 239 0.553551384 -1.873058140 9.864 FALSE  
## 240 -0.501943489 -0.081136988 2.094 FALSE  
## 241 -0.995343702 -1.062626028 2.713 FALSE  
## 242 1.500240390 -0.294865844 4.416 FALSE  
## 243 -0.118379441 -0.508724936 0.937 FALSE  
## 244 -0.308403857 0.118211713 3.972 FALSE  
## 245 0.094487870 -0.706698502 2.215 FALSE  
## 246 -0.168651610 -0.163553943 2.178 FALSE  
## 247 2.182791880 0.227855903 7.378 FALSE  
## 248 2.248599346 0.572483146 7.230 FALSE  
## 249 0.661368019 0.146391098 3.988 FALSE  
## 250 -0.570849157 0.873324272 3.764 FALSE  
## 251 0.506638571 0.468456327 0.506 FALSE  
## 252 0.626444946 -0.553268571 1.826 FALSE  
## 253 0.269217355 -0.009112619 0.539 FALSE  
## 254 0.565683812 0.083497537 1.038 FALSE  
## 255 0.807736454 0.119091469 7.174 FALSE  
## 256 0.881883684 0.220362595 0.876 FALSE  
## 257 0.680692670 0.586990252 5.976 FALSE  
## 258 0.557531760 0.122553337 1.654 FALSE  
## 259 1.051560430 -0.031960761 4.410 FALSE  
## 260 -0.735823015 -1.065016611 2.575 FALSE  
## 261 -1.299437727 -1.492296849 3.222 FALSE  
## 262 -1.243134568 -0.113752247 3.034 FALSE  
## 263 -0.658592201 0.312327939 7.740 FALSE  
## 264 -0.957168807 -0.577185529 1.802 FALSE  
## 265 -0.964445871 0.667108184 7.004 FALSE  
## 266 -0.722310807 0.535067006 6.978 FALSE  
## 267 -0.866275250 0.876694277 12.276 FALSE  
## 268 -0.702580282 -0.659298361 6.426 FALSE  
## 269 -1.308513048 -1.447085265 3.273 FALSE  
## 270 -1.024846876 -0.779585571 2.395 FALSE  
## 271 -1.129869779 -0.230703910 5.594 FALSE  
## 272 0.210386971 0.037444280 3.454 FALSE  
## 273 -0.330425003 0.319344058 1.909 FALSE  
## 274 -0.117516611 -0.155382582 6.485 FALSE  
## 275 -0.404798062 -0.428013373 4.731 FALSE  
## 276 -0.804928546 -2.079248756 7.256 FALSE  
## 277 0.573389030 0.416706200 2.331 FALSE  
## 278 -1.630770217 -2.235641024 7.581 FALSE  
## 279 1.487282945 0.789519065 2.844 FALSE  
## 280 0.429623069 1.046185135 1.803 FALSE  
## 281 2.824980383 0.961402547 11.959 FALSE  
## 282 2.824980383 0.926230741 12.566 FALSE  
## 283 2.824980383 1.148665578 12.720 FALSE  
## 284 1.141184676 0.259934787 2.447 FALSE  
## 285 -0.495238449 -0.054482848 0.950 FALSE  
## 286 1.549886265 0.585602531 2.921 FALSE  
## 287 -0.867556273 -1.417450582 6.282 FALSE  
## 288 -1.558418291 -1.684937343 8.329 FALSE

## .. Filter outliers ----  
spLHmat<-LHtraits%>%  
 filter(is.outlier=="FALSE")%>%  
 select(-c(is.outlier,mahal.dist)) %>%  
column\_to\_rownames(var = "ID")

## 3.1 Fast-slow continuum / Life history PCA

* Perform PCA with life history data
* Check eigenvalues
* Plot eigenvalues and correlogram

LHpca<-spLHmat%>%filter(complete.cases(.))%>%PCA(.,graph=FALSE,scale=TRUE) # Using raw data without imputatation  
  
# LHpca - Map variables  
LHpca$eig%>%t() #Explained variables

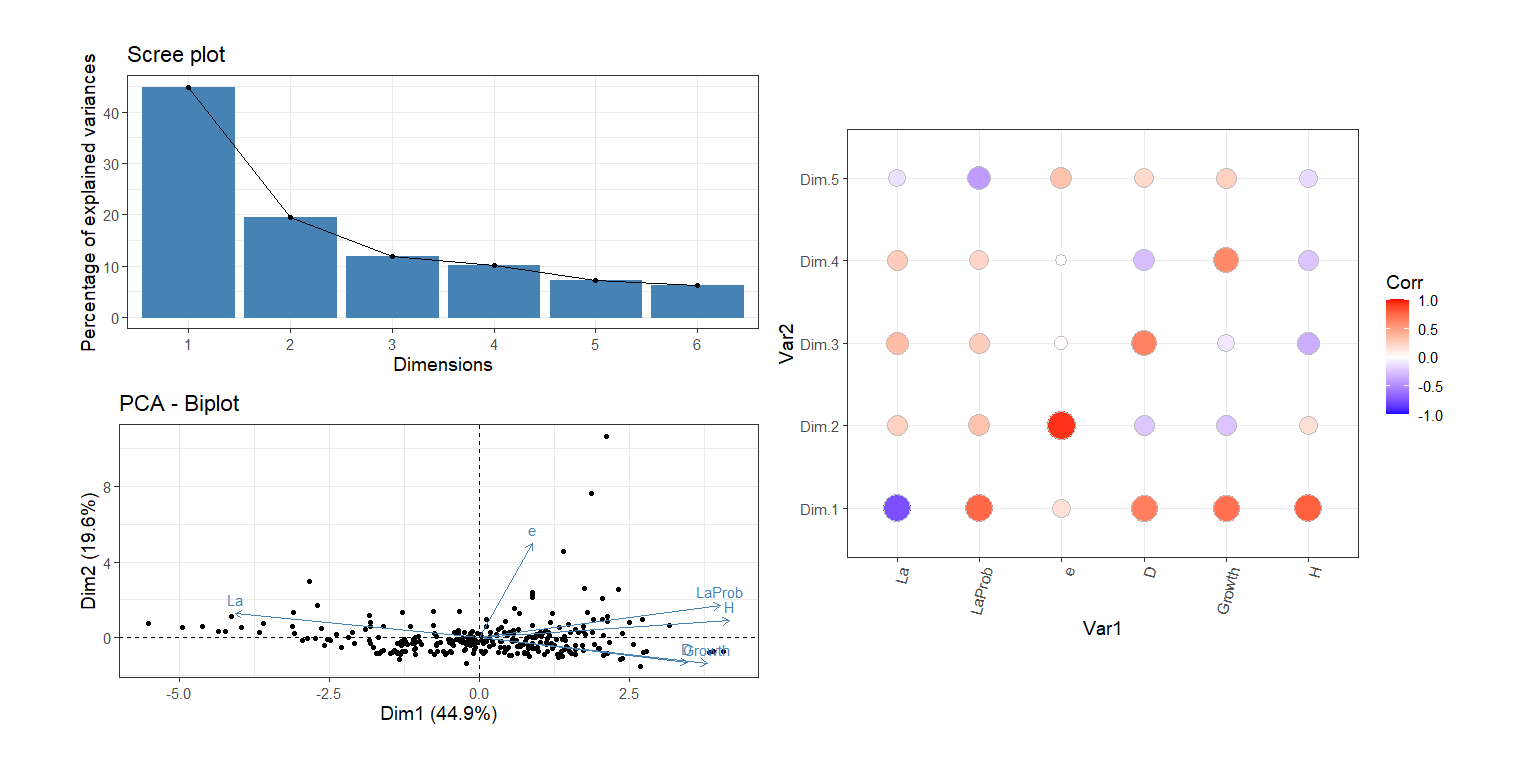
## comp 1 comp 2 comp 3 comp 4  
## eigenvalue 2.696769 1.173172 0.7162735 0.6095803  
## percentage of variance 44.946155 19.552872 11.9378909 10.1596722  
## cumulative percentage of variance 44.946155 64.499028 76.4369184 86.5965906  
## comp 5 comp 6  
## eigenvalue 0.4286934 0.3755112  
## percentage of variance 7.1448894 6.2585200  
## cumulative percentage of variance 93.7414800 100.0000000

#LHpca$ind$coord #Eigenvalues  
dimdesc(LHpca, axes = 1:3, proba = 0.05)

## $Dim.1  
##   
## Link between the variable and the continuous variables (R-square)  
## =================================================================================  
## correlation p.value  
## H 0.7782491 6.313930e-59  
## LaProb 0.7487164 2.802252e-52  
## Growth 0.7104679 6.192170e-45  
## D 0.6479642 3.320243e-35  
## e 0.1633963 5.779568e-03  
## La -0.7610525 6.144154e-55  
##   
## $Dim.2  
##   
## Link between the variable and the continuous variables (R-square)  
## =================================================================================  
## correlation p.value  
## e 0.9300967 1.118102e-124  
## LaProb 0.3165349 4.990971e-08  
## La 0.2377485 5.185214e-05  
## H 0.1668020 4.826793e-03  
## D -0.2444222 3.123859e-05  
## Growth -0.2526037 1.645514e-05  
##   
## $Dim.3  
##   
## Link between the variable and the continuous variables (R-square)  
## =================================================================================  
## correlation p.value  
## D 0.6282915 1.345055e-32  
## La 0.3476003 1.735429e-09  
## LaProb 0.2631009 6.998948e-06  
## H -0.3471587 1.825150e-09

# 2.2.Check PCA -----  
cowplot::plot\_grid(nrow=1,  
 cowplot::plot\_grid(ncol=1,  
 fviz\_eig(LHpca)+theme\_bw(base\_size=14),  
 fviz\_pca(LHpca, geom=c("point"))+theme\_bw(base\_size=14)  
 ),  
 LHpca$var$cor%>%  
 ggcorrplot::ggcorrplot(method = "circle")+  
 theme\_bw(base\_size=14)+theme(  
 axis.text.x=element\_text(angle=75,hjust=1)))+  
 coord\_fixed(ratio=.50)

## Coordinate system already present. Adding new coordinate system, which will  
## replace the existing one.



#ggsave(file="Figures/PCALH.svg")  
  
  
#Use Principal Components as variables - add to LHtraits  
LHtraits<-left\_join(by="ID",  
 LHtraits,  
 LHpca$ind$coord%>%data.frame()%>%  
 rownames\_to\_column(var="ID")%>%as\_tibble()%>%  
 rename\_with(., ~ gsub("Dim", "LHAxis", .x, fixed = TRUE))%>%  
 select(ID,LHAxis.1:LHAxis.2))%>%  
 filter(complete.cases(.))

# 4. Climate variables and environmental PCA

Extract and store climatic data from CHELSAcruts (Karger et al. (2017)) in an intermediary dataset, remove collinear variable, perform environmental PCA and plot PCA’s axes across the globe

## 4.1. Extract and store climatic information

Extracted climatic data is available in Data/Climate\_df.RDS

Because data download and information extraction is quite time consuming a dedicated Jupyter notebook to run on Google Colab is provided: ChelsaData Download and extraction - Google Colab.ipynb

Run this Google Colab by typing in your brownser: <https://githubtocolab.com/Ecosantos/Demogbuff-pops>

climate\_df<-readRDS("Data/climate\_df.RDS")

## 4.1. Analyse climatic timeseries, calculate environmental stochasticity and summarise information into a PCA

3 - Climatic variables calculation.R use the already extracted climatic data to:

* Produce data summary and extract metrics described in methods
* Produce final dataset to analyse: climate\_df.RDS
  + “Mean\_trend\_TMax”:
  + “Stoch\_noisesize\_TMax”
  + “Ampli\_trend\_TMax”
  + “Ampli\_trend\_TMin”
  + “Mean\_trend\_Prec”
  + “Ampli\_trend\_Prec”

### 4.1.1. Checking collinearity and retaining climatic variables

cor\_matrix <- climate\_df %>% select(-ID) %>% cor()  
diag(cor\_matrix) <- NA   
  
# Find values higher than 0.65  
high\_corr <- which(abs(cor\_matrix) > 0.65, arr.ind = TRUE)  
  
# Output to selection  
data.frame(  
 Var1 = rownames(cor\_matrix)[high\_corr[, 1]],  
 Var2 = colnames(cor\_matrix)[high\_corr[, 2]],  
 Correlation = cor\_matrix[high\_corr]  
) %>% arrange(desc(abs(Correlation)))

## Var1 Var2 Correlation  
## 1 Mean\_trend\_TMin Mean\_trend\_TMax 0.9227075  
## 2 Mean\_trend\_TMax Mean\_trend\_TMin 0.9227075  
## 3 Stoch\_noisesize\_TMin Stoch\_noisesize\_TMax 0.8976632  
## 4 Stoch\_noisesize\_TMax Stoch\_noisesize\_TMin 0.8976632  
## 5 Stoch\_noisesize\_Prec Mean\_trend\_Prec 0.8077346  
## 6 Mean\_trend\_Prec Stoch\_noisesize\_Prec 0.8077346

# Plot all variables to visualize collinearity  
#climate\_df%>%select(-ID)%>%  
# select(-c(Ampli\_season\_TMax,  
# Ampli\_season\_TMin,  
# Ampli\_season\_Prec))%>%  
# cor()%>%corrplot::corrplot()  
  
## Retaining climatic variables -----  
climate\_df<-climate\_df%>%select(  
 -c(Mean\_trend\_TMin,  
 Stoch\_noisesize\_TMin,Stoch\_noisesize\_Prec,  
 Ampli\_season\_TMax,Ampli\_season\_TMin,Ampli\_season\_Prec))%>%  
 as\_tibble()

### 4.1.2. Climatic/environmental PCA

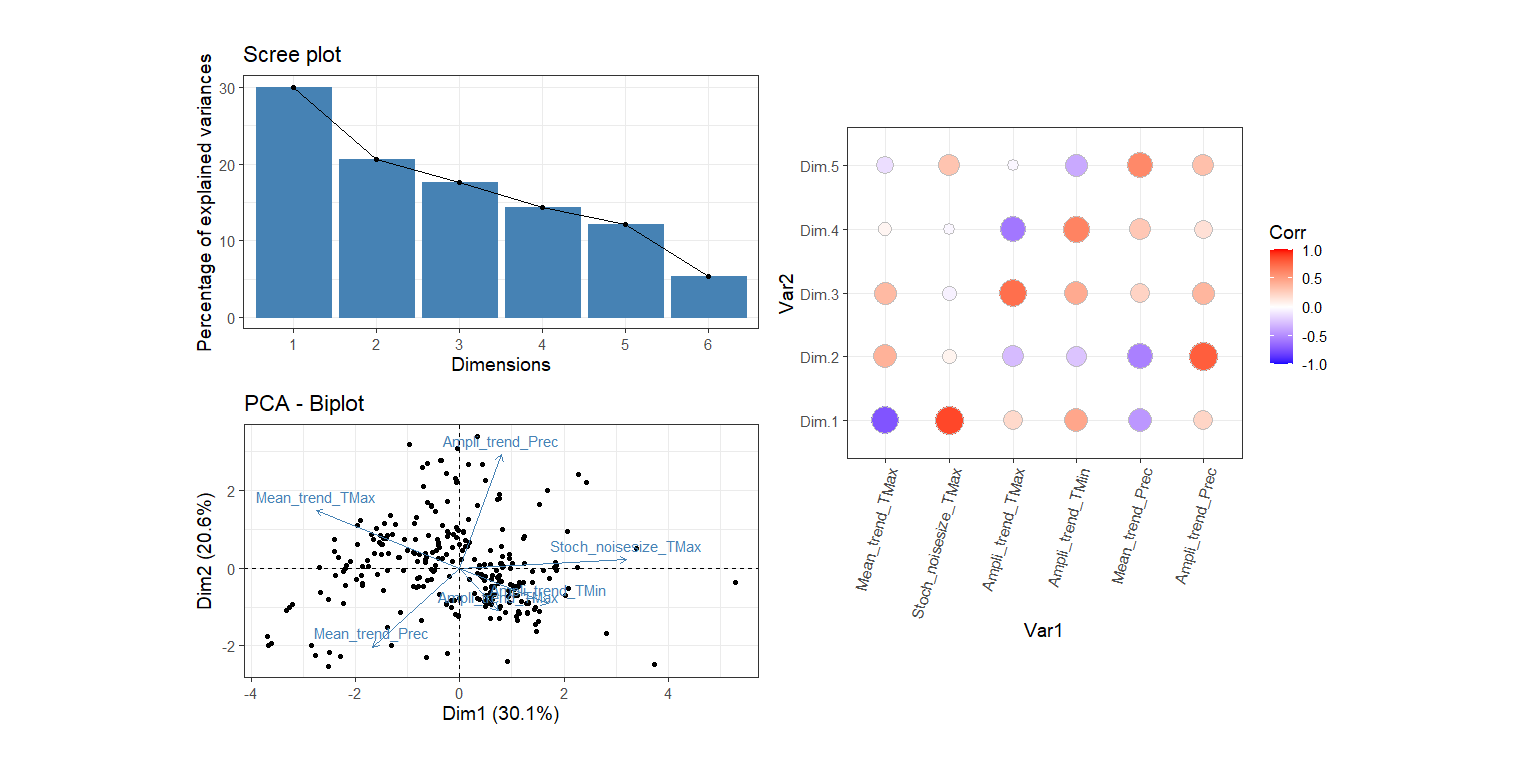
Run environmental PCA and show its output

# Produce the climatic/environmental PCA  
ClimPCA<-climate\_df%>%  
mutate\_at(vars(-c(ID)),scale)%>%  
column\_to\_rownames("ID")%>%  
#cor(.)%>%corrplot::corrplot(.)  
PCA(.,graph=F,scale=FALSE)  
  
#ClimPCA$ind$coord  
ClimPCA$eig%>%t() #Explained variables

## comp 1 comp 2 comp 3 comp 4  
## eigenvalue 1.799101 1.231347 1.049691 0.8588607  
## percentage of variance 30.077274 20.585597 17.548683 14.3583897  
## cumulative percentage of variance 30.077274 50.662871 68.211554 82.5699438  
## comp 5 comp 6  
## eigenvalue 0.7230174 0.319578  
## percentage of variance 12.0873684 5.342688  
## cumulative percentage of variance 94.6573121 100.000000

cowplot::plot\_grid(nrow=1,  
cowplot::plot\_grid(ncol=1,  
fviz\_eig(ClimPCA)+theme\_bw(base\_size=14),  
fviz\_pca(ClimPCA, geom=c("point"))+theme\_bw(base\_size=14)),  
ClimPCA$var$cor%>%ggcorrplot::ggcorrplot(method = "circle")+theme\_bw(base\_size=14)+  
 theme(axis.text.x=element\_text(angle=75,hjust=1)))+  
coord\_fixed(ratio=.60)

## Coordinate system already present. Adding new coordinate system, which will  
## replace the existing one.



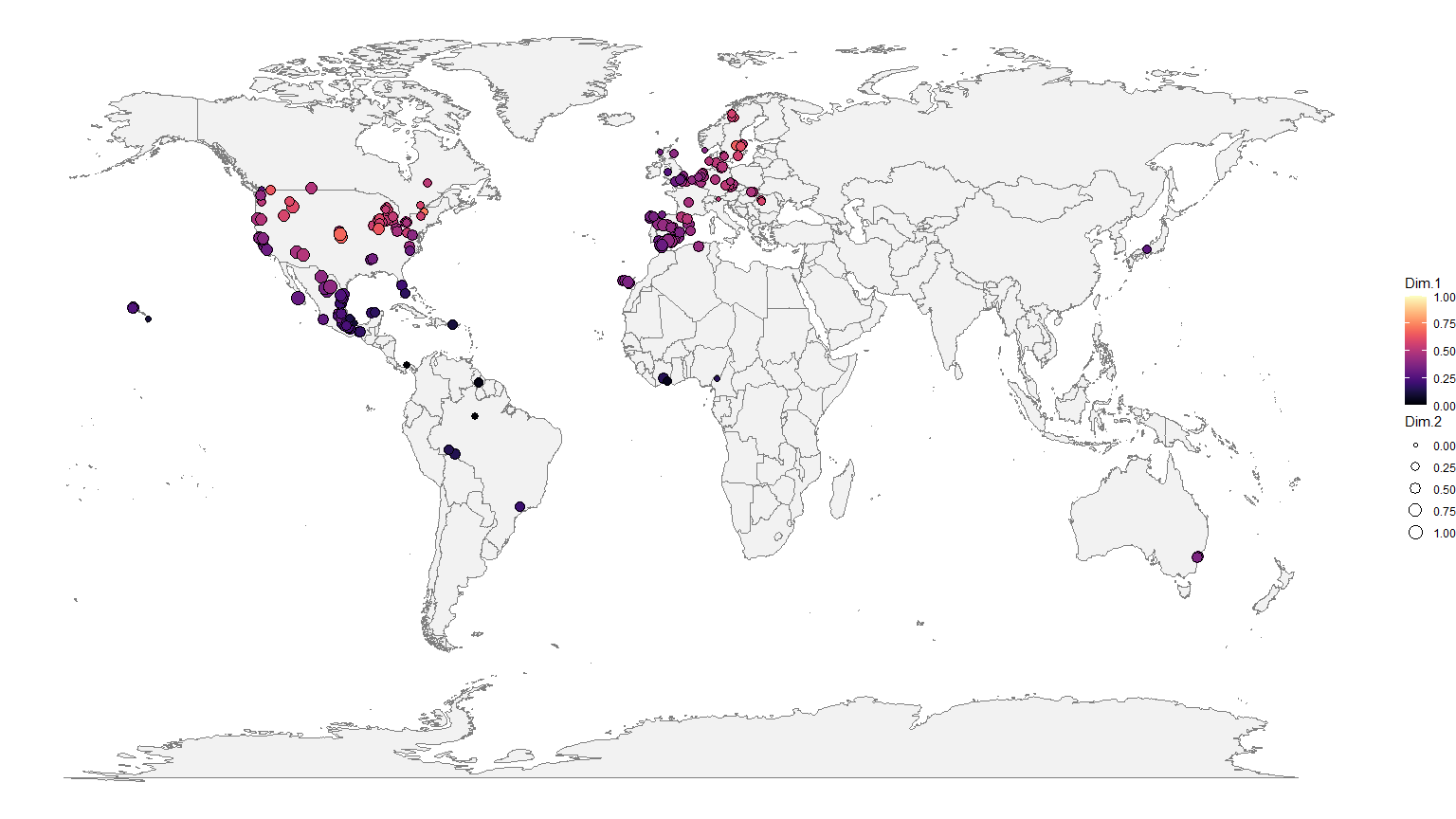
dimdesc(ClimPCA, axes = 1:3, proba = 0.05)

## $Dim.1  
##   
## Link between the variable and the continuous variables (R-square)  
## =================================================================================  
## correlation p.value  
## Stoch\_noisesize\_TMax 0.8668087 6.183297e-100  
## Ampli\_trend\_TMin 0.4590744 2.130222e-18  
## Ampli\_trend\_Prec 0.2177142 7.386559e-05  
## Ampli\_trend\_TMax 0.1981180 3.193055e-04  
## Mean\_trend\_Prec -0.4508056 1.008298e-17  
## Mean\_trend\_TMax -0.7434070 1.507656e-58  
##   
## $Dim.2  
##   
## Link between the variable and the continuous variables (R-square)  
## =================================================================================  
## correlation p.value  
## Ampli\_trend\_Prec 0.7886580 2.021982e-70  
## Mean\_trend\_TMax 0.4022397 4.147529e-14  
## Ampli\_trend\_TMin -0.2481373 5.784008e-06  
## Ampli\_trend\_TMax -0.2935288 6.707701e-08  
## Mean\_trend\_Prec -0.5476851 6.527546e-27  
##   
## $Dim.3  
##   
## Link between the variable and the continuous variables (R-square)  
## =================================================================================  
## correlation p.value  
## Ampli\_trend\_TMax 0.7230280 5.494684e-54  
## Ampli\_trend\_TMin 0.4402050 6.962149e-17  
## Ampli\_trend\_Prec 0.3842174 6.557083e-13  
## Mean\_trend\_TMax 0.3647761 1.071806e-11  
## Mean\_trend\_Prec 0.2271603 3.473356e-05

### 4.3 Mapping climatic axes

Plot spatial distribution of studies with climatic data available as well as the values of the two main principal component analyses: life-history and environmental PCAs

Plot\_clim<-Metadata%>%  
 filter(Kingdom=="Plantae")%>%  
 dplyr::select(.,c(ID,Lat,Lon))%>%  
distinct(.,.keep\_all=T)%>%  
left\_join(.,  
data.frame(ClimPCA$ind$coord)%>%rownames\_to\_column(.,var="ID"),  
by="ID")%>%  
filter(complete.cases(.))%>%  
mutate(across(Dim.1:Dim.3,scales::rescale,to=c(0,1)))  
  
#Plot map  
world <- map\_data("world")  
  
gmap<-ggplot() +  
geom\_map(  
 data = world, map = world,  
 aes(long, lat, map\_id = region),  
 color = "grey50", fill = "grey95", linewidth= 0.05)  
  
gmap +  
 geom\_point(  
 data = left\_join(Plot\_clim,distinct(MetadataClean,ID,.keep\_all=T)%>%select(ID)),  
 aes(x=Lon, y=Lat, fill = Dim.1,stroke=.3,size=Dim.2),shape=21)+  
scale\_fill\_viridis(option="magma")+  
scale\_size(range = c(1.5, 5))+  
 theme\_void()



#ggsave(file="Figures/ClimMap\_all\_taxa2.svg")

# 5. Calculate Demographic buffering From Vital Rates (Lower Level Parameters)

## 5.1. Sourcing main function used in this calculation

Main function calculates the stochastic elasticities within respect to variance of lower level vital rates

* This script creates the following functions:
  1. My.vitalRatePerturbation: produce the stochastic elasticity with respect to variance
     + This function is an adaptation of VitalRatePerturbation function in the Rage package (see Jones et al. (2022))
  2. array\_to\_matrix: an ancillary function to transform timeseries of MPMs, usually returned as an array element to a timeserie of MPM in a object class matrix.

source("MainFunction - Stochastic elasticities of variance lower level.R")

## [1] "An ancillary function - 'array\_to\_matrix' - has been created, be pround!"  
## [1] "Core function 'my.vitalRatePerturbation' - has been created, You nailed it!"  
## 'my.vitalRatePerturbation' is based on:   
## - VitalRatePerturbation function in the Rage package: https://github.com/jonesor/Rage.   
## - Stochastic elasticticity in Caswell 2001 p.406-407.   
## Outputs are:   
## [[1]] Lower-level Stochastic Sensitivities   
## [[2]] Lower-level Stochastic Elasticities   
## [[3]] Lower-level Stochastic Elasticities   
## [[4]] Lower-level Stochastic Elasticities with respect to variance  
## [[5]] Matrix level stochastic Elasticitity with respect to the meanNULL

## 5.2. Derivative demographic buffering in plants and animals

* Derivates demographic buffering in plants and animals
* Merge into a single data frame

# Organize unique ID to rethrive matrices to metadata after analyses  
uniqueID<-unique(Metadata$ID)  
  
# Create vectors to accomated estimated buffering and ancilliary statistics  
Buffmx<-temp<-MatRep<-StochElasVR<-ElasSigVR<-SigRatioVR<-NULL  
  
  
for(i in 1:length(uniqueID)){  
temp<-my.vitalRatePerturbation(   
lapply(filter(Metadata,ID==uniqueID[i])$mat,matU), #Determines matU  
lapply(filter(Metadata,ID==uniqueID[i])$mat,matF), #Determines matF  
lapply(filter(Metadata,ID==uniqueID[i])$mat,matC)) #Determines matC  
Buffmx[[i]]<-sum(temp[[5]])  
StochElasVR[[i]]<-temp[[3]]  
ElasSigVR[[i]]<-temp[[4]]  
names(StochElasVR)[[i]]<-uniqueID[i]  
names(ElasSigVR)[[i]]<-uniqueID[i]  
# quantify timeseries length   
MatRep[[i]]<-length(lapply(filter(Metadata,ID==uniqueID[i])$mat,matU))  
 #add verbose   
 if (i == 1 || i%%50 == 0) {  
 message("Calculating mean Matrices",   
 i)  
 }  
rm(temp)  
}

### 5.2.1. Number of populations with timeseries longer than three

# Quantify the number of populations with timeseries longer than three  
unlist(MatRep)[unlist(MatRep)>2]%>%length()

## [1] 182

### 5.2.2. Merging demographic buffering into a single data frame

#'---------------------------------------------------------------------------  
# Merge Demographic buffering calculations in a single Data frame  
#'---------------------------------------------------------------------------  
ElasSigVR\_full<-lapply(ElasSigVR,rownames\_to\_column, var = "VR")%>%  
Map(cbind, ID = names(.), .)%>%  
do.call(rbind,.)%>%  
as\_tibble()%>%  
pivot\_wider(names\_from = VR,values\_from=c(Mean,SD))%>%  
filter(complete.cases(.))  
  
ElasSigVR\_data<-lapply(ElasSigVR,rownames\_to\_column, var = "VR")%>%  
Map(cbind, ID = names(.), .)%>%  
do.call(rbind,.)%>%  
as\_tibble()%>%  
select(-SD)%>% #Remove standard desviation  
pivot\_wider(names\_from = VR,values\_from=Mean)%>%  
filter(complete.cases(.))  
  
  
StochElasVR\_data<-lapply(StochElasVR,rownames\_to\_column, var = "VR")%>%  
Map(cbind, ID = names(.), .)%>%  
do.call(rbind,.)%>%  
as\_tibble()%>%  
select(-SD)%>%  
pivot\_wider(names\_from = VR,values\_from=Mean)%>%  
filter(complete.cases(.))

### 5.2.3. Produce a definitive demographic buffering data frame

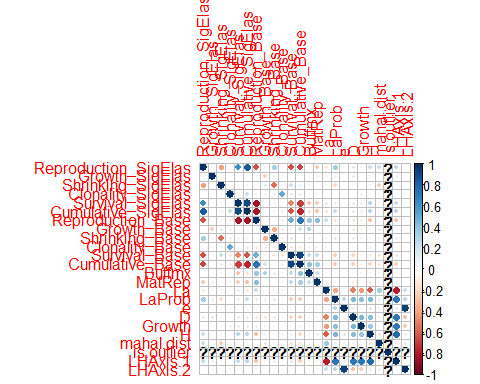
This new data frame will be ready for merging with climatic data and life history traits

databuff\_data<-left\_join(  
ElasSigVR\_data%>%setNames(paste0(names(.),'\_SigElas')),  
StochElasVR\_data%>%setNames(paste0(names(.),'\_Base')),  
by=c("ID\_SigElas"="ID\_Base"))  
  
databuff\_data

## # A tibble: 350 × 13  
## ID\_SigElas Reproduction\_SigElas Growth\_SigElas Shrinking\_SigElas  
## <chr> <dbl> <dbl> <dbl>  
## 1 Drc2.151\_550 -0.0000551 0.00160 -0.000129   
## 2 Drc2.151\_548 -0.0000983 -0.00111 -0.0000306   
## 3 Drc2.151\_546 -0.0000198 -0.000534 -0.0000270   
## 4 Drc2.151\_547 0 0 0   
## 5 Pnx2.399\_1046 -0.000236 0.00300 0.00000517  
## 6 Prm4.582\_1157 -0.138 0.0431 0.0142   
## 7 Crsm.158\_413 -0.0346 0 0   
## 8 Trll.304\_1438 0 -0.0000977 0.0000160   
## 9 Trll.304\_1442 0 0.000722 -0.00000727  
## 10 Trll.304\_1445 0 0.000158 0.00000199  
## # ℹ 340 more rows  
## # ℹ 9 more variables: Clonality\_SigElas <dbl>, Survival\_SigElas <dbl>,  
## # Cumulative\_SigElas <dbl>, Reproduction\_Base <dbl>, Growth\_Base <dbl>,  
## # Shrinking\_Base <dbl>, Clonality\_Base <dbl>, Survival\_Base <dbl>,  
## # Cumulative\_Base <dbl>

MPMinfo<-data.frame(  
 Buffmx=unlist(Buffmx),  
 MatRep=unlist(MatRep),  
 ID=uniqueID)%>%as\_tibble()  
  
  
databuff\_data<-left\_join(  
 databuff\_data,MPMinfo,  
 by=c("ID\_SigElas"="ID"))%>%  
 filter(MatRep>2)%>%  
 rename(ID="ID\_SigElas")  
  
#Comparing buffering in vital rates and life history traits  
databuff\_data%>%  
left\_join(.,LHtraits,by="ID")%>%  
filter(complete.cases(.))%>%  
select(-"ID")%>%cor()%>%corrplot::corrplot()

## Warning in cor(.): o desvio padrão é zero



# 6. Merging all (Climatic data + Life history + Buffering)

colnames(ClimPCA$ind$coord)<-gsub("Dim.", "ClimPC.", colnames(ClimPCA$ind$coord))  
colnames(LHpca$ind$coord)<-gsub("Dim.", "LHPC.", colnames(LHpca$ind$coord))  
  
LHpca\_axes12<-LHpca$ind$coord[,c(1,2)]%>%data.frame()%>%rownames\_to\_column("ID")  
ClimPCA\_axes123<-ClimPCA$ind$coord[,c(1,2,3)]%>%data.frame()%>%rownames\_to\_column("ID")  
  
merged\_data<-databuff\_data%>%  
left\_join(.,LHpca\_axes12,by="ID")%>%  
left\_join(.,ClimPCA\_axes123,by="ID")%>%  
filter(complete.cases(.))%>%  
left\_join(.,MetadataClean,by="ID")%>%  
distinct(ID,.keep\_all=TRUE)  
  
  
merged\_data

## # A tibble: 134 × 30  
## ID Reproduction\_SigElas Growth\_SigElas Shrinking\_SigElas Clonality\_SigElas  
## <chr> <dbl> <dbl> <dbl> <dbl>  
## 1 Drc2… -0.0000551 0.00160 -0.000129 0  
## 2 Prm4… -0.138 0.0431 0.0142 0  
## 3 Trll… 0 -0.0000977 0.0000160 0  
## 4 Trll… 0 0.000722 -0.00000727 0  
## 5 Trll… 0 0.000640 -0.0000496 0  
## 6 Trll… 0 0.000102 -0.000196 0  
## 7 Trll… 0 -0.000569 -0.000170 0  
## 8 Trll… 0 0.0000227 0 0  
## 9 Trll… 0 0.000256 0.0000229 0  
## 10 Trll… 0 -0.00157 0.000000315 0  
## # ℹ 124 more rows  
## # ℹ 25 more variables: Survival\_SigElas <dbl>, Cumulative\_SigElas <dbl>,  
## # Reproduction\_Base <dbl>, Growth\_Base <dbl>, Shrinking\_Base <dbl>,  
## # Clonality\_Base <dbl>, Survival\_Base <dbl>, Cumulative\_Base <dbl>,  
## # Buffmx <dbl>, MatRep <int>, LHPC.1 <dbl>, LHPC.2 <dbl>, ClimPC.1 <dbl>,  
## # ClimPC.2 <dbl>, ClimPC.3 <dbl>, SpeciesAccepted <chr>, Kingdom <chr>,  
## # Phylum <chr>, Class <chr>, Order <chr>, OrganismType <chr>, …

# 7. Building the super tree and make sure it works on phylogenetic analyses

* Check must return:
  + No duplicates: Each species is a tip in the phylogeny
  + No polytomyes: Methods require no polytomyes so it need to be removed
  + Is.rooted == TRUE: A phylogeny need a root, it is, an initial state
  + is.binary == TRUE:
  + is.ultrametric == TRUE: Ultrametic means branches lenght reflect evolutionary history,
  + “any edge == 0” == FALSE.

#Make subtree  
sppINphylo<-unique(merged\_data$Binomial)[unique(merged\_data$Binomial)%in%supertree$tip]  
  
subtree<-keep.tip(supertree, sppINphylo)  
  
#Check and Avoid duplicates  
any(duplicated(subtree$node.label))

## [1] TRUE

subtree<-makeNodeLabel(subtree); any(duplicated(subtree$node.label))

## [1] FALSE

#Avoid polytomyes  
subtree\_backup<-subtree<-multi2di(subtree)  
  
  
#Make sure branches are comparable, non-negative and non-zero  
subtree$edge.length<-scales::rescale(subtree$edge.length,to=c(0.00001,.99999))  
  
#Force ultrametric  
subtree<-phytools::force.ultrametric(subtree, method="extend")

## \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  
## \* Note: \*  
## \* force.ultrametric does not include a formal method to \*  
## \* ultrametricize a tree & should only be used to coerce \*  
## \* a phylogeny that fails is.ultrametric due to rounding -- \*  
## \* not as a substitute for formal rate-smoothing methods. \*  
## \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

#Check if structure are kept  
identical(subtree,subtree\_backup)

## [1] FALSE

all.equal.phylo(subtree,subtree\_backup,use.edge.length=FALSE)

## [1] TRUE

is.rooted(subtree)

## [1] TRUE

is.binary(subtree)

## [1] TRUE

is.ultrametric(subtree)

## [1] TRUE

any(subtree$edge.length==0)

## [1] FALSE

subtree$edge.length[subtree$edge.length==0]

## numeric(0)

# 8. Produce final dataset and phylogenetic analyses

final\_data<-merged\_data%>%  
mutate(phylo=Binomial)%>%  
mutate(inPhylo=Binomial%in%sppINphylo)%>%  
filter(inPhylo!=FALSE)%>%  
select(-inPhylo)%>%  
arrange(.,match(Binomial,subtree$tip))%>%  
data.frame()

final\_data

## ID Reproduction\_SigElas Growth\_SigElas Shrinking\_SigElas  
## 1 Urs2.183\_726 1.364528e-04 7.525562e-04 4.928246e-04  
## 2 Flcn.170\_257 -1.938652e-03 0.000000e+00 0.000000e+00  
## 3 Lgps.394\_383 -2.377753e-02 0.000000e+00 0.000000e+00  
## 4 Lgps.394\_384 -1.022987e-02 0.000000e+00 0.000000e+00  
## 5 Scl2.252\_644 -1.766308e-06 -3.650052e-03 0.000000e+00  
## 6 Xnsr.320\_747 -1.805037e-04 -5.502203e-04 0.000000e+00  
## 7 Xnsr.320\_746 -2.421680e-03 -3.121283e-03 0.000000e+00  
## 8 Xnsr.414\_745 -4.923438e-03 -7.674374e-03 0.000000e+00  
## 9 Clnc.87\_178 -3.162860e-01 4.751101e-03 0.000000e+00  
## 10 Clnc.87\_177 -1.097668e-01 -4.329936e-03 0.000000e+00  
## 11 Clsl.157\_182 1.101861e-01 0.000000e+00 0.000000e+00  
## 12 Scl2.22\_651 -1.829560e-03 0.000000e+00 0.000000e+00  
## 13 Prmr.231\_529 -3.473658e-05 -2.503286e-05 7.266289e-04  
## 14 Ephr.267\_629 -3.746532e-04 -7.572104e-04 3.269931e-05  
## 15 Hypr.463\_756 -6.467530e-02 -4.189061e-03 -1.993659e-03  
## 16 Agrm.300\_46 2.274530e-05 -2.648489e-03 5.880106e-05  
## 17 Prsh.362\_1204 3.710245e-05 6.848113e-03 -7.212616e-04  
## 18 Ccrb.457\_472 2.780779e-01 -4.533997e-04 0.000000e+00  
## 19 Cstn.134\_322 9.410967e-07 -3.264915e-04 2.075794e-05  
## 20 Cstn.134\_326 -1.011935e-07 -7.387550e-04 2.398223e-05  
## 21 Cstn.134\_325 1.007925e-07 -1.305185e-04 2.980198e-05  
## 22 Cstn.134\_324 -7.655142e-07 -3.928064e-05 3.473416e-05  
## 23 Cstn.134\_323 -1.846865e-06 -2.030624e-03 9.826631e-05  
## 24 Astr.326\_189 -1.301715e-02 5.216766e-03 -1.370287e-02  
## 25 Astr.409\_177 1.176005e-02 2.087632e-03 0.000000e+00  
## 26 Astr.267\_196 1.278097e-04 -4.118595e-03 3.892633e-05  
## 27 Dryc.267\_540 3.067388e-02 8.848441e-03 0.000000e+00  
## 28 Ant..355\_100 1.908372e-04 -1.420634e-04 1.226419e-03  
## 29 Lpns.132\_902 1.058989e-03 -1.189091e-02 2.629081e-03  
## 30 Lpns.132\_901 1.124107e-03 -6.153192e-03 3.406878e-03  
## 31 Lpn..55\_899 -4.611941e-02 3.033784e-02 9.327366e-04  
## 32 Crp2.123\_294 -7.193321e-07 2.644265e-04 0.000000e+00  
## 33 Acrs.330\_19 -1.942699e-03 -3.815111e-03 0.000000e+00  
## 34 All4.185\_58 9.441758e-02 -1.129481e-03 0.000000e+00  
## 35 All4.185\_56 9.409866e-02 -2.513995e-03 0.000000e+00  
## 36 All4.185\_62 3.897842e-02 -3.568100e-04 0.000000e+00  
## 37 All4.185\_55 1.651605e-01 -9.997637e-03 0.000000e+00  
## 38 All4.185\_59 1.699247e-01 -4.329829e-03 0.000000e+00  
## 39 All4.185\_65 1.461733e-01 -9.709006e-03 0.000000e+00  
## 40 Sphr.129\_1358 -2.104041e-01 0.000000e+00 0.000000e+00  
## 41 Hlnt.267\_711 -2.335690e-03 -1.148483e-02 1.611358e-03  
## 42 Hlnt.267\_712 -3.580157e-03 -3.124747e-02 8.387555e-04  
## 43 Erdm.267\_599 -2.754661e-05 -1.082883e-03 -1.066889e-04  
## 44 Erdm.267\_598 2.808797e-05 4.280003e-04 -6.524920e-05  
## 45 Ont..575\_1014 -3.797247e-02 -2.640438e-04 -1.654824e-06  
## 46 Sxfr.152\_1302 4.350709e-01 0.000000e+00 -1.068240e-01  
## 47 Pln2.608\_1122 2.861199e-03 -6.155718e-02 1.189334e-03  
## 48 Pln2.608\_1124 -1.185861e-02 -2.086196e-02 1.059105e-03  
## 49 Pln2.608\_1129 -6.571590e-03 -9.694594e-04 2.344591e-03  
## 50 Drc2.151\_550 -5.514313e-05 1.598278e-03 -1.286515e-04  
## 51 Drc2.151\_549 4.792627e-05 -1.991213e-03 -1.105230e-04  
## 52 Rmnd.445\_1217 -3.507665e-06 2.483465e-05 -8.568739e-06  
## 53 Rmnd.445\_1214 5.069338e-05 -1.280223e-02 5.437151e-04  
## 54 Myst.152\_983 6.352450e-01 0.000000e+00 2.104031e-03  
## 55 Gntn.423\_679 5.785807e-04 -3.895910e-03 9.044300e-04  
## 56 Hypc.282\_759 1.857057e-04 -8.573868e-04 1.252851e-02  
## 57 Echn.129\_555 -4.556823e-02 0.000000e+00 0.000000e+00  
## 58 Ech2.263\_557 -3.341240e-04 -2.446895e-04 1.211224e-06  
## 59 Ech2.263\_556 5.442867e-05 3.648008e-04 -9.845581e-05  
## 60 Rtbd.129\_1225 -6.581060e-01 0.000000e+00 0.000000e+00  
## 61 Ltrs.166\_862 -5.985893e-03 3.201929e-02 3.136667e-03  
## 62 Artm.355\_146 -3.480291e-05 1.380049e-05 1.180574e-03  
## 63 Sldg.129\_1354 -1.270544e-01 0.000000e+00 0.000000e+00  
## 64 Crsm.474\_389 -8.065638e-03 -1.568766e-02 0.000000e+00  
## 65 Crsm.283\_383 1.540169e-04 -1.194387e-04 -1.143753e-04  
## 66 Crsm.283\_384 3.489597e-04 -2.180634e-04 5.892436e-05  
## 67 Crsm.283\_386 5.062695e-04 6.639794e-03 1.117036e-02  
## 68 Crs3.41\_395 8.653618e-02 3.700410e-03 7.132525e-05  
## 69 Crs5.166\_400 8.155830e-02 7.619270e-04 1.274713e-04  
## 70 Crsm.129\_409 -2.326958e-02 0.000000e+00 0.000000e+00  
## 71 Jrnf.267\_786 -4.216837e-03 -1.427212e-04 1.230737e-04  
## 72 Cntr.282\_346 4.987168e-02 -4.278258e-03 -1.530113e-03  
## 73 Cntr.282\_347 2.742320e-02 3.520732e-03 -1.055724e-03  
## 74 Chrl.267\_374 -6.069221e-03 -1.206062e-03 0.000000e+00  
## 75 Crmc.301\_320 5.571422e-02 -1.885842e-03 7.835922e-04  
## 76 Crmc.301\_319 4.989620e-02 -8.745159e-03 -1.267489e-04  
## 77 Sccs.282\_1371 -2.506157e-04 1.272455e-03 1.058512e-03  
## 78 Sccs.282\_1370 5.875971e-04 3.624779e-04 -5.457551e-04  
## 79 Sccs.282\_1368 -6.744761e-05 1.534331e-03 -1.068427e-03  
## 80 Scc3.381\_1377 6.927251e-04 1.134496e-02 2.694870e-04  
## 81 Ards.431\_127 -2.818867e-04 -9.146217e-03 3.799730e-05  
## 82 Andr.152\_83 3.514658e-01 0.000000e+00 -3.849840e-02  
## 83 Prm4.582\_1157 -1.383515e-01 4.312519e-02 1.416895e-02  
## 84 Prm5.73\_1164 -7.772986e-06 1.600067e-03 1.700682e-03  
## 85 Prml.272\_1153 8.362892e-06 -7.918209e-04 -1.459930e-04  
## 86 Prml.596\_1165 3.602506e-04 1.076073e-02 1.101186e-03  
## 87 Prm2.170\_1169 -1.327601e-02 7.679306e-04 5.229724e-04  
## 88 Prm3.591\_1170 -4.455454e-04 2.412247e-03 3.129632e-04  
## 89 Srr2.571\_1298 -1.243162e-05 1.833618e-04 5.677130e-07  
## 90 Prny.129\_1065 -1.238293e-01 0.000000e+00 0.000000e+00  
## 91 Atrp.603\_217 2.355208e-04 -9.955307e-02 6.960505e-04  
## 92 Nbxb.182\_991 6.478582e-05 1.096793e-03 -2.204655e-05  
## 93 Nbx2.183\_992 6.889012e-05 1.764007e-03 -2.011543e-05  
## 94 Nbx3.183\_990 -4.282122e-06 -1.080990e-04 -8.074914e-05  
## 95 Mmml.193\_925 -1.337765e-06 7.099273e-04 1.307458e-03  
## 96 Mmm2.194\_928 -3.284005e-04 4.792671e-03 1.384336e-04  
## 97 Mmml.490\_935 -1.374624e-03 3.370801e-04 1.961760e-05  
## 98 Arcr.350\_132 -1.682590e-05 9.715924e-04 1.293279e-05  
## 99 Arcr.350\_131 -4.309725e-06 -4.129180e-04 3.501265e-04  
## 100 Cryp.511\_463 -9.527210e-06 -1.126878e-03 0.000000e+00  
## 101 Rmxr.267\_1261 1.198250e-04 1.785600e-03 -3.525705e-04  
## 102 Armr.208\_139 -2.174559e-03 -2.217982e-03 -7.709862e-05  
## 103 Lmnm.267\_871 -6.700071e-03 2.738740e-03 -6.570648e-04  
## 104 Rnnc.266\_1222 -4.509389e-02 -2.512034e-02 1.903172e-03  
## 105 Acts.204\_27 -7.254452e-05 2.080658e-03 4.607404e-04  
## 106 Acts.204\_28 -6.588281e-05 9.105740e-04 -2.351034e-04  
## 107 Dcnt.331\_511 -3.774857e-05 -1.493787e-04 -2.862153e-06  
## 108 Dcnt.331\_510 1.842111e-04 1.161441e-03 -1.939162e-04  
## 109 Dcnt.331\_509 -4.033717e-04 1.411501e-03 4.228909e-04  
## 110 Chmd.594\_367 -3.817657e-04 4.294244e-05 0.000000e+00  
## 111 Chmd.172\_368 3.176458e-04 2.708267e-03 1.582705e-03  
## 112 Brss.36\_238 -9.842322e-06 6.164722e-05 4.547185e-06  
## 113 Plpn.355\_1136 -9.921824e-05 2.448080e-03 2.793806e-04  
## 114 Zdpl.500\_1534 -1.057153e-04 1.343679e-02 9.896167e-04  
## 115 Dnth.384\_499 -3.826597e-03 1.996066e-03 2.438940e-03  
## 116 Hlrm.601\_725 -1.551924e-03 -2.504789e-02 1.198529e-03  
## 117 Ctps.143\_328 -8.939245e-03 3.979938e-04 -4.361848e-04  
## 118 Orch.273\_1029 -1.479776e-04 3.981909e-04 8.641597e-04  
## 119 Cypr.576\_483 -9.207344e-05 4.108961e-04 -3.307495e-04  
## 120 Cypr.576\_482 -1.186338e-04 2.274123e-03 1.937584e-03  
## 121 Cypr.576\_484 -4.596083e-05 -1.137449e-04 -5.377853e-04  
## 122 Allm.402\_69 2.766143e-03 -1.017325e-03 1.863293e-04  
## 123 Trll.304\_1438 0.000000e+00 -9.770756e-05 1.595867e-05  
## 124 Trll.304\_1442 0.000000e+00 7.217425e-04 -7.271393e-06  
## 125 Trll.304\_1446 0.000000e+00 6.397791e-04 -4.955547e-05  
## 126 Trll.304\_1443 0.000000e+00 1.018407e-04 -1.959553e-04  
## 127 Trll.304\_1437 0.000000e+00 -5.688097e-04 -1.698155e-04  
## 128 Trll.304\_1435 0.000000e+00 2.265819e-05 0.000000e+00  
## 129 Trll.304\_1439 0.000000e+00 2.564256e-04 2.294640e-05  
## 130 Trll.304\_1441 0.000000e+00 -1.568601e-03 3.146574e-07  
## 131 Trll.304\_1444 0.000000e+00 3.708480e-04 3.718267e-05  
## 132 Clch.382\_287 -4.962345e-04 6.965824e-04 3.703569e-04  
## 133 Asrm.131\_148 -6.751073e-03 1.041108e-03 0.000000e+00  
## 134 Pnss.391\_1116 8.702378e-06 1.773344e-04 0.000000e+00  
## Clonality\_SigElas Survival\_SigElas Cumulative\_SigElas Reproduction\_Base  
## 1 0.000000e+00 -1.692481e-02 -0.0155429721 0.0197248821  
## 2 0.000000e+00 -7.611464e-03 -0.0095501157 0.1232468171  
## 3 0.000000e+00 -8.279373e-02 -0.1065712526 0.3462910353  
## 4 0.000000e+00 -9.817078e-02 -0.1084006494 0.2242017642  
## 5 0.000000e+00 -6.627570e-03 -0.0102793875 0.1033852123  
## 6 0.000000e+00 -2.302241e-03 -0.0030329646 0.0519432883  
## 7 0.000000e+00 -9.403786e-03 -0.0149467498 0.1146915381  
## 8 0.000000e+00 -4.012159e-02 -0.0527193995 0.1005632685  
## 9 0.000000e+00 -7.039959e-01 -1.0155307652 0.4452559759  
## 10 0.000000e+00 -2.201415e-01 -0.3342382840 0.2564613326  
## 11 0.000000e+00 7.211032e-05 0.1102581640 0.0000000000  
## 12 0.000000e+00 -7.208796e-03 -0.0090383560 0.0801650625  
## 13 0.000000e+00 -9.571801e-04 -0.0002903206 0.0100477745  
## 14 0.000000e+00 -1.492507e-03 -0.0025916716 0.0208575272  
## 15 0.000000e+00 -1.199857e-01 -0.1908436699 0.1574231567  
## 16 0.000000e+00 -6.514767e-03 -0.0090817103 0.0187942564  
## 17 0.000000e+00 6.431885e-02 0.0704828041 0.0100989031  
## 18 0.000000e+00 -7.402989e-04 0.2768842385 0.0000000000  
## 19 0.000000e+00 -3.302788e-04 -0.0006350713 0.0042349408  
## 20 0.000000e+00 -1.278424e-03 -0.0019932976 0.0046392387  
## 21 0.000000e+00 -4.386394e-04 -0.0005392551 0.0011490011  
## 22 0.000000e+00 -2.161637e-04 -0.0002214757 0.0051360454  
## 23 0.000000e+00 -2.491582e-03 -0.0044257874 0.0062306310  
## 24 0.000000e+00 -1.907617e-02 -0.0405794188 0.1590745115  
## 25 0.000000e+00 4.929481e-02 0.0631424979 0.0584920277  
## 26 0.000000e+00 -1.147877e-04 -0.0040666465 0.0319563555  
## 27 0.000000e+00 1.209782e-01 0.1605005273 0.0741727391  
## 28 0.000000e+00 -6.002037e-03 -0.0047268433 0.0405977458  
## 29 0.000000e+00 -1.122510e-03 -0.0093253474 0.0829108661  
## 30 0.000000e+00 -7.458346e-03 -0.0090805532 0.0770128960  
## 31 0.000000e+00 -1.087097e-01 -0.1235585541 0.3257759679  
## 32 0.000000e+00 1.196359e-03 0.0014600660 0.0052306828  
## 33 0.000000e+00 -8.748851e-03 -0.0145066615 0.0516656630  
## 34 0.000000e+00 -5.179131e-03 0.0881089646 0.0000000000  
## 35 0.000000e+00 3.004808e-03 0.0945894720 0.0000000000  
## 36 0.000000e+00 -9.294972e-03 0.0293266359 0.0000000000  
## 37 0.000000e+00 -3.394509e-02 0.1212177982 0.0000000000  
## 38 0.000000e+00 3.813056e-02 0.2037254736 0.0000000000  
## 39 0.000000e+00 -9.146317e-02 0.0450010817 0.0000000000  
## 40 0.000000e+00 -4.226229e-01 -0.6330270154 0.6677830504  
## 41 0.000000e+00 -1.087410e-02 -0.0230832569 0.0530603772  
## 42 0.000000e+00 -7.192719e-02 -0.1059160671 0.1254696234  
## 43 0.000000e+00 -9.970538e-04 -0.0022141725 0.0098806075  
## 44 0.000000e+00 -1.383320e-03 -0.0009924813 0.0131953830  
## 45 0.000000e+00 -6.886427e-02 -0.1071024312 0.0782870048  
## 46 0.000000e+00 -1.145268e-01 0.2137200951 0.0000000000  
## 47 0.000000e+00 -1.296219e-01 -0.1871285211 0.1806201390  
## 48 0.000000e+00 -6.666257e-02 -0.0983240409 0.1784938543  
## 49 0.000000e+00 -4.696490e-02 -0.0521613555 0.1371370729  
## 50 0.000000e+00 6.214475e-03 0.0076289579 0.0146967690  
## 51 0.000000e+00 -2.006373e-03 -0.0040601833 0.0257270307  
## 52 0.000000e+00 8.781801e-05 0.0001005763 0.0183693660  
## 53 0.000000e+00 -2.205962e-02 -0.0342674372 0.0109517287  
## 54 0.000000e+00 -2.059389e-03 0.6352896581 0.0000000000  
## 55 0.000000e+00 -8.605643e-03 -0.0110185425 0.0591399887  
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## 57 0.000000e+00 -1.124150e-01 -0.1579832558 0.3886782543  
## 58 0.000000e+00 -4.998179e-04 -0.0010774201 0.0180489979  
## 59 0.000000e+00 4.976895e-04 0.0008184631 0.0272615749  
## 60 0.000000e+00 -1.355710e+00 -2.0138158723 1.1375038324  
## 61 0.000000e+00 1.216314e-02 0.0413332040 0.0840052449  
## 62 0.000000e+00 -2.632782e-03 -0.0014732110 0.0381488743  
## 63 0.000000e+00 -2.734569e-01 -0.4005113269 0.6514233962  
## 64 0.000000e+00 -3.054799e-02 -0.0543012894 0.1280766816  
## 65 1.807953e-01 -8.720921e-03 0.1719946290 0.0000000000  
## 66 7.802471e-02 -4.518761e-03 0.0736957665 0.0000000000  
## 67 2.395295e-01 -1.696512e-01 0.0881946579 0.0000000000  
## 68 0.000000e+00 8.134306e-03 0.0984422249 0.0000000000  
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## 70 0.000000e+00 -4.756358e-02 -0.0708331612 0.4547379525  
## 71 0.000000e+00 -2.828022e-02 -0.0325167026 0.1146798428  
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## 73 4.262420e-01 -7.199570e-02 0.3841345465 0.0000000000  
## 74 0.000000e+00 -1.375033e-02 -0.0210256103 0.1066981183  
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## 77 8.462191e-04 1.191313e-03 0.0041178833 0.0442656069  
## 78 2.201031e-05 1.613227e-03 0.0020395569 0.0588650721  
## 79 1.797835e-04 1.966254e-03 0.0025444941 0.0547330460  
## 80 0.000000e+00 4.990288e-02 0.0622100563 0.0406600099  
## 81 0.000000e+00 1.951426e-02 0.0101241581 0.0484153522  
## 82 0.000000e+00 -9.305599e-02 0.2199114054 0.0000000000  
## 83 0.000000e+00 -2.185634e-01 -0.2996207857 0.2723426030  
## 84 0.000000e+00 -7.504536e-03 -0.0042115602 0.0480514082  
## 85 0.000000e+00 -2.314389e-03 -0.0032438397 0.0326831824  
## 86 0.000000e+00 -4.275384e-02 -0.0305316733 0.0302341211  
## 87 0.000000e+00 -1.809123e-02 -0.0300763392 0.0686846184  
## 88 0.000000e+00 -5.575161e-05 0.0022239136 0.0460930633  
## 89 0.000000e+00 2.331020e-04 0.0004045999 0.0206966824  
## 90 0.000000e+00 -2.811162e-01 -0.4049455351 0.5248679129  
## 91 0.000000e+00 -1.367290e-01 -0.2353505230 0.0278021143  
## 92 0.000000e+00 1.594839e-03 0.0027343721 0.0060150092  
## 93 0.000000e+00 -3.172368e-03 -0.0013595864 0.0065561255  
## 94 0.000000e+00 8.680372e-04 0.0006749069 0.0116839089  
## 95 0.000000e+00 -8.349851e-05 0.0019325491 0.0001958907  
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## 97 0.000000e+00 -3.171483e-03 -0.0041894093 0.0170813096  
## 98 0.000000e+00 2.693891e-03 0.0036615905 0.0056779808  
## 99 0.000000e+00 -3.169151e-02 -0.0317586117 0.0028227417  
## 100 0.000000e+00 -1.048319e-03 -0.0021847250 0.0256800228  
## 101 0.000000e+00 -1.200429e-02 -0.0104514359 0.0195919196  
## 102 0.000000e+00 -5.819248e-03 -0.0102888869 0.0643206097  
## 103 0.000000e+00 -4.083153e-03 -0.0087015483 0.0805434729  
## 104 0.000000e+00 -1.307869e-01 -0.1990979463 0.2774854882  
## 105 0.000000e+00 5.421641e-03 0.0078904944 0.0278940086  
## 106 0.000000e+00 5.401356e-03 0.0060109438 0.0157481089  
## 107 -7.275529e-05 -1.323052e-05 -0.0002759752 0.0035427636  
## 108 2.233719e-04 -9.700826e-06 0.0013654069 0.0102294121  
## 109 3.039467e-04 6.954876e-04 0.0024304547 0.0205109477  
## 110 -2.120882e-05 -2.245672e-04 -0.0005845992 0.0232502019  
## 111 0.000000e+00 -3.716247e-04 0.0042369927 0.0271430776  
## 112 0.000000e+00 4.172605e-04 0.0004736126 0.0098350576  
## 113 1.265238e-04 4.250371e-03 0.0070051368 0.0118699596  
## 114 0.000000e+00 7.758207e-03 0.0220788988 0.0343599847  
## 115 0.000000e+00 -3.591053e-02 -0.0353021194 0.0546882635  
## 116 0.000000e+00 -8.005753e-02 -0.1054588184 0.0658793777  
## 117 0.000000e+00 -1.272564e-02 -0.0217030794 0.0454652527  
## 118 0.000000e+00 -5.077108e-03 -0.0039627351 0.0198246100  
## 119 0.000000e+00 -1.337868e-03 -0.0013497951 0.0279596217  
## 120 0.000000e+00 -1.334057e-04 0.0039596679 0.0260059423  
## 121 0.000000e+00 -2.273735e-03 -0.0029712256 0.0257139012  
## 122 2.708920e-01 -2.358525e-03 0.2704686714 0.0000000000  
## 123 0.000000e+00 -1.731355e-03 -0.0018131038 0.0076042551  
## 124 0.000000e+00 -1.970706e-04 0.0005174006 0.0131320524  
## 125 0.000000e+00 1.151916e-03 0.0017421393 0.0016302185  
## 126 0.000000e+00 -8.259829e-04 -0.0009200976 0.0075877066  
## 127 0.000000e+00 -7.087578e-04 -0.0014473830 0.0181232486  
## 128 0.000000e+00 -5.200273e-04 -0.0004973691 0.0080675020  
## 129 0.000000e+00 -4.206070e-04 -0.0001412349 0.0088870471  
## 130 0.000000e+00 -4.055232e-03 -0.0056235191 0.0209670439  
## 131 0.000000e+00 3.065281e-05 0.0004386835 0.0062736872  
## 132 0.000000e+00 -1.646235e-03 -0.0010755302 0.0298040064  
## 133 -1.010784e-03 -2.229265e-02 -0.0290133976 0.0516794999  
## 134 0.000000e+00 9.126873e-04 0.0010987241 0.0044381842  
## Growth\_Base Shrinking\_Base Clonality\_Base Survival\_Base Cumulative\_Base  
## 1 0.043845806 -0.0098642914 0.000000000 1.10218780 1.1558942  
## 2 0.000000000 0.0000000000 0.000000000 0.83317542 0.9564222  
## 3 0.000000000 0.0000000000 0.000000000 1.16314745 1.5094385  
## 4 0.000000000 0.0000000000 0.000000000 1.33438892 1.5585907  
## 5 0.135054984 0.0000000000 0.000000000 1.08445915 1.3228993  
## 6 0.146554625 0.0000000000 0.000000000 0.92021949 1.1187174  
## 7 0.105110378 0.0000000000 0.000000000 1.02437333 1.2441753  
## 8 0.163429196 0.0000000000 0.000000000 0.92379831 1.1877908  
## 9 0.109955126 0.0000000000 0.000000000 1.64817699 2.2033881  
## 10 0.155009839 0.0000000000 0.000000000 1.37013424 1.7816054  
## 11 0.000000000 0.0000000000 0.000000000 1.38613391 1.3861339  
## 12 0.000000000 0.0000000000 0.000000000 0.70408036 0.7842454  
## 13 0.052601249 -0.0497611179 0.000000000 1.12392931 1.1368172  
## 14 0.017781476 -0.0040658388 0.000000000 1.03620846 1.0707816  
## 15 0.291021640 -0.0235077738 0.000000000 1.22124002 1.6461770  
## 16 0.046532915 -0.0252377704 0.000000000 0.99849590 1.0385853  
## 17 0.123153808 -0.1211425363 0.000000000 2.22153669 2.2336469  
## 18 0.227465719 0.0000000000 0.000000000 0.31028144 0.5377472  
## 19 0.022956031 -0.0169400089 0.000000000 1.01244470 1.0226957  
## 20 0.024670040 -0.0066842007 0.000000000 0.98314050 1.0057656  
## 21 0.021885167 -0.0459680732 0.000000000 1.04099839 1.0180645  
## 22 0.029506109 -0.0157584576 0.000000000 0.97712079 0.9960045  
## 23 0.030017554 -0.0278808876 0.000000000 1.03087155 1.0392388  
## 24 0.148486462 -0.1787462820 0.000000000 0.98717326 1.1159879  
## 25 0.221682266 0.0000000000 0.000000000 0.64633146 0.9265058  
## 26 0.048060150 -0.0220012523 0.000000000 0.96090237 1.0189176  
## 27 0.150528002 0.0000000000 0.000000000 0.71863947 0.9433402  
## 28 0.135504333 -0.0542912135 0.000000000 1.01154790 1.1333588  
## 29 0.151524711 -0.0335898645 0.000000000 0.95637650 1.1572222  
## 30 0.131612228 -0.0468899761 0.000000000 0.96817896 1.1299141  
## 31 0.323320075 -0.0109667062 0.000000000 1.59009900 2.2282283  
## 32 0.025705011 0.0000000000 0.000000000 1.07303795 1.1039736  
## 33 0.077070222 0.0000000000 0.000000000 0.97785757 1.1065935  
## 34 0.068110375 0.0000000000 0.000000000 0.79927550 0.8673859  
## 35 0.120071752 0.0000000000 0.000000000 1.03441703 1.1544888  
## 36 0.017402154 0.0000000000 0.000000000 1.22880092 1.2462031  
## 37 0.124064805 0.0000000000 0.000000000 0.80641755 0.9304824  
## 38 0.119606632 0.0000000000 0.000000000 0.91152088 1.0311275  
## 39 0.102090469 0.0000000000 0.000000000 0.82794900 0.9300395  
## 40 0.000000000 0.0000000000 0.000000000 1.51032393 2.1781070  
## 41 0.196690337 -0.0183160611 0.000000000 1.06272781 1.2941625  
## 42 0.230190580 -0.0084022304 0.000000000 1.06742358 1.4146815  
## 43 0.045247924 -0.0451766662 0.000000000 1.03927339 1.0492253  
## 44 0.038922030 -0.0326056406 0.000000000 1.00949956 1.0290113  
## 45 -0.030593473 -0.0001670247 0.000000000 1.22658918 1.2741157  
## 46 0.000000000 0.2629095281 0.000000000 0.30404508 0.5669546  
## 47 0.326295790 -0.0295399738 0.000000000 1.30948060 1.7868566  
## 48 0.279340611 -0.0602550298 0.000000000 1.07791415 1.4754936  
## 49 0.239336493 -0.0622901604 0.000000000 0.99828306 1.3124665  
## 50 0.065332427 -0.0149823337 0.000000000 1.05571168 1.1207585  
## 51 0.091023884 -0.0328602230 0.000000000 1.00685253 1.0907432  
## 52 0.062215130 -0.0417155300 0.000000000 0.95843770 0.9973067  
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## 58 0.039190766 -0.0009753174 0.000000000 0.97744271 1.0337072  
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## 60 0.000000000 0.0000000000 0.000000000 2.45764352 3.5951474  
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## 62 0.118713556 -0.0628747860 0.000000000 0.95838311 1.0523708  
## 63 0.000000000 0.0000000000 0.000000000 1.43506497 2.0864884  
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## 66 0.010851372 0.0151922895 0.209461378 0.86348107 1.0989861  
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## 68 0.113529808 -0.0041325400 0.000000000 0.81297575 0.9223730  
## 69 0.217607014 -0.0028378709 0.000000000 0.64000095 0.8547701  
## 70 0.000000000 0.0000000000 0.000000000 1.07825094 1.5329889  
## 71 -0.001372050 0.0001373277 0.000000000 1.35556564 1.4690108  
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## 73 0.047808690 -0.0229034305 0.055981476 0.72853318 0.8094199  
## 74 0.021532074 0.0000000000 0.000000000 1.06502858 1.1932588  
## 75 0.147381550 -0.0106093598 0.000000000 0.98940940 1.1261816  
## 76 0.100709675 -0.0025569721 0.000000000 0.96398177 1.0621345  
## 77 0.103048068 -0.0900381779 0.034161470 0.88920956 0.9806465  
## 78 0.138403085 -0.1361218754 0.027447941 0.79105726 0.8796515  
## 79 0.149880681 -0.0891737725 0.009915420 0.76036892 0.8857243  
## 80 0.187984472 -0.1306052695 0.000000000 1.55177268 1.6498119  
## 81 0.233505894 -0.0116185847 0.000000000 1.03358519 1.3038879  
## 82 0.000000000 0.4520957849 0.000000000 0.99390410 1.4459999  
## 83 0.347302244 -0.0559092490 0.000000000 1.63762505 2.2013606  
## 84 0.089395559 -0.0603957958 0.000000000 1.08130031 1.1583515  
## 85 0.055320836 -0.0218010111 0.000000000 0.97139525 1.0375983  
## 86 0.243400369 -0.0554456229 0.000000000 1.18163904 1.3998279  
## 87 0.188491494 -0.0341037855 0.000000000 0.90719875 1.1302711  
## 88 0.134280699 -0.0441801028 0.000000000 1.15299396 1.2891876  
## 89 0.066814894 -0.0375692301 0.000000000 0.98348505 1.0334274  
## 90 0.000000000 0.0000000000 0.000000000 1.46810748 1.9929754  
## 91 0.216144518 -0.0458118616 0.000000000 1.31993191 1.5180667  
## 92 0.159642083 -0.0040220568 0.000000000 1.64401260 1.8056476  
## 93 0.193937066 -0.0042020252 0.000000000 2.38888247 2.5851736  
## 94 0.078342692 -0.0084147900 0.000000000 1.05781380 1.1394256  
## 95 -0.050405568 0.0263010878 0.000000000 1.29906693 1.2751583  
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## 100 0.042694073 0.0000000000 0.000000000 0.96794292 1.0363170  
## 101 0.081405500 -0.0671846930 0.000000000 1.33712922 1.3709420  
## 102 0.160534876 -0.0115817624 0.000000000 0.99090826 1.2041820  
## 103 0.116189830 -0.0346288606 0.000000000 1.07023951 1.2323440  
## 104 0.398259365 -0.2083035597 0.000000000 1.35634656 1.8237879  
## 105 0.145277405 -0.0458345185 0.000000000 1.04030430 1.1676412  
## 106 0.093431309 -0.0393049347 0.000000000 1.09558933 1.1654638  
## 107 0.056364670 -0.0315634732 0.088200051 0.93612066 1.0526647  
## 108 0.062874180 -0.0228763650 0.079131919 0.97837446 1.1077336  
## 109 0.085469076 -0.0366902394 0.065303870 0.95738035 1.0919740  
## 110 0.081730298 0.0000000000 0.001485262 0.92375575 1.0302215  
## 111 0.132674155 -0.0394176495 0.000000000 1.00333242 1.1237320  
## 112 0.033062103 -0.0053357852 0.000000000 0.99004996 1.0276113  
## 113 0.129928283 -0.0783082269 0.027819520 1.01306307 1.1043726  
## 114 0.182006831 -0.1422626605 0.000000000 1.19951011 1.2736143  
## 115 0.174640656 -0.0753612293 0.000000000 0.99973661 1.1537043  
## 116 0.246035305 -0.1900279065 0.000000000 1.28762943 1.4095162  
## 117 0.133373439 -0.0303284455 0.000000000 0.99427635 1.1427866  
## 118 0.049397538 -0.0521892730 0.000000000 1.53547866 1.5525115  
## 119 0.045580418 -0.0131448866 0.000000000 1.00702250 1.0674177  
## 120 0.046465967 -0.0221385594 0.000000000 1.04470643 1.0950398  
## 121 0.037802608 -0.0076329839 0.000000000 1.03810595 1.0939895  
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## 124 0.060277766 -0.0374740811 0.000000000 1.02444495 1.0603807  
## 125 0.027702498 -0.0356235844 0.000000000 1.04131772 1.0350268  
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## Buffmx MatRep LHPC.1 LHPC.2 ClimPC.1 ClimPC.2  
## 1 1.0205700 5 4.05552254 -0.696663102 3.3882768319 0.49804850  
## 2 1.0084916 5 -2.96241998 -0.129954659 -0.2612498958 2.44691133  
## 3 1.1488676 5 -3.59768115 0.739745017 0.1603933441 2.66836759  
## 4 1.1131551 6 1.60253930 -0.610977250 0.1603933441 2.66836759  
## 5 1.0170366 5 1.07509621 -0.896281636 -0.5167914941 0.41581270  
## 6 1.0021638 3 1.97902479 -0.569041959 -0.6578174921 0.23769963  
## 7 1.0016533 3 -1.07902225 -0.891892347 -1.9770167841 -0.29011295  
## 8 1.0365248 4 -0.50409553 -0.232676243 -2.2290941788 -0.91908833  
## 9 1.1473994 9 -2.19358958 0.004938690 0.3348892538 3.40241087  
## 10 1.1819587 11 -2.64253822 0.478711460 0.3348892538 3.40241087  
## 11 1.0975750 3 3.82639825 -0.770342398 0.8190551764 1.00520023  
## 12 1.0013446 3 3.89629428 -0.743585228 0.7290900834 -0.23588262  
## 13 1.0022744 4 -0.65872765 -0.244696963 -0.2610845348 0.36555424  
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## 15 1.1469247 53 -1.42492399 -0.649069599 -1.7561907820 0.04956925  
## 16 1.0117730 4 0.56077336 0.164523234 1.8598982808 -0.06178840  
## 17 1.0988250 7 -0.96962137 -0.340730299 0.4375307731 2.67206519  
## 18 1.0172371 3 1.09629297 0.389760264 -0.7730831616 0.34794691  
## 19 0.9975678 4 -0.55655519 -0.813525720 1.4472669041 -1.00114517  
## 20 1.0013987 4 -1.06729001 -0.261477978 1.2858271979 -0.89654864  
## 21 1.0010531 4 2.37514805 -1.099652568 1.0944563796 -1.24164970  
## 22 0.9976748 4 2.34539416 -1.157483245 1.1425652992 -1.16795116  
## 23 1.0062788 4 0.21879672 -0.185191173 1.1212553499 -1.13208352  
## 24 1.1022898 5 0.33967682 -0.204267535 1.6907544333 1.99312203  
## 25 1.0064223 6 0.58654442 1.552895288 0.4760451051 -0.32094170  
## 26 1.0045646 3 2.68610180 -1.508329446 0.1855146450 0.65577927  
## 27 1.0902586 4 2.13295782 0.859818742 -0.1224602535 0.86297646  
## 28 1.0103733 4 1.31952961 -1.035990880 0.9097750097 -2.39020122  
## 29 1.0579087 5 -0.38478405 -0.092261418 -0.2316797050 0.95835523  
## 30 1.0110815 6 1.50838482 0.269527637 -0.2223902021 0.89572714  
## 31 1.9381641 17 0.62209109 -0.432490111 0.8774241269 -1.13693440  
## 32 0.9954316 5 1.00434501 0.295205182 -2.3926197845 -0.18185305  
## 33 1.0169975 4 1.35067955 -0.954406230 2.0755021947 0.95538347  
## 34 1.0414770 3 -0.12053648 0.342208089 1.1086906247 -0.46406791  
## 35 1.0671800 3 0.65426452 1.301049021 1.2417517508 0.82778456  
## 36 1.0141861 3 2.13426916 -0.807632593 1.2283556324 -0.35890996  
## 37 1.1081790 3 1.89249324 0.989150312 1.0126619397 0.12345998  
## 38 1.3555067 3 -0.26206038 0.259625422 1.0181982496 -0.44286222  
## 39 1.2751194 3 1.64771068 0.290618241 1.1150215913 -0.48773093  
## 40 1.1199191 26 -4.62204819 0.597566619 2.4257757354 2.21229460  
## 41 1.0095946 5 -2.83595721 2.971082188 0.0645731944 0.94284066  
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## 56 1.0520314 3 -1.07358046 0.040761906 0.4863720564 -0.20995834  
## 57 1.1249988 30 0.41477648 0.299127306 2.2871049397 2.41124712  
## 58 0.9966785 5 0.18242622 0.276822341 0.5918071001 0.09849035  
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## 60 1.1427458 14 -2.29821434 -0.517832263 2.4257757354 2.21229460  
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## 62 1.0111736 3 1.87801910 0.282782785 0.9097750097 -2.39020122  
## 63 1.1766299 19 -4.23747569 0.323511508 2.4257757354 2.21229460  
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## 65 1.0064660 3 -3.08938703 0.215411257 0.4014577875 -0.18865705  
## 66 1.0222895 3 2.77729996 -0.744645144 0.4681051969 -0.21333330  
## 67 1.1123591 3 1.21352791 -0.371621315 0.4667961789 -0.21919017  
## 68 1.0699287 4 -0.10507296 -0.826523034 0.9451028628 -0.59948045  
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## 71 1.0203434 4 0.87005479 0.671516129 -0.4681933238 0.06649261  
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## 74 1.0006248 3 0.44057252 -0.616964686 -0.1397928929 0.53624725  
## 75 1.0144133 3 0.87544995 -0.307634285 1.0769134011 -0.69736036  
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## 79 0.9987339 4 -4.62629978 0.596240214 0.4014577875 -0.18865705  
## 80 1.0643938 15 0.16203807 0.012146991 1.8156994500 0.02731675  
## 81 1.0282270 3 -0.45828842 -0.257370385 -2.2039661972 -0.43245497  
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## 84 1.0528927 12 1.41128425 -0.625449275 0.3891227737 -0.17737344  
## 85 1.0043468 5 0.81871825 -0.579572921 0.3475026740 -0.77983148  
## 86 1.2005358 10 1.50162477 -0.738864602 -0.2549818707 -0.92466195  
## 87 1.0136580 14 0.41502047 -0.532623775 -0.0002088708 -0.78039694  
## 88 1.0062161 24 2.06022126 -0.954533847 -0.7425642082 -1.34483703  
## 89 1.0001203 4 -4.34768652 0.310739550 0.9599472516 -0.87928286  
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## 95 1.0026622 5 0.36538940 -0.179072345 -1.5952953930 1.02210963  
## 96 1.0040824 5 0.46331537 0.137758712 -1.6917671379 0.86555414  
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## 104 1.0575854 3 -0.14821863 -0.398410796 2.2676408997 0.01708203  
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## 106 1.0111872 5 0.11746148 -0.201083931 1.8622642755 0.06927096  
## 107 0.9997896 4 -1.28049486 1.324442705 0.3716436184 0.02078917  
## 108 1.0031133 6 -0.22657292 -0.270479797 0.3770234619 0.06830037  
## 109 1.0048691 6 -1.29266891 -0.727598290 0.4736846285 0.10346305  
## 110 1.0040503 6 0.87637358 0.024204126 -3.6880681000 -1.75233219  
## 111 1.0115493 14 -1.25296387 -0.305498084 -1.2433093245 1.12819762  
## 112 1.0001780 4 0.93360200 0.039306015 -2.3197370835 0.27446076  
## 113 1.0040632 5 -0.48113223 -0.267143995 0.9097750097 -2.39020122  
## 114 1.0422046 11 1.11591045 -0.224008873 -1.0543613796 0.73770969  
## 115 1.0713503 3 -3.11960903 0.615379811 0.2801875797 0.21788596  
## 116 1.1658164 4 0.01026127 0.196708591 -0.7135975980 2.58121786  
## 117 1.0132490 3 -1.06761350 -0.556191663 -1.8739491435 -0.45318379  
## 118 1.0043283 16 -1.24316113 -0.737201942 0.7979207719 -0.33450502  
## 119 1.0047770 7 -1.16028746 0.577307150 0.3430433599 1.61505992  
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## 123 1.0014665 5 -0.11102808 -0.001042222 0.5057094428 -0.87317673  
## 124 0.9991554 5 -0.11288327 -0.263697643 0.6055468241 -0.77949621  
## 125 0.9996627 5 -0.34238159 -0.082509243 0.4970393113 -0.99556381  
## 126 0.9974504 3 -0.16314967 0.243580718 0.5731929552 -0.84398631  
## 127 1.0012208 5 -0.35598966 0.239821971 0.4951619353 -0.85904086  
## 128 1.0036398 3 -0.03661108 -0.264173768 0.5134626127 -0.82758632  
## 129 0.9997875 7 -0.28062667 -0.043255956 0.5082677717 -0.86911082  
## 130 0.9995278 3 -0.28035214 -0.155445924 0.6076304668 -0.74343628  
## 131 1.0010317 4 -0.21225711 -0.001855859 0.6734935916 -0.66963609  
## 132 1.0061722 32 2.16602800 -0.257929140 2.0927212323 -0.52744279  
## 133 1.0207404 14 0.63911719 0.437562271 2.8220623624 -1.68655232  
## 134 0.9959259 9 2.05580076 0.097852476 0.5888131058 -1.28451621  
## ClimPC.3 SpeciesAccepted Kingdom Phylum  
## 1 -2.79206556 Ursus maritimus Animalia Chordata  
## 2 0.98342288 Falco naumanni Animalia Chordata  
## 3 -9.83423801 Lagopus leucura Animalia Chordata  
## 4 -9.83423801 Lagopus muta Animalia Chordata  
## 5 -0.17896246 Sceloporus grammicus Animalia Chordata  
## 6 -0.14995031 Xenosaurus platyceps Animalia Chordata  
## 7 0.15402991 Xenosaurus platyceps Animalia Chordata  
## 8 0.24238609 Xenosaurus grandis Animalia Chordata  
## 9 1.28751588 Clinocottus analis Animalia Chordata  
## 10 1.28751588 Clinocottus analis Animalia Chordata  
## 11 -0.71832752 Colias alexandra Animalia Arthropoda  
## 12 -0.46418968 Scolytus ventralis Animalia Arthropoda  
## 13 -0.08638376 Paramuricea clavata Animalia Cnidaria  
## 14 -0.32364884 Euphorbia fontqueriana Plantae Magnoliophyta  
## 15 0.52991276 Hypericum cumulicola Plantae Magnoliophyta  
## 16 0.11224260 Agrimonia eupatoria Plantae Magnoliophyta  
## 17 0.96562898 Purshia subintegra Plantae Magnoliophyta  
## 18 0.40958101 Cucurbita pepo Plantae Magnoliophyta  
## 19 0.36312670 Castanea dentata Plantae Tracheophyta  
## 20 0.03574476 Castanea dentata Plantae Tracheophyta  
## 21 0.01949560 Castanea dentata Plantae Tracheophyta  
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## 24 -0.88785777 Astragalus scaphoides Plantae Magnoliophyta  
## 25 -0.12789129 Astragalus alopecurus Plantae Magnoliophyta  
## 26 -0.28465691 Astragalus tremolsianus Plantae Magnoliophyta  
## 27 -0.17848110 Dorycnium spectabile Plantae Magnoliophyta  
## 28 0.62282181 Anthyllis vulneraria Plantae Magnoliophyta  
## 29 0.21723754 Lupinus tidestromii Plantae Magnoliophyta  
## 30 0.17701314 Lupinus tidestromii Plantae Magnoliophyta  
## 31 1.62120290 Lupinus lepidus Plantae Magnoliophyta  
## 32 0.59888797 Carapa guianensis Plantae Magnoliophyta  
## 33 1.32691290 Acer saccharum Plantae Magnoliophyta  
## 34 -0.20821291 Alliaria petiolata Plantae Magnoliophyta  
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## 40 1.20748053 Sphaeralcea coccinea Plantae Magnoliophyta  
## 41 0.03310394 Helianthemum polygonoides Plantae Magnoliophyta  
## 42 -0.39610567 Helianthemum teneriffae Plantae Magnoliophyta  
## 43 -0.07098295 Erodium paularense Plantae Magnoliophyta  
## 44 -0.02090477 Erodium paularense Plantae Magnoliophyta  
## 45 0.55070377 Oenothera deltoides Plantae Magnoliophyta  
## 46 -0.59497021 Saxifraga tridactylites Plantae Magnoliophyta  
## 47 1.02619889 Plantago coronopus Plantae Magnoliophyta  
## 48 0.07901195 Plantago coronopus Plantae Magnoliophyta  
## 49 -0.31691032 Plantago coronopus Plantae Magnoliophyta  
## 50 -0.36804073 Dracocephalum austriacum Plantae Magnoliophyta  
## 51 -0.36555976 Dracocephalum austriacum Plantae Magnoliophyta  
## 52 0.40369338 Ramonda myconi Plantae Magnoliophyta  
## 53 0.53507414 Ramonda myconi Plantae Magnoliophyta  
## 54 -0.59497021 Myosotis ramosissima Plantae Magnoliophyta  
## 55 -0.02771252 Gentiana pneumonanthe Plantae Magnoliophyta  
## 56 -0.37533525 Hypochaeris radicata Plantae Magnoliophyta  
## 57 1.25690733 Echinacea angustifolia Plantae Magnoliophyta  
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## 60 1.20748053 Ratibida columnifera Plantae Magnoliophyta  
## 61 -0.01312157 Liatris scariosa Plantae Magnoliophyta  
## 62 0.62282181 Artemisia genipi Plantae Magnoliophyta  
## 63 1.20748053 Solidago mollis Plantae Magnoliophyta  
## 64 -0.78333529 Cirsium palustre Plantae Magnoliophyta  
## 65 -0.38653722 Cirsium dissectum Plantae Magnoliophyta  
## 66 -0.37798458 Cirsium dissectum Plantae Magnoliophyta  
## 67 -0.31861025 Cirsium dissectum Plantae Magnoliophyta  
## 68 0.12070552 Cirsium pitcheri Plantae Magnoliophyta  
## 69 0.12318110 Cirsium pitcheri Plantae Magnoliophyta  
## 70 1.25690733 Cirsium undulatum Plantae Magnoliophyta  
## 71 -0.21288706 Jurinea fontqueri Plantae Magnoliophyta  
## 72 -0.38653722 Centaurea jacea Plantae Magnoliophyta  
## 73 -0.37798458 Centaurea jacea Plantae Magnoliophyta  
## 74 -0.42230483 Cheirolophus metlesicsii Plantae Magnoliophyta  
## 75 -1.47238536 Carum carvi Plantae Magnoliophyta  
## 76 -0.83812394 Carum carvi Plantae Magnoliophyta  
## 77 -0.36925265 Succisa pratensis Plantae Magnoliophyta  
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## 79 -0.38653722 Succisa pratensis Plantae Magnoliophyta  
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## 81 0.32090193 Ardisia escallonioides Plantae Magnoliophyta  
## 82 -0.59497021 Androsace elongata Plantae Magnoliophyta  
## 83 -0.37001193 Primula farinosa Plantae Tracheophyta  
## 84 -0.29741967 Primula veris Plantae Magnoliophyta  
## 85 -0.34411841 Primula elatior Plantae Magnoliophyta  
## 86 -0.86292672 Primula vulgaris Plantae Magnoliophyta  
## 87 -0.78443947 Primula vulgaris Plantae Magnoliophyta  
## 88 -0.11362628 Primula vulgaris Plantae Magnoliophyta  
## 89 -0.56193794 Sarracenia purpurea Plantae Magnoliophyta  
## 90 1.25690733 Paronychia jamesii Plantae Magnoliophyta  
## 91 0.86974688 Atriplex canescens Plantae Tracheophyta  
## 92 -0.30163189 Neobuxbaumia mezcalaensis Plantae Magnoliophyta  
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## 94 -0.30163189 Neobuxbaumia macrocephala Plantae Magnoliophyta  
## 95 0.21559050 Mammillaria huitzilopochtli Plantae Magnoliophyta  
## 96 0.20846126 Mammillaria huitzilopochtli Plantae Magnoliophyta  
## 97 -0.24287384 Mammillaria solisioides Plantae Magnoliophyta  
## 98 0.95716696 Ariocarpus fissuratus Plantae Magnoliophyta  
## 99 0.94874098 Ariocarpus fissuratus Plantae Magnoliophyta  
## 100 0.98725395 Escobaria robbinsorum Plantae Magnoliophyta  
## 101 0.21859866 Rumex rupestris Plantae Magnoliophyta  
## 102 0.04057466 Armeria caespitosa Plantae Magnoliophyta  
## 103 -0.02332064 Limonium erectum Plantae Magnoliophyta  
## 104 0.32163290 Ranunculus peltatus Plantae Magnoliophyta  
## 105 0.03820071 Actaea spicata Plantae Magnoliophyta  
## 106 0.06856271 Actaea spicata Plantae Magnoliophyta  
## 107 0.04085176 Dicentra canadensis Plantae Tracheophyta  
## 108 0.02851837 Dicentra canadensis Plantae Tracheophyta  
## 109 -0.09195498 Dicentra canadensis Plantae Tracheophyta  
## 110 2.02884510 Chamaedorea elegans Plantae Magnoliophyta  
## 111 0.74686358 Chamaedorea radicalis Plantae Magnoliophyta  
## 112 0.25868305 Borassus aethiopum Plantae Magnoliophyta  
## 113 0.62282181 Poa alpina Plantae Magnoliophyta  
## 114 0.79148913 Zea diploperennis Plantae Magnoliophyta  
## 115 0.18110723 Danthonia sericea Plantae Magnoliophyta  
## 116 0.76691034 Hilaria mutica Plantae Magnoliophyta  
## 117 -0.14444214 Catopsis compacta Plantae Magnoliophyta  
## 118 -0.03864572 Orchis purpurea Plantae Magnoliophyta  
## 119 0.91408058 Cypripedium fasciculatum Plantae Magnoliophyta  
## 120 0.83829973 Cypripedium fasciculatum Plantae Magnoliophyta  
## 121 0.65950726 Cypripedium fasciculatum Plantae Magnoliophyta  
## 122 0.55521569 Allium tricoccum Plantae Magnoliophyta  
## 123 -0.25452323 Trillium grandiflorum Plantae Magnoliophyta  
## 124 -0.35605880 Trillium grandiflorum Plantae Magnoliophyta  
## 125 -0.25529127 Trillium grandiflorum Plantae Magnoliophyta  
## 126 -0.31908468 Trillium grandiflorum Plantae Magnoliophyta  
## 127 -0.27161723 Trillium grandiflorum Plantae Magnoliophyta  
## 128 -0.33631872 Trillium grandiflorum Plantae Magnoliophyta  
## 129 -0.28504364 Trillium grandiflorum Plantae Magnoliophyta  
## 130 -0.35436699 Trillium grandiflorum Plantae Magnoliophyta  
## 131 -0.40946570 Trillium grandiflorum Plantae Magnoliophyta  
## 132 1.62879830 Calochortus lyallii Plantae Magnoliophyta  
## 133 1.66817327 Asarum canadense Plantae Magnoliophyta  
## 134 0.11992176 Pinus strobus Plantae Pinophyta  
## Class Order OrganismType AngioGymno lambda  
## 1 Mammalia Carnivora Mammalia <NA> 1.0590883  
## 2 Aves Falconiformes Aves <NA> 1.3078824  
## 3 Aves Galliformes Aves <NA> 1.7937087  
## 4 Aves Galliformes Aves <NA> 1.1555296  
## 5 Reptilia Squamata Reptilia <NA> 1.0604761  
## 6 Reptilia Squamata Reptilia <NA> 1.1419108  
## 7 Reptilia Squamata Reptilia <NA> 1.0466930  
## 8 Reptilia Squamata Reptilia <NA> 1.2940579  
## 9 Actinopterygii Scorpaeniformes Actinopterygii <NA> 1.0807503  
## 10 Actinopterygii Scorpaeniformes Actinopterygii <NA> 0.6312393  
## 11 Insecta Lepidoptera Insecta <NA> 1.1707720  
## 12 Insecta Coleoptera Insecta <NA> 1.2386318  
## 13 Anthozoa Alcyonacea Anthozoa <NA> 0.8728669  
## 14 Magnoliopsida Malpighiales Succulent Angiosperm 0.9779625  
## 15 Magnoliopsida Theales Herbaceous perennial Angiosperm 1.0243679  
## 16 Magnoliopsida Rosales Herbaceous perennial Angiosperm 0.9283973  
## 17 Magnoliopsida Rosales Shrub Angiosperm 0.9751571  
## 18 Magnoliopsida Curcurbitales Annual Angiosperm 1.2408827  
## 19 Magnoliopsida Fagales Tree Angiosperm 1.0088920  
## 20 Magnoliopsida Fagales Tree Angiosperm 1.0067955  
## 21 Magnoliopsida Fagales Tree Angiosperm 0.9940440  
## 22 Magnoliopsida Fagales Tree Angiosperm 0.9934334  
## 23 Magnoliopsida Fagales Tree Angiosperm 0.9818987  
## 24 Magnoliopsida Fabales Herbaceous perennial Angiosperm 1.5999061  
## 25 Magnoliopsida Fabales Herbaceous perennial Angiosperm 1.5506323  
## 26 Magnoliopsida Fabales Herbaceous perennial Angiosperm 1.0965123  
## 27 Magnoliopsida Fabales Herbaceous perennial Angiosperm 1.9158723  
## 28 Magnoliopsida Fabales Herbaceous perennial Angiosperm 1.0510285  
## 29 Magnoliopsida Fabales Herbaceous perennial Angiosperm 1.0111035  
## 30 Magnoliopsida Fabales Herbaceous perennial Angiosperm 0.9262035  
## 31 Magnoliopsida Fabales Herbaceous perennial Angiosperm 0.9799277  
## 32 Magnoliopsida Sapindales Tree Angiosperm 0.9956000  
## 33 Magnoliopsida Sapindales Tree Angiosperm 0.9644052  
## 34 Magnoliopsida Brassicales Herbaceous perennial Angiosperm 1.0239866  
## 35 Magnoliopsida Brassicales Herbaceous perennial Angiosperm 1.4037297  
## 36 Magnoliopsida Brassicales Herbaceous perennial Angiosperm 0.7869247  
## 37 Magnoliopsida Brassicales Herbaceous perennial Angiosperm 1.0359177  
## 38 Magnoliopsida Brassicales Herbaceous perennial Angiosperm 0.9716492  
## 39 Magnoliopsida Brassicales Herbaceous perennial Angiosperm 1.3648033  
## 40 Magnoliopsida Malvales Herbaceous perennial Angiosperm 0.7611410  
## 41 Magnoliopsida Malvales Herbaceous perennial Angiosperm 0.9308673  
## 42 Magnoliopsida Malvales Herbaceous perennial Angiosperm 1.5407796  
## 43 Magnoliopsida Geraniales Herbaceous perennial Angiosperm 0.9575419  
## 44 Magnoliopsida Geraniales Herbaceous perennial Angiosperm 1.0879999  
## 45 Magnoliopsida Myrtales Herbaceous perennial Angiosperm 0.8553326  
## 46 Magnoliopsida Saxifragales Annual Angiosperm 1.8316693  
## 47 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 0.5322755  
## 48 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 1.1257721  
## 49 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 1.7314892  
## 50 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 0.9656341  
## 51 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 0.9791057  
## 52 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 1.0326716  
## 53 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 0.9677607  
## 54 Magnoliopsida Lamiales Annual Angiosperm 1.6732773  
## 55 Magnoliopsida Gentianales Herbaceous perennial Angiosperm 1.1326931  
## 56 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.1230529  
## 57 Magnoliopsida Asterales Herbaceous perennial Angiosperm 0.6215339  
## 58 Magnoliopsida Asterales Herbaceous perennial Angiosperm 0.9919496  
## 59 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.0365163  
## 60 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.1283010  
## 61 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.3243933  
## 62 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.1443488  
## 63 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.8015241  
## 64 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.2362850  
## 65 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.0875591  
## 66 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.0558414  
## 67 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.4936542  
## 68 Magnoliopsida Asterales Herbaceous perennial Angiosperm 0.9146098  
## 69 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.0535111  
## 70 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.1119058  
## 71 Magnoliopsida Asterales Herbaceous perennial Angiosperm 0.6170490  
## 72 Magnoliopsida Asterales Herbaceous perennial Angiosperm 0.7721355  
## 73 Magnoliopsida Asterales Herbaceous perennial Angiosperm 0.8874202  
## 74 Magnoliopsida Asterales Herbaceous perennial Angiosperm 0.9634498  
## 75 Magnoliopsida Apiales Herbaceous perennial Angiosperm 0.7839479  
## 76 Magnoliopsida Apiales Herbaceous perennial Angiosperm 0.9832736  
## 77 Magnoliopsida Dipsacales Herbaceous perennial Angiosperm 1.2656266  
## 78 Magnoliopsida Dipsacales Herbaceous perennial Angiosperm 1.4304409  
## 79 Magnoliopsida Dipsacales Herbaceous perennial Angiosperm 1.2955549  
## 80 Magnoliopsida Dipsacales Herbaceous perennial Angiosperm 0.7613167  
## 81 Magnoliopsida Ericales Shrub Angiosperm 1.3372438  
## 82 Magnoliopsida Ericales Annual Angiosperm 0.6744272  
## 83 Magnoliopsida Ericales Herbaceous perennial Angiosperm 1.1426327  
## 84 Magnoliopsida Ericales Herbaceous perennial Angiosperm 0.8550317  
## 85 Magnoliopsida Ericales Herbaceous perennial Angiosperm 1.0551724  
## 86 Magnoliopsida Ericales Herbaceous perennial Angiosperm 0.8672650  
## 87 Magnoliopsida Ericales Herbaceous perennial Angiosperm 0.9802187  
## 88 Magnoliopsida Ericales Herbaceous perennial Angiosperm 0.8083969  
## 89 Magnoliopsida Ericales Herbaceous perennial Angiosperm 1.0164304  
## 90 Magnoliopsida Caryophyllales Herbaceous perennial Angiosperm 0.6241799  
## 91 Magnoliopsida Caryophyllales Shrub Angiosperm 1.7211020  
## 92 Magnoliopsida Caryophyllales Succulent Angiosperm 1.0001012  
## 93 Magnoliopsida Caryophyllales Succulent Angiosperm 1.0001012  
## 94 Magnoliopsida Caryophyllales Succulent Angiosperm 1.0448792  
## 95 Magnoliopsida Caryophyllales Succulent Angiosperm 0.8096500  
## 96 Magnoliopsida Caryophyllales Succulent Angiosperm 1.2437146  
## 97 Magnoliopsida Caryophyllales Succulent Angiosperm 0.7717743  
## 98 Magnoliopsida Caryophyllales Succulent Angiosperm 0.8536424  
## 99 Magnoliopsida Caryophyllales Succulent Angiosperm 0.9123507  
## 100 Magnoliopsida Caryophyllales Succulent Angiosperm 1.0675543  
## 101 Magnoliopsida Caryophyllales Herbaceous perennial Angiosperm 0.6939522  
## 102 Magnoliopsida Caryophyllales Herbaceous perennial Angiosperm 1.1056787  
## 103 Magnoliopsida Caryophyllales Herbaceous perennial Angiosperm 0.8622434  
## 104 Magnoliopsida Ranunculales Herbaceous perennial Angiosperm 0.6678511  
## 105 Magnoliopsida Ranunculales Herbaceous perennial Angiosperm 1.0111375  
## 106 Magnoliopsida Ranunculales Herbaceous perennial Angiosperm 0.9799315  
## 107 Magnoliopsida Ranunculales Herbaceous perennial Angiosperm 1.0953694  
## 108 Magnoliopsida Ranunculales Herbaceous perennial Angiosperm 1.0512885  
## 109 Magnoliopsida Ranunculales Herbaceous perennial Angiosperm 1.1280523  
## 110 Liliopsida Arecales Palm Angiosperm 1.1669544  
## 111 Liliopsida Arecales Palm Angiosperm 1.1789035  
## 112 Liliopsida Arecales Palm Angiosperm 1.0295980  
## 113 Liliopsida Poales Herbaceous perennial Angiosperm 0.9987145  
## 114 Liliopsida Poales Herbaceous perennial Angiosperm 0.5545652  
## 115 Liliopsida Poales Herbaceous perennial Angiosperm 1.0100578  
## 116 Liliopsida Poales Herbaceous perennial Angiosperm 1.7385142  
## 117 Liliopsida Poales Epiphyte Angiosperm 1.0615691  
## 118 Liliopsida Asparagales Herbaceous perennial Angiosperm 0.9831117  
## 119 Liliopsida Asparagales Herbaceous perennial Angiosperm 1.0643108  
## 120 Liliopsida Asparagales Herbaceous perennial Angiosperm 1.0191296  
## 121 Liliopsida Asparagales Herbaceous perennial Angiosperm 1.0732602  
## 122 Liliopsida Asparagales Herbaceous perennial Angiosperm 1.1331204  
## 123 Liliopsida Liliales Herbaceous perennial Angiosperm 1.0406040  
## 124 Liliopsida Liliales Herbaceous perennial Angiosperm 1.0022867  
## 125 Liliopsida Liliales Herbaceous perennial Angiosperm 0.9735535  
## 126 Liliopsida Liliales Herbaceous perennial Angiosperm 0.9536967  
## 127 Liliopsida Liliales Herbaceous perennial Angiosperm 1.0089756  
## 128 Liliopsida Liliales Herbaceous perennial Angiosperm 0.9905149  
## 129 Liliopsida Liliales Herbaceous perennial Angiosperm 0.9847658  
## 130 Liliopsida Liliales Herbaceous perennial Angiosperm 1.0981481  
## 131 Liliopsida Liliales Herbaceous perennial Angiosperm 0.9909749  
## 132 Liliopsida Liliales Herbaceous perennial Angiosperm 1.0226717  
## 133 Magnoliopsida Piperales Herbaceous perennial Angiosperm 1.0447722  
## 134 Pinopsida Pinales Tree Gymnosperm 1.0184607  
## Ecoregion Binomial phylo  
## 1 POE Ursus\_maritimus Ursus\_maritimus  
## 2 MED Falco\_naumanni Falco\_naumanni  
## 3 TUN Lagopus\_leucura Lagopus\_leucura  
## 4 TUN Lagopus\_muta Lagopus\_muta  
## 5 TSC Sceloporus\_grammicus Sceloporus\_grammicus  
## 6 TMB Xenosaurus\_platyceps Xenosaurus\_platyceps  
## 7 TMB Xenosaurus\_platyceps Xenosaurus\_platyceps  
## 8 TMB Xenosaurus\_grandis Xenosaurus\_grandis  
## 9 TRU Clinocottus\_analis Clinocottus\_analis  
## 10 TRU Clinocottus\_analis Clinocottus\_analis  
## 11 TGS Colias\_alexandra Colias\_alexandra  
## 12 TCF Scolytus\_ventralis Scolytus\_ventralis  
## 13 TSS Paramuricea\_clavata Paramuricea\_clavata  
## 14 MED Euphorbia\_fontqueriana Euphorbia\_fontqueriana  
## 15 TCF Hypericum\_cumulicola Hypericum\_cumulicola  
## 16 FGS Agrimonia\_eupatoria Agrimonia\_eupatoria  
## 17 DES Purshia\_subintegra Purshia\_subintegra  
## 18 TBM Cucurbita\_pepo Cucurbita\_pepo  
## 19 TBM Castanea\_dentata Castanea\_dentata  
## 20 TBM Castanea\_dentata Castanea\_dentata  
## 21 TBM Castanea\_dentata Castanea\_dentata  
## 22 TBM Castanea\_dentata Castanea\_dentata  
## 23 TBM Castanea\_dentata Castanea\_dentata  
## 24 DES Astragalus\_scaphoides Astragalus\_scaphoides  
## 25 TBM Astragalus\_alopecurus Astragalus\_alopecurus  
## 26 MED Astragalus\_tremolsianus Astragalus\_tremolsianus  
## 27 MED Dorycnium\_spectabile Dorycnium\_spectabile  
## 28 TBM Anthyllis\_vulneraria Anthyllis\_vulneraria  
## 29 DES Lupinus\_tidestromii Lupinus\_tidestromii  
## 30 DES Lupinus\_tidestromii Lupinus\_tidestromii  
## 31 TCF Lupinus\_lepidus Lupinus\_lepidus  
## 32 TMB Carapa\_guianensis Carapa\_guianensis  
## 33 TBM Acer\_saccharum Acer\_saccharum  
## 34 TBM Alliaria\_petiolata Alliaria\_petiolata  
## 35 TBM Alliaria\_petiolata Alliaria\_petiolata  
## 36 TBM Alliaria\_petiolata Alliaria\_petiolata  
## 37 TBM Alliaria\_petiolata Alliaria\_petiolata  
## 38 TBM Alliaria\_petiolata Alliaria\_petiolata  
## 39 TBM Alliaria\_petiolata Alliaria\_petiolata  
## 40 TGS Sphaeralcea\_coccinea Sphaeralcea\_coccinea  
## 41 MED Helianthemum\_polygonoides Helianthemum\_polygonoides  
## 42 MED Helianthemum\_teneriffae Helianthemum\_teneriffae  
## 43 MED Erodium\_paularense Erodium\_paularense  
## 44 MED Erodium\_paularense Erodium\_paularense  
## 45 DES Oenothera\_deltoides Oenothera\_deltoides  
## 46 TBM Saxifraga\_tridactylites Saxifraga\_tridactylites  
## 47 MED Plantago\_coronopus Plantago\_coronopus  
## 48 TBM Plantago\_coronopus Plantago\_coronopus  
## 49 TBM Plantago\_coronopus Plantago\_coronopus  
## 50 TBM Dracocephalum\_austriacum Dracocephalum\_austriacum  
## 51 TBM Dracocephalum\_austriacum Dracocephalum\_austriacum  
## 52 MED Ramonda\_myconi Ramonda\_myconi  
## 53 MED Ramonda\_myconi Ramonda\_myconi  
## 54 TBM Myosotis\_ramosissima Myosotis\_ramosissima  
## 55 TBM Gentiana\_pneumonanthe Gentiana\_pneumonanthe  
## 56 TBM Hypochaeris\_radicata Hypochaeris\_radicata  
## 57 TGS Echinacea\_angustifolia Echinacea\_angustifolia  
## 58 TGS Echinacea\_angustifolia Echinacea\_angustifolia  
## 59 TGS Echinacea\_angustifolia Echinacea\_angustifolia  
## 60 TGS Ratibida\_columnifera Ratibida\_columnifera  
## 61 TGS Liatris\_scariosa Liatris\_scariosa  
## 62 TCF Artemisia\_genipi Artemisia\_genipi  
## 63 TGS Solidago\_mollis Solidago\_mollis  
## 64 FGS Cirsium\_palustre Cirsium\_palustre  
## 65 TBM Cirsium\_dissectum Cirsium\_dissectum  
## 66 TBM Cirsium\_dissectum Cirsium\_dissectum  
## 67 TBM Cirsium\_dissectum Cirsium\_dissectum  
## 68 TGS Cirsium\_pitcheri Cirsium\_pitcheri  
## 69 TGS Cirsium\_pitcheri Cirsium\_pitcheri  
## 70 TGS Cirsium\_undulatum Cirsium\_undulatum  
## 71 MED Jurinea\_fontqueri Jurinea\_fontqueri  
## 72 TBM Centaurea\_jacea Centaurea\_jacea  
## 73 TBM Centaurea\_jacea Centaurea\_jacea  
## 74 MED Cheirolophus\_metlesicsii Cheirolophus\_metlesicsii  
## 75 TBM Carum\_carvi Carum\_carvi  
## 76 TBM Carum\_carvi Carum\_carvi  
## 77 TBM Succisa\_pratensis Succisa\_pratensis  
## 78 TBM Succisa\_pratensis Succisa\_pratensis  
## 79 TBM Succisa\_pratensis Succisa\_pratensis  
## 80 TBM Succisa\_pratensis Succisa\_pratensis  
## 81 TMB Ardisia\_escallonioides Ardisia\_escallonioides  
## 82 TBM Androsace\_elongata Androsace\_elongata  
## 83 TBM Primula\_farinosa Primula\_farinosa  
## 84 TBM Primula\_veris Primula\_veris  
## 85 TBM Primula\_elatior Primula\_elatior  
## 86 TBM Primula\_vulgaris Primula\_vulgaris  
## 87 TBM Primula\_vulgaris Primula\_vulgaris  
## 88 TBM Primula\_vulgaris Primula\_vulgaris  
## 89 BOR Sarracenia\_purpurea Sarracenia\_purpurea  
## 90 TGS Paronychia\_jamesii Paronychia\_jamesii  
## 91 DES Atriplex\_canescens Atriplex\_canescens  
## 92 TSC Neobuxbaumia\_mezcalaensis Neobuxbaumia\_mezcalaensis  
## 93 DES Neobuxbaumia\_mezcalaensis Neobuxbaumia\_mezcalaensis  
## 94 DES Neobuxbaumia\_macrocephala Neobuxbaumia\_macrocephala  
## 95 TGV Mammillaria\_huitzilopochtli Mammillaria\_huitzilopochtli  
## 96 DES Mammillaria\_huitzilopochtli Mammillaria\_huitzilopochtli  
## 97 DES Mammillaria\_solisioides Mammillaria\_solisioides  
## 98 DES Ariocarpus\_fissuratus Ariocarpus\_fissuratus  
## 99 DES Ariocarpus\_fissuratus Ariocarpus\_fissuratus  
## 100 DES Escobaria\_robbinsorum Escobaria\_robbinsorum  
## 101 TBM Rumex\_rupestris Rumex\_rupestris  
## 102 MED Armeria\_caespitosa Armeria\_caespitosa  
## 103 MED Limonium\_erectum Limonium\_erectum  
## 104 TBM Ranunculus\_peltatus Ranunculus\_peltatus  
## 105 TBM Actaea\_spicata Actaea\_spicata  
## 106 TBM Actaea\_spicata Actaea\_spicata  
## 107 TBM Dicentra\_canadensis Dicentra\_canadensis  
## 108 TBM Dicentra\_canadensis Dicentra\_canadensis  
## 109 TBM Dicentra\_canadensis Dicentra\_canadensis  
## 110 TSC Chamaedorea\_elegans Chamaedorea\_elegans  
## 111 MED Chamaedorea\_radicalis Chamaedorea\_radicalis  
## 112 TGV Borassus\_aethiopum Borassus\_aethiopum  
## 113 TCF Poa\_alpina Poa\_alpina  
## 114 MON Zea\_diploperennis Zea\_diploperennis  
## 115 TCF Danthonia\_sericea Danthonia\_sericea  
## 116 DES Hilaria\_mutica Hilaria\_mutica  
## 117 TSC Catopsis\_compacta Catopsis\_compacta  
## 118 TBM Orchis\_purpurea Orchis\_purpurea  
## 119 TCF Cypripedium\_fasciculatum Cypripedium\_fasciculatum  
## 120 TCF Cypripedium\_fasciculatum Cypripedium\_fasciculatum  
## 121 TCF Cypripedium\_fasciculatum Cypripedium\_fasciculatum  
## 122 TBM Allium\_tricoccum Allium\_tricoccum  
## 123 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 124 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 125 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 126 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 127 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 128 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 129 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 130 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 131 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 132 TGS Calochortus\_lyallii Calochortus\_lyallii  
## 133 TBM Asarum\_canadense Asarum\_canadense  
## 134 TBM Pinus\_strobus Pinus\_strobus

#Total populations  
print("Total pops"); (final\_data%>%dim())[1]

## [1] "Total pops"

## [1] 134

#Total species  
print("Total species"); final\_data$SpeciesAccepted%>%unique()%>%length()

## [1] "Total species"

## [1] 89

#Populations by kingdom  
final\_data%>%select(Kingdom)%>%table()

## Kingdom  
## Animalia Plantae   
## 13 121

#Species by kingdom  
final\_data%>%select(SpeciesAccepted,Kingdom)%>%  
distinct()%>%select(Kingdom)%>%table()

## Kingdom  
## Animalia Plantae   
## 11 78

# USED MPMs  
print("Total MPMs");filter(Metadata, ID %in% final\_data$ID)$mat%>%length()

## [1] "Total MPMs"

## [1] 889

Because animal population are scarce we keep the analyses for plants only.

final\_data<-final\_data%>%filter(Kingdom=="Plantae")

## 8.1. Prepare phylogenetic information associated

PhyloSig\_data<-final\_data%>%  
as\_tibble()%>%  
distinct(Binomial,.keep\_all=TRUE)%>%  
column\_to\_rownames("Binomial")%>%  
select(where(is.numeric),Kingdom)%>% # Old "select(is.numeric,Kingdom)%>%" but deprecated in recent versions of tidyverse  
select(-c(Clonality\_Base,Clonality\_SigElas))  
  
PhyloSig\_data\_PLANTS<-PhyloSig\_data%>%filter(Kingdom=="Plantae")%>%select(-Kingdom)  
subtree\_Plants<-keep.tip(subtree, rownames(PhyloSig\_data\_PLANTS))

# 9. GLMM parameters & data imput

## 9.1. A separate dataset was created data\_model

Data\_model now includes absolute values of sum of stochastic elasticity within respect to variance (i.e, cumulativa\_SigEla).[[1]](#footnote-55)

data\_model<-final\_data%>%select(-c(Reproduction\_Base:Cumulative\_Base))%>%  
 mutate(across(Reproduction\_SigElas:Cumulative\_SigElas, abs)) #All calculations will be performed with the absolute values  
  
data\_model

## ID Reproduction\_SigElas Growth\_SigElas Shrinking\_SigElas  
## 1 Ephr.267\_629 3.746532e-04 7.572104e-04 3.269931e-05  
## 2 Hypr.463\_756 6.467530e-02 4.189061e-03 1.993659e-03  
## 3 Agrm.300\_46 2.274530e-05 2.648489e-03 5.880106e-05  
## 4 Prsh.362\_1204 3.710245e-05 6.848113e-03 7.212616e-04  
## 5 Ccrb.457\_472 2.780779e-01 4.533997e-04 0.000000e+00  
## 6 Cstn.134\_322 9.410967e-07 3.264915e-04 2.075794e-05  
## 7 Cstn.134\_326 1.011935e-07 7.387550e-04 2.398223e-05  
## 8 Cstn.134\_325 1.007925e-07 1.305185e-04 2.980198e-05  
## 9 Cstn.134\_324 7.655142e-07 3.928064e-05 3.473416e-05  
## 10 Cstn.134\_323 1.846865e-06 2.030624e-03 9.826631e-05  
## 11 Astr.326\_189 1.301715e-02 5.216766e-03 1.370287e-02  
## 12 Astr.409\_177 1.176005e-02 2.087632e-03 0.000000e+00  
## 13 Astr.267\_196 1.278097e-04 4.118595e-03 3.892633e-05  
## 14 Dryc.267\_540 3.067388e-02 8.848441e-03 0.000000e+00  
## 15 Ant..355\_100 1.908372e-04 1.420634e-04 1.226419e-03  
## 16 Lpns.132\_902 1.058989e-03 1.189091e-02 2.629081e-03  
## 17 Lpns.132\_901 1.124107e-03 6.153192e-03 3.406878e-03  
## 18 Lpn..55\_899 4.611941e-02 3.033784e-02 9.327366e-04  
## 19 Crp2.123\_294 7.193321e-07 2.644265e-04 0.000000e+00  
## 20 Acrs.330\_19 1.942699e-03 3.815111e-03 0.000000e+00  
## 21 All4.185\_58 9.441758e-02 1.129481e-03 0.000000e+00  
## 22 All4.185\_56 9.409866e-02 2.513995e-03 0.000000e+00  
## 23 All4.185\_62 3.897842e-02 3.568100e-04 0.000000e+00  
## 24 All4.185\_55 1.651605e-01 9.997637e-03 0.000000e+00  
## 25 All4.185\_59 1.699247e-01 4.329829e-03 0.000000e+00  
## 26 All4.185\_65 1.461733e-01 9.709006e-03 0.000000e+00  
## 27 Sphr.129\_1358 2.104041e-01 0.000000e+00 0.000000e+00  
## 28 Hlnt.267\_711 2.335690e-03 1.148483e-02 1.611358e-03  
## 29 Hlnt.267\_712 3.580157e-03 3.124747e-02 8.387555e-04  
## 30 Erdm.267\_599 2.754661e-05 1.082883e-03 1.066889e-04  
## 31 Erdm.267\_598 2.808797e-05 4.280003e-04 6.524920e-05  
## 32 Ont..575\_1014 3.797247e-02 2.640438e-04 1.654824e-06  
## 33 Sxfr.152\_1302 4.350709e-01 0.000000e+00 1.068240e-01  
## 34 Pln2.608\_1122 2.861199e-03 6.155718e-02 1.189334e-03  
## 35 Pln2.608\_1124 1.185861e-02 2.086196e-02 1.059105e-03  
## 36 Pln2.608\_1129 6.571590e-03 9.694594e-04 2.344591e-03  
## 37 Drc2.151\_550 5.514313e-05 1.598278e-03 1.286515e-04  
## 38 Drc2.151\_549 4.792627e-05 1.991213e-03 1.105230e-04  
## 39 Rmnd.445\_1217 3.507665e-06 2.483465e-05 8.568739e-06  
## 40 Rmnd.445\_1214 5.069338e-05 1.280223e-02 5.437151e-04  
## 41 Myst.152\_983 6.352450e-01 0.000000e+00 2.104031e-03  
## 42 Gntn.423\_679 5.785807e-04 3.895910e-03 9.044300e-04  
## 43 Hypc.282\_759 1.857057e-04 8.573868e-04 1.252851e-02  
## 44 Echn.129\_555 4.556823e-02 0.000000e+00 0.000000e+00  
## 45 Ech2.263\_557 3.341240e-04 2.446895e-04 1.211224e-06  
## 46 Ech2.263\_556 5.442867e-05 3.648008e-04 9.845581e-05  
## 47 Rtbd.129\_1225 6.581060e-01 0.000000e+00 0.000000e+00  
## 48 Ltrs.166\_862 5.985893e-03 3.201929e-02 3.136667e-03  
## 49 Artm.355\_146 3.480291e-05 1.380049e-05 1.180574e-03  
## 50 Sldg.129\_1354 1.270544e-01 0.000000e+00 0.000000e+00  
## 51 Crsm.474\_389 8.065638e-03 1.568766e-02 0.000000e+00  
## 52 Crsm.283\_383 1.540169e-04 1.194387e-04 1.143753e-04  
## 53 Crsm.283\_384 3.489597e-04 2.180634e-04 5.892436e-05  
## 54 Crsm.283\_386 5.062695e-04 6.639794e-03 1.117036e-02  
## 55 Crs3.41\_395 8.653618e-02 3.700410e-03 7.132525e-05  
## 56 Crs5.166\_400 8.155830e-02 7.619270e-04 1.274713e-04  
## 57 Crsm.129\_409 2.326958e-02 0.000000e+00 0.000000e+00  
## 58 Jrnf.267\_786 4.216837e-03 1.427212e-04 1.230737e-04  
## 59 Cntr.282\_346 4.987168e-02 4.278258e-03 1.530113e-03  
## 60 Cntr.282\_347 2.742320e-02 3.520732e-03 1.055724e-03  
## 61 Chrl.267\_374 6.069221e-03 1.206062e-03 0.000000e+00  
## 62 Crmc.301\_320 5.571422e-02 1.885842e-03 7.835922e-04  
## 63 Crmc.301\_319 4.989620e-02 8.745159e-03 1.267489e-04  
## 64 Sccs.282\_1371 2.506157e-04 1.272455e-03 1.058512e-03  
## 65 Sccs.282\_1370 5.875971e-04 3.624779e-04 5.457551e-04  
## 66 Sccs.282\_1368 6.744761e-05 1.534331e-03 1.068427e-03  
## 67 Scc3.381\_1377 6.927251e-04 1.134496e-02 2.694870e-04  
## 68 Ards.431\_127 2.818867e-04 9.146217e-03 3.799730e-05  
## 69 Andr.152\_83 3.514658e-01 0.000000e+00 3.849840e-02  
## 70 Prm4.582\_1157 1.383515e-01 4.312519e-02 1.416895e-02  
## 71 Prm5.73\_1164 7.772986e-06 1.600067e-03 1.700682e-03  
## 72 Prml.272\_1153 8.362892e-06 7.918209e-04 1.459930e-04  
## 73 Prml.596\_1165 3.602506e-04 1.076073e-02 1.101186e-03  
## 74 Prm2.170\_1169 1.327601e-02 7.679306e-04 5.229724e-04  
## 75 Prm3.591\_1170 4.455454e-04 2.412247e-03 3.129632e-04  
## 76 Srr2.571\_1298 1.243162e-05 1.833618e-04 5.677130e-07  
## 77 Prny.129\_1065 1.238293e-01 0.000000e+00 0.000000e+00  
## 78 Atrp.603\_217 2.355208e-04 9.955307e-02 6.960505e-04  
## 79 Nbxb.182\_991 6.478582e-05 1.096793e-03 2.204655e-05  
## 80 Nbx2.183\_992 6.889012e-05 1.764007e-03 2.011543e-05  
## 81 Nbx3.183\_990 4.282122e-06 1.080990e-04 8.074914e-05  
## 82 Mmml.193\_925 1.337765e-06 7.099273e-04 1.307458e-03  
## 83 Mmm2.194\_928 3.284005e-04 4.792671e-03 1.384336e-04  
## 84 Mmml.490\_935 1.374624e-03 3.370801e-04 1.961760e-05  
## 85 Arcr.350\_132 1.682590e-05 9.715924e-04 1.293279e-05  
## 86 Arcr.350\_131 4.309725e-06 4.129180e-04 3.501265e-04  
## 87 Cryp.511\_463 9.527210e-06 1.126878e-03 0.000000e+00  
## 88 Rmxr.267\_1261 1.198250e-04 1.785600e-03 3.525705e-04  
## 89 Armr.208\_139 2.174559e-03 2.217982e-03 7.709862e-05  
## 90 Lmnm.267\_871 6.700071e-03 2.738740e-03 6.570648e-04  
## 91 Rnnc.266\_1222 4.509389e-02 2.512034e-02 1.903172e-03  
## 92 Acts.204\_27 7.254452e-05 2.080658e-03 4.607404e-04  
## 93 Acts.204\_28 6.588281e-05 9.105740e-04 2.351034e-04  
## 94 Dcnt.331\_511 3.774857e-05 1.493787e-04 2.862153e-06  
## 95 Dcnt.331\_510 1.842111e-04 1.161441e-03 1.939162e-04  
## 96 Dcnt.331\_509 4.033717e-04 1.411501e-03 4.228909e-04  
## 97 Chmd.594\_367 3.817657e-04 4.294244e-05 0.000000e+00  
## 98 Chmd.172\_368 3.176458e-04 2.708267e-03 1.582705e-03  
## 99 Brss.36\_238 9.842322e-06 6.164722e-05 4.547185e-06  
## 100 Plpn.355\_1136 9.921824e-05 2.448080e-03 2.793806e-04  
## 101 Zdpl.500\_1534 1.057153e-04 1.343679e-02 9.896167e-04  
## 102 Dnth.384\_499 3.826597e-03 1.996066e-03 2.438940e-03  
## 103 Hlrm.601\_725 1.551924e-03 2.504789e-02 1.198529e-03  
## 104 Ctps.143\_328 8.939245e-03 3.979938e-04 4.361848e-04  
## 105 Orch.273\_1029 1.479776e-04 3.981909e-04 8.641597e-04  
## 106 Cypr.576\_483 9.207344e-05 4.108961e-04 3.307495e-04  
## 107 Cypr.576\_482 1.186338e-04 2.274123e-03 1.937584e-03  
## 108 Cypr.576\_484 4.596083e-05 1.137449e-04 5.377853e-04  
## 109 Allm.402\_69 2.766143e-03 1.017325e-03 1.863293e-04  
## 110 Trll.304\_1438 0.000000e+00 9.770756e-05 1.595867e-05  
## 111 Trll.304\_1442 0.000000e+00 7.217425e-04 7.271393e-06  
## 112 Trll.304\_1446 0.000000e+00 6.397791e-04 4.955547e-05  
## 113 Trll.304\_1443 0.000000e+00 1.018407e-04 1.959553e-04  
## 114 Trll.304\_1437 0.000000e+00 5.688097e-04 1.698155e-04  
## 115 Trll.304\_1435 0.000000e+00 2.265819e-05 0.000000e+00  
## 116 Trll.304\_1439 0.000000e+00 2.564256e-04 2.294640e-05  
## 117 Trll.304\_1441 0.000000e+00 1.568601e-03 3.146574e-07  
## 118 Trll.304\_1444 0.000000e+00 3.708480e-04 3.718267e-05  
## 119 Clch.382\_287 4.962345e-04 6.965824e-04 3.703569e-04  
## 120 Asrm.131\_148 6.751073e-03 1.041108e-03 0.000000e+00  
## 121 Pnss.391\_1116 8.702378e-06 1.773344e-04 0.000000e+00  
## Clonality\_SigElas Survival\_SigElas Cumulative\_SigElas Buffmx MatRep  
## 1 0.000000e+00 1.492507e-03 0.0025916716 1.0004237 4  
## 2 0.000000e+00 1.199857e-01 0.1908436699 1.1469247 53  
## 3 0.000000e+00 6.514767e-03 0.0090817103 1.0117730 4  
## 4 0.000000e+00 6.431885e-02 0.0704828041 1.0988250 7  
## 5 0.000000e+00 7.402989e-04 0.2768842385 1.0172371 3  
## 6 0.000000e+00 3.302788e-04 0.0006350713 0.9975678 4  
## 7 0.000000e+00 1.278424e-03 0.0019932976 1.0013987 4  
## 8 0.000000e+00 4.386394e-04 0.0005392551 1.0010531 4  
## 9 0.000000e+00 2.161637e-04 0.0002214757 0.9976748 4  
## 10 0.000000e+00 2.491582e-03 0.0044257874 1.0062788 4  
## 11 0.000000e+00 1.907617e-02 0.0405794188 1.1022898 5  
## 12 0.000000e+00 4.929481e-02 0.0631424979 1.0064223 6  
## 13 0.000000e+00 1.147877e-04 0.0040666465 1.0045646 3  
## 14 0.000000e+00 1.209782e-01 0.1605005273 1.0902586 4  
## 15 0.000000e+00 6.002037e-03 0.0047268433 1.0103733 4  
## 16 0.000000e+00 1.122510e-03 0.0093253474 1.0579087 5  
## 17 0.000000e+00 7.458346e-03 0.0090805532 1.0110815 6  
## 18 0.000000e+00 1.087097e-01 0.1235585541 1.9381641 17  
## 19 0.000000e+00 1.196359e-03 0.0014600660 0.9954316 5  
## 20 0.000000e+00 8.748851e-03 0.0145066615 1.0169975 4  
## 21 0.000000e+00 5.179131e-03 0.0881089646 1.0414770 3  
## 22 0.000000e+00 3.004808e-03 0.0945894720 1.0671800 3  
## 23 0.000000e+00 9.294972e-03 0.0293266359 1.0141861 3  
## 24 0.000000e+00 3.394509e-02 0.1212177982 1.1081790 3  
## 25 0.000000e+00 3.813056e-02 0.2037254736 1.3555067 3  
## 26 0.000000e+00 9.146317e-02 0.0450010817 1.2751194 3  
## 27 0.000000e+00 4.226229e-01 0.6330270154 1.1199191 26  
## 28 0.000000e+00 1.087410e-02 0.0230832569 1.0095946 5  
## 29 0.000000e+00 7.192719e-02 0.1059160671 1.0948962 3  
## 30 0.000000e+00 9.970538e-04 0.0022141725 1.0029059 5  
## 31 0.000000e+00 1.383320e-03 0.0009924813 1.0013082 5  
## 32 0.000000e+00 6.886427e-02 0.1071024312 1.0016803 12  
## 33 0.000000e+00 1.145268e-01 0.2137200951 1.0881019 6  
## 34 0.000000e+00 1.296219e-01 0.1871285211 1.1898041 3  
## 35 0.000000e+00 6.666257e-02 0.0983240409 1.0598832 3  
## 36 0.000000e+00 4.696490e-02 0.0521613555 1.1273793 3  
## 37 0.000000e+00 6.214475e-03 0.0076289579 1.0064561 3  
## 38 0.000000e+00 2.006373e-03 0.0040601833 1.0011119 3  
## 39 0.000000e+00 8.781801e-05 0.0001005763 1.0017544 3  
## 40 0.000000e+00 2.205962e-02 0.0342674372 1.0100856 6  
## 41 0.000000e+00 2.059389e-03 0.6352896581 1.0617870 3  
## 42 0.000000e+00 8.605643e-03 0.0110185425 1.0819747 3  
## 43 9.106199e-04 1.086539e-02 0.0019020587 1.0520314 3  
## 44 0.000000e+00 1.124150e-01 0.1579832558 1.1249988 30  
## 45 0.000000e+00 4.998179e-04 0.0010774201 0.9966785 5  
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## 47 0.000000e+00 1.355710e+00 2.0138158723 1.1427458 14  
## 48 0.000000e+00 1.216314e-02 0.0413332040 1.1040372 5  
## 49 0.000000e+00 2.632782e-03 0.0014732110 1.0111736 3  
## 50 0.000000e+00 2.734569e-01 0.4005113269 1.1766299 19  
## 51 0.000000e+00 3.054799e-02 0.0543012894 1.0224502 3  
## 52 1.807953e-01 8.720921e-03 0.1719946290 1.0064660 3  
## 53 7.802471e-02 4.518761e-03 0.0736957665 1.0222895 3  
## 54 2.395295e-01 1.696512e-01 0.0881946579 1.1123591 3  
## 55 0.000000e+00 8.134306e-03 0.0984422249 1.0699287 4  
## 56 0.000000e+00 9.336925e-04 0.0815140053 1.0202616 4  
## 57 0.000000e+00 4.756358e-02 0.0708331612 1.1238899 25  
## 58 0.000000e+00 2.828022e-02 0.0325167026 1.0203434 4  
## 59 2.626497e-01 2.402223e-02 0.2826907289 1.0022460 4  
## 60 4.262420e-01 7.199570e-02 0.3841345465 1.0170315 4  
## 61 0.000000e+00 1.375033e-02 0.0210256103 1.0006248 3  
## 62 0.000000e+00 8.400276e-03 0.0462116981 1.0144133 3  
## 63 0.000000e+00 4.276458e-03 0.0367478326 1.0081205 3  
## 64 8.462191e-04 1.191313e-03 0.0041178833 1.0137131 4  
## 65 2.201031e-05 1.613227e-03 0.0020395569 1.0124443 3  
## 66 1.797835e-04 1.966254e-03 0.0025444941 0.9987339 4  
## 67 0.000000e+00 4.990288e-02 0.0622100563 1.0643938 15  
## 68 0.000000e+00 1.951426e-02 0.0101241581 1.0282270 3  
## 69 0.000000e+00 9.305599e-02 0.2199114054 1.2549325 5  
## 70 0.000000e+00 2.185634e-01 0.2996207857 1.0963114 3  
## 71 0.000000e+00 7.504536e-03 0.0042115602 1.0528927 12  
## 72 0.000000e+00 2.314389e-03 0.0032438397 1.0043468 5  
## 73 0.000000e+00 4.275384e-02 0.0305316733 1.2005358 10  
## 74 0.000000e+00 1.809123e-02 0.0300763392 1.0136580 14  
## 75 0.000000e+00 5.575161e-05 0.0022239136 1.0062161 24  
## 76 0.000000e+00 2.331020e-04 0.0004045999 1.0001203 4  
## 77 0.000000e+00 2.811162e-01 0.4049455351 1.1200143 25  
## 78 0.000000e+00 1.367290e-01 0.2353505230 1.1415555 3  
## 79 0.000000e+00 1.594839e-03 0.0027343721 0.9857018 3  
## 80 0.000000e+00 3.172368e-03 0.0013595864 1.0363167 3  
## 81 0.000000e+00 8.680372e-04 0.0006749069 1.0037322 3  
## 82 0.000000e+00 8.349851e-05 0.0019325491 1.0026622 5  
## 83 0.000000e+00 8.959835e-03 0.0135625394 1.0040824 5  
## 84 0.000000e+00 3.171483e-03 0.0041894093 0.9991667 3  
## 85 0.000000e+00 2.693891e-03 0.0036615905 1.0040889 4  
## 86 0.000000e+00 3.169151e-02 0.0317586117 1.0142548 3  
## 87 0.000000e+00 1.048319e-03 0.0021847250 1.0052818 5  
## 88 0.000000e+00 1.200429e-02 0.0104514359 1.0143370 4  
## 89 0.000000e+00 5.819248e-03 0.0102888869 1.0133921 24  
## 90 0.000000e+00 4.083153e-03 0.0087015483 1.0016138 5  
## 91 0.000000e+00 1.307869e-01 0.1990979463 1.0575854 3  
## 92 0.000000e+00 5.421641e-03 0.0078904944 1.0145514 6  
## 93 0.000000e+00 5.401356e-03 0.0060109438 1.0111872 5  
## 94 7.275529e-05 1.323052e-05 0.0002759752 0.9997896 4  
## 95 2.233719e-04 9.700826e-06 0.0013654069 1.0031133 6  
## 96 3.039467e-04 6.954876e-04 0.0024304547 1.0048691 6  
## 97 2.120882e-05 2.245672e-04 0.0005845992 1.0040503 6  
## 98 0.000000e+00 3.716247e-04 0.0042369927 1.0115493 14  
## 99 0.000000e+00 4.172605e-04 0.0004736126 1.0001780 4  
## 100 1.265238e-04 4.250371e-03 0.0070051368 1.0040632 5  
## 101 0.000000e+00 7.758207e-03 0.0220788988 1.0422046 11  
## 102 0.000000e+00 3.591053e-02 0.0353021194 1.0713503 3  
## 103 0.000000e+00 8.005753e-02 0.1054588184 1.1658164 4  
## 104 0.000000e+00 1.272564e-02 0.0217030794 1.0132490 3  
## 105 0.000000e+00 5.077108e-03 0.0039627351 1.0043283 16  
## 106 0.000000e+00 1.337868e-03 0.0013497951 1.0047770 7  
## 107 0.000000e+00 1.334057e-04 0.0039596679 1.0181906 7  
## 108 0.000000e+00 2.273735e-03 0.0029712256 1.0079742 5  
## 109 2.708920e-01 2.358525e-03 0.2704686714 1.0117780 4  
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## 111 0.000000e+00 1.970706e-04 0.0005174006 0.9991554 5  
## 112 0.000000e+00 1.151916e-03 0.0017421393 0.9996627 5  
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## 114 0.000000e+00 7.087578e-04 0.0014473830 1.0012208 5  
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## 120 1.010784e-03 2.229265e-02 0.0290133976 1.0207404 14  
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## LHPC.1 LHPC.2 ClimPC.1 ClimPC.2 ClimPC.3  
## 1 1.32464828 0.537854879 0.1901416531 -0.28772696 -0.32364884  
## 2 -1.42492399 -0.649069599 -1.7561907820 0.04956925 0.52991276  
## 3 0.56077336 0.164523234 1.8598982808 -0.06178840 0.11224260  
## 4 -0.96962137 -0.340730299 0.4375307731 2.67206519 0.96562898  
## 5 1.09629297 0.389760264 -0.7730831616 0.34794691 0.40958101  
## 6 -0.55655519 -0.813525720 1.4472669041 -1.00114517 0.36312670  
## 7 -1.06729001 -0.261477978 1.2858271979 -0.89654864 0.03574476  
## 8 2.37514805 -1.099652568 1.0944563796 -1.24164970 0.01949560  
## 9 2.34539416 -1.157483245 1.1425652992 -1.16795116 0.00961047  
## 10 0.21879672 -0.185191173 1.1212553499 -1.13208352 0.10430753  
## 11 0.33967682 -0.204267535 1.6907544333 1.99312203 -0.88785777  
## 12 0.58654442 1.552895288 0.4760451051 -0.32094170 -0.12789129  
## 13 2.68610180 -1.508329446 0.1855146450 0.65577927 -0.28465691  
## 14 2.13295782 0.859818742 -0.1224602535 0.86297646 -0.17848110  
## 15 1.31952961 -1.035990880 0.9097750097 -2.39020122 0.62282181  
## 16 -0.38478405 -0.092261418 -0.2316797050 0.95835523 0.21723754  
## 17 1.50838482 0.269527637 -0.2223902021 0.89572714 0.17701314  
## 18 0.62209109 -0.432490111 0.8774241269 -1.13693440 1.62120290  
## 19 1.00434501 0.295205182 -2.3926197845 -0.18185305 0.59888797  
## 20 1.35067955 -0.954406230 2.0755021947 0.95538347 1.32691290  
## 21 -0.12053648 0.342208089 1.1086906247 -0.46406791 -0.20821291  
## 22 0.65426452 1.301049021 1.2417517508 0.82778456 0.44571374  
## 23 2.13426916 -0.807632593 1.2283556324 -0.35890996 -0.32905057  
## 24 1.89249324 0.989150312 1.0126619397 0.12345998 0.06007740  
## 25 -0.26206038 0.259625422 1.0181982496 -0.44286222 -0.33302275  
## 26 1.64771068 0.290618241 1.1150215913 -0.48773093 -0.43707692  
## 27 -4.62204819 0.597566619 2.4257757354 2.21229460 1.20748053  
## 28 -2.83595721 2.971082188 0.0645731944 0.94284066 0.03310394  
## 29 -0.34423198 1.409778546 -0.4073604547 0.58685928 -0.39610567  
## 30 -0.18148396 -0.020375412 0.1418401072 0.56464639 -0.07098295  
## 31 0.11793730 -0.034542972 -0.0134516680 0.61697753 -0.02090477  
## 32 2.30548757 2.560948144 -0.2355186453 1.72796797 0.55070377  
## 33 1.72460210 0.590967280 0.7395830604 -0.26063871 -0.59497021  
## 34 -0.07774510 -0.316277460 -0.6879615697 2.10077564 1.02619889  
## 35 -0.43331618 -0.390104238 -0.6894463627 -0.46803216 0.07901195  
## 36 -0.07259981 -0.497804902 0.7626892441 -1.02418802 -0.31691032  
## 37 1.38217819 -0.087009229 0.9505472946 0.25373062 -0.36804073  
## 38 0.28268740 0.199731108 0.9529629675 0.36575851 -0.36555976  
## 39 1.79724754 1.340636343 0.5968969616 0.46873583 0.40369338  
## 40 0.02348962 0.089457485 0.8265089105 0.29215625 0.53507414  
## 41 2.04385585 0.943217705 0.7395830604 -0.26063871 -0.59497021  
## 42 -4.13027561 1.133271320 0.7619565639 -0.18606683 -0.02771252  
## 43 -1.07358046 0.040761906 0.4863720564 -0.20995834 -0.37533525  
## 44 0.41477648 0.299127306 2.2871049397 2.41124712 1.25690733  
## 45 0.18242622 0.276822341 0.5918071001 0.09849035 -0.05782457  
## 46 -1.33815439 -1.158104197 0.2767905277 -0.64299861 -0.31952387  
## 47 -2.29821434 -0.517832263 2.4257757354 2.21229460 1.20748053  
## 48 1.47004816 0.722283861 1.3884443409 -0.35922791 -0.01312157  
## 49 1.87801910 0.282782785 0.9097750097 -2.39020122 0.62282181  
## 50 -4.23747569 0.323511508 2.4257757354 2.21229460 1.20748053  
## 51 2.06180504 -0.950831472 1.0361104449 -0.49700718 -0.78333529  
## 52 -3.08938703 0.215411257 0.4014577875 -0.18865705 -0.38653722  
## 53 2.77729996 -0.744645144 0.4681051969 -0.21333330 -0.37798458  
## 54 1.21352791 -0.371621315 0.4667961789 -0.21919017 -0.31861025  
## 55 -0.10507296 -0.826523034 0.9451028628 -0.59948045 0.12070552  
## 56 -0.23147707 -0.638967301 1.6114594226 -0.04575505 0.12318110  
## 57 0.82647843 -1.007634897 2.2871049397 2.41124712 1.25690733  
## 58 0.87005479 0.671516129 -0.4681933238 0.06649261 -0.21288706  
## 59 1.60244842 -0.868181765 0.4014577875 -0.18865705 -0.38653722  
## 60 0.44521397 -0.640920856 0.4681051969 -0.21333330 -0.37798458  
## 61 0.44057252 -0.616964686 -0.1397928929 0.53624725 -0.42230483  
## 62 0.87544995 -0.307634285 1.0769134011 -0.69736036 -1.47238536  
## 63 1.28762421 -0.894993575 1.5329901236 -1.12182273 -0.83812394  
## 64 -4.23747569 0.323511508 0.4302852079 -0.24179492 -0.36925265  
## 65 -4.96112780 0.549810577 0.4681051969 -0.21333330 -0.37798458  
## 66 -4.62629978 0.596240214 0.4014577875 -0.18865705 -0.38653722  
## 67 0.16203807 0.012146991 1.8156994500 0.02731675 -0.03538656  
## 68 -0.45828842 -0.257370385 -2.2039661972 -0.43245497 0.32090193  
## 69 -1.48937190 -0.851180889 0.7395830604 -0.26063871 -0.59497021  
## 70 0.42060089 0.846082394 1.3902869769 -0.07324338 -0.37001193  
## 71 1.41128425 -0.625449275 0.3891227737 -0.17737344 -0.29741967  
## 72 0.81871825 -0.579572921 0.3475026740 -0.77983148 -0.34411841  
## 73 1.50162477 -0.738864602 -0.2549818707 -0.92466195 -0.86292672  
## 74 0.41502047 -0.532623775 -0.0002088708 -0.78039694 -0.78443947  
## 75 2.06022126 -0.954533847 -0.7425642082 -1.34483703 -0.11362628  
## 76 -4.34768652 0.310739550 0.9599472516 -0.87928286 -0.56193794  
## 77 0.47294500 -0.498375939 2.2871049397 2.41124712 1.25690733  
## 78 -2.09548698 -0.294589929 -0.6145513071 2.70427584 0.86974688  
## 79 -0.32716913 -0.179802414 -1.3738783145 0.37527046 -0.30163189  
## 80 0.11606091 0.961718360 -1.3738783145 0.37527046 -0.30163189  
## 81 2.55366921 -0.374189229 -1.3738783145 0.37527046 -0.30163189  
## 82 0.36538940 -0.179072345 -1.5952953930 1.02210963 0.21559050  
## 83 0.46331537 0.137758712 -1.6917671379 0.86555414 0.20846126  
## 84 0.88092508 2.144336179 -1.6309258120 0.38437375 -0.24287384  
## 85 -0.29625503 -0.235721588 -0.3717725042 2.78160961 0.95716696  
## 86 1.85338100 7.599812825 -0.3607361355 2.76380872 0.94874098  
## 87 1.53069143 -0.833409703 0.7670786060 1.90505915 0.98725395  
## 88 -1.45321573 -0.801290883 -0.6197935504 -0.30374064 0.21859866  
## 89 -0.03599821 0.248647534 0.0290749929 0.21792912 0.04057466  
## 90 2.13134796 1.112210121 -0.0545412156 0.78337097 -0.02332064  
## 91 -0.14821863 -0.398410796 2.2676408997 0.01708203 0.32163290  
## 92 1.00351444 0.118662360 1.8403665291 0.13846913 0.03820071  
## 93 0.11746148 -0.201083931 1.8622642755 0.06927096 0.06856271  
## 94 -1.28049486 1.324442705 0.3716436184 0.02078917 0.04085176  
## 95 -0.22657292 -0.270479797 0.3770234619 0.06830037 0.02851837  
## 96 -1.29266891 -0.727598290 0.4736846285 0.10346305 -0.09195498  
## 97 0.87637358 0.024204126 -3.6880681000 -1.75233219 2.02884510  
## 98 -1.25296387 -0.305498084 -1.2433093245 1.12819762 0.74686358  
## 99 0.93360200 0.039306015 -2.3197370835 0.27446076 0.25868305  
## 100 -0.48113223 -0.267143995 0.9097750097 -2.39020122 0.62282181  
## 101 1.11591045 -0.224008873 -1.0543613796 0.73770969 0.79148913  
## 102 -3.11960903 0.615379811 0.2801875797 0.21788596 0.18110723  
## 103 0.01026127 0.196708591 -0.7135975980 2.58121786 0.76691034  
## 104 -1.06761350 -0.556191663 -1.8739491435 -0.45318379 -0.14444214  
## 105 -1.24316113 -0.737201942 0.7979207719 -0.33450502 -0.03864572  
## 106 -1.16028746 0.577307150 0.3430433599 1.61505992 0.91408058  
## 107 -2.70732004 1.708784793 0.4949018701 2.25916732 0.83829973  
## 108 -2.58371786 -0.382985166 0.7639910865 1.79538409 0.65950726  
## 109 -1.29887476 -0.383840462 1.4732264132 -1.63849580 0.55521569  
## 110 -0.11102808 -0.001042222 0.5057094428 -0.87317673 -0.25452323  
## 111 -0.11288327 -0.263697643 0.6055468241 -0.77949621 -0.35605880  
## 112 -0.34238159 -0.082509243 0.4970393113 -0.99556381 -0.25529127  
## 113 -0.16314967 0.243580718 0.5731929552 -0.84398631 -0.31908468  
## 114 -0.35598966 0.239821971 0.4951619353 -0.85904086 -0.27161723  
## 115 -0.03661108 -0.264173768 0.5134626127 -0.82758632 -0.33631872  
## 116 -0.28062667 -0.043255956 0.5082677717 -0.86911082 -0.28504364  
## 117 -0.28035214 -0.155445924 0.6076304668 -0.74343628 -0.35436699  
## 118 -0.21225711 -0.001855859 0.6734935916 -0.66963609 -0.40946570  
## 119 2.16602800 -0.257929140 2.0927212323 -0.52744279 1.62879830  
## 120 0.63911719 0.437562271 2.8220623624 -1.68655232 1.66817327  
## 121 2.05580076 0.097852476 0.5888131058 -1.28451621 0.11992176  
## SpeciesAccepted Kingdom Phylum Class  
## 1 Euphorbia fontqueriana Plantae Magnoliophyta Magnoliopsida  
## 2 Hypericum cumulicola Plantae Magnoliophyta Magnoliopsida  
## 3 Agrimonia eupatoria Plantae Magnoliophyta Magnoliopsida  
## 4 Purshia subintegra Plantae Magnoliophyta Magnoliopsida  
## 5 Cucurbita pepo Plantae Magnoliophyta Magnoliopsida  
## 6 Castanea dentata Plantae Tracheophyta Magnoliopsida  
## 7 Castanea dentata Plantae Tracheophyta Magnoliopsida  
## 8 Castanea dentata Plantae Tracheophyta Magnoliopsida  
## 9 Castanea dentata Plantae Tracheophyta Magnoliopsida  
## 10 Castanea dentata Plantae Tracheophyta Magnoliopsida  
## 11 Astragalus scaphoides Plantae Magnoliophyta Magnoliopsida  
## 12 Astragalus alopecurus Plantae Magnoliophyta Magnoliopsida  
## 13 Astragalus tremolsianus Plantae Magnoliophyta Magnoliopsida  
## 14 Dorycnium spectabile Plantae Magnoliophyta Magnoliopsida  
## 15 Anthyllis vulneraria Plantae Magnoliophyta Magnoliopsida  
## 16 Lupinus tidestromii Plantae Magnoliophyta Magnoliopsida  
## 17 Lupinus tidestromii Plantae Magnoliophyta Magnoliopsida  
## 18 Lupinus lepidus Plantae Magnoliophyta Magnoliopsida  
## 19 Carapa guianensis Plantae Magnoliophyta Magnoliopsida  
## 20 Acer saccharum Plantae Magnoliophyta Magnoliopsida  
## 21 Alliaria petiolata Plantae Magnoliophyta Magnoliopsida  
## 22 Alliaria petiolata Plantae Magnoliophyta Magnoliopsida  
## 23 Alliaria petiolata Plantae Magnoliophyta Magnoliopsida  
## 24 Alliaria petiolata Plantae Magnoliophyta Magnoliopsida  
## 25 Alliaria petiolata Plantae Magnoliophyta Magnoliopsida  
## 26 Alliaria petiolata Plantae Magnoliophyta Magnoliopsida  
## 27 Sphaeralcea coccinea Plantae Magnoliophyta Magnoliopsida  
## 28 Helianthemum polygonoides Plantae Magnoliophyta Magnoliopsida  
## 29 Helianthemum teneriffae Plantae Magnoliophyta Magnoliopsida  
## 30 Erodium paularense Plantae Magnoliophyta Magnoliopsida  
## 31 Erodium paularense Plantae Magnoliophyta Magnoliopsida  
## 32 Oenothera deltoides Plantae Magnoliophyta Magnoliopsida  
## 33 Saxifraga tridactylites Plantae Magnoliophyta Magnoliopsida  
## 34 Plantago coronopus Plantae Magnoliophyta Magnoliopsida  
## 35 Plantago coronopus Plantae Magnoliophyta Magnoliopsida  
## 36 Plantago coronopus Plantae Magnoliophyta Magnoliopsida  
## 37 Dracocephalum austriacum Plantae Magnoliophyta Magnoliopsida  
## 38 Dracocephalum austriacum Plantae Magnoliophyta Magnoliopsida  
## 39 Ramonda myconi Plantae Magnoliophyta Magnoliopsida  
## 40 Ramonda myconi Plantae Magnoliophyta Magnoliopsida  
## 41 Myosotis ramosissima Plantae Magnoliophyta Magnoliopsida  
## 42 Gentiana pneumonanthe Plantae Magnoliophyta Magnoliopsida  
## 43 Hypochaeris radicata Plantae Magnoliophyta Magnoliopsida  
## 44 Echinacea angustifolia Plantae Magnoliophyta Magnoliopsida  
## 45 Echinacea angustifolia Plantae Magnoliophyta Magnoliopsida  
## 46 Echinacea angustifolia Plantae Magnoliophyta Magnoliopsida  
## 47 Ratibida columnifera Plantae Magnoliophyta Magnoliopsida  
## 48 Liatris scariosa Plantae Magnoliophyta Magnoliopsida  
## 49 Artemisia genipi Plantae Magnoliophyta Magnoliopsida  
## 50 Solidago mollis Plantae Magnoliophyta Magnoliopsida  
## 51 Cirsium palustre Plantae Magnoliophyta Magnoliopsida  
## 52 Cirsium dissectum Plantae Magnoliophyta Magnoliopsida  
## 53 Cirsium dissectum Plantae Magnoliophyta Magnoliopsida  
## 54 Cirsium dissectum Plantae Magnoliophyta Magnoliopsida  
## 55 Cirsium pitcheri Plantae Magnoliophyta Magnoliopsida  
## 56 Cirsium pitcheri Plantae Magnoliophyta Magnoliopsida  
## 57 Cirsium undulatum Plantae Magnoliophyta Magnoliopsida  
## 58 Jurinea fontqueri Plantae Magnoliophyta Magnoliopsida  
## 59 Centaurea jacea Plantae Magnoliophyta Magnoliopsida  
## 60 Centaurea jacea Plantae Magnoliophyta Magnoliopsida  
## 61 Cheirolophus metlesicsii Plantae Magnoliophyta Magnoliopsida  
## 62 Carum carvi Plantae Magnoliophyta Magnoliopsida  
## 63 Carum carvi Plantae Magnoliophyta Magnoliopsida  
## 64 Succisa pratensis Plantae Magnoliophyta Magnoliopsida  
## 65 Succisa pratensis Plantae Magnoliophyta Magnoliopsida  
## 66 Succisa pratensis Plantae Magnoliophyta Magnoliopsida  
## 67 Succisa pratensis Plantae Magnoliophyta Magnoliopsida  
## 68 Ardisia escallonioides Plantae Magnoliophyta Magnoliopsida  
## 69 Androsace elongata Plantae Magnoliophyta Magnoliopsida  
## 70 Primula farinosa Plantae Tracheophyta Magnoliopsida  
## 71 Primula veris Plantae Magnoliophyta Magnoliopsida  
## 72 Primula elatior Plantae Magnoliophyta Magnoliopsida  
## 73 Primula vulgaris Plantae Magnoliophyta Magnoliopsida  
## 74 Primula vulgaris Plantae Magnoliophyta Magnoliopsida  
## 75 Primula vulgaris Plantae Magnoliophyta Magnoliopsida  
## 76 Sarracenia purpurea Plantae Magnoliophyta Magnoliopsida  
## 77 Paronychia jamesii Plantae Magnoliophyta Magnoliopsida  
## 78 Atriplex canescens Plantae Tracheophyta Magnoliopsida  
## 79 Neobuxbaumia mezcalaensis Plantae Magnoliophyta Magnoliopsida  
## 80 Neobuxbaumia mezcalaensis Plantae Magnoliophyta Magnoliopsida  
## 81 Neobuxbaumia macrocephala Plantae Magnoliophyta Magnoliopsida  
## 82 Mammillaria huitzilopochtli Plantae Magnoliophyta Magnoliopsida  
## 83 Mammillaria huitzilopochtli Plantae Magnoliophyta Magnoliopsida  
## 84 Mammillaria solisioides Plantae Magnoliophyta Magnoliopsida  
## 85 Ariocarpus fissuratus Plantae Magnoliophyta Magnoliopsida  
## 86 Ariocarpus fissuratus Plantae Magnoliophyta Magnoliopsida  
## 87 Escobaria robbinsorum Plantae Magnoliophyta Magnoliopsida  
## 88 Rumex rupestris Plantae Magnoliophyta Magnoliopsida  
## 89 Armeria caespitosa Plantae Magnoliophyta Magnoliopsida  
## 90 Limonium erectum Plantae Magnoliophyta Magnoliopsida  
## 91 Ranunculus peltatus Plantae Magnoliophyta Magnoliopsida  
## 92 Actaea spicata Plantae Magnoliophyta Magnoliopsida  
## 93 Actaea spicata Plantae Magnoliophyta Magnoliopsida  
## 94 Dicentra canadensis Plantae Tracheophyta Magnoliopsida  
## 95 Dicentra canadensis Plantae Tracheophyta Magnoliopsida  
## 96 Dicentra canadensis Plantae Tracheophyta Magnoliopsida  
## 97 Chamaedorea elegans Plantae Magnoliophyta Liliopsida  
## 98 Chamaedorea radicalis Plantae Magnoliophyta Liliopsida  
## 99 Borassus aethiopum Plantae Magnoliophyta Liliopsida  
## 100 Poa alpina Plantae Magnoliophyta Liliopsida  
## 101 Zea diploperennis Plantae Magnoliophyta Liliopsida  
## 102 Danthonia sericea Plantae Magnoliophyta Liliopsida  
## 103 Hilaria mutica Plantae Magnoliophyta Liliopsida  
## 104 Catopsis compacta Plantae Magnoliophyta Liliopsida  
## 105 Orchis purpurea Plantae Magnoliophyta Liliopsida  
## 106 Cypripedium fasciculatum Plantae Magnoliophyta Liliopsida  
## 107 Cypripedium fasciculatum Plantae Magnoliophyta Liliopsida  
## 108 Cypripedium fasciculatum Plantae Magnoliophyta Liliopsida  
## 109 Allium tricoccum Plantae Magnoliophyta Liliopsida  
## 110 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 111 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 112 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 113 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
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## 118 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 119 Calochortus lyallii Plantae Magnoliophyta Liliopsida  
## 120 Asarum canadense Plantae Magnoliophyta Magnoliopsida  
## 121 Pinus strobus Plantae Pinophyta Pinopsida  
## Order OrganismType AngioGymno lambda Ecoregion  
## 1 Malpighiales Succulent Angiosperm 0.9779625 MED  
## 2 Theales Herbaceous perennial Angiosperm 1.0243679 TCF  
## 3 Rosales Herbaceous perennial Angiosperm 0.9283973 FGS  
## 4 Rosales Shrub Angiosperm 0.9751571 DES  
## 5 Curcurbitales Annual Angiosperm 1.2408827 TBM  
## 6 Fagales Tree Angiosperm 1.0088920 TBM  
## 7 Fagales Tree Angiosperm 1.0067955 TBM  
## 8 Fagales Tree Angiosperm 0.9940440 TBM  
## 9 Fagales Tree Angiosperm 0.9934334 TBM  
## 10 Fagales Tree Angiosperm 0.9818987 TBM  
## 11 Fabales Herbaceous perennial Angiosperm 1.5999061 DES  
## 12 Fabales Herbaceous perennial Angiosperm 1.5506323 TBM  
## 13 Fabales Herbaceous perennial Angiosperm 1.0965123 MED  
## 14 Fabales Herbaceous perennial Angiosperm 1.9158723 MED  
## 15 Fabales Herbaceous perennial Angiosperm 1.0510285 TBM  
## 16 Fabales Herbaceous perennial Angiosperm 1.0111035 DES  
## 17 Fabales Herbaceous perennial Angiosperm 0.9262035 DES  
## 18 Fabales Herbaceous perennial Angiosperm 0.9799277 TCF  
## 19 Sapindales Tree Angiosperm 0.9956000 TMB  
## 20 Sapindales Tree Angiosperm 0.9644052 TBM  
## 21 Brassicales Herbaceous perennial Angiosperm 1.0239866 TBM  
## 22 Brassicales Herbaceous perennial Angiosperm 1.4037297 TBM  
## 23 Brassicales Herbaceous perennial Angiosperm 0.7869247 TBM  
## 24 Brassicales Herbaceous perennial Angiosperm 1.0359177 TBM  
## 25 Brassicales Herbaceous perennial Angiosperm 0.9716492 TBM  
## 26 Brassicales Herbaceous perennial Angiosperm 1.3648033 TBM  
## 27 Malvales Herbaceous perennial Angiosperm 0.7611410 TGS  
## 28 Malvales Herbaceous perennial Angiosperm 0.9308673 MED  
## 29 Malvales Herbaceous perennial Angiosperm 1.5407796 MED  
## 30 Geraniales Herbaceous perennial Angiosperm 0.9575419 MED  
## 31 Geraniales Herbaceous perennial Angiosperm 1.0879999 MED  
## 32 Myrtales Herbaceous perennial Angiosperm 0.8553326 DES  
## 33 Saxifragales Annual Angiosperm 1.8316693 TBM  
## 34 Lamiales Herbaceous perennial Angiosperm 0.5322755 MED  
## 35 Lamiales Herbaceous perennial Angiosperm 1.1257721 TBM  
## 36 Lamiales Herbaceous perennial Angiosperm 1.7314892 TBM  
## 37 Lamiales Herbaceous perennial Angiosperm 0.9656341 TBM  
## 38 Lamiales Herbaceous perennial Angiosperm 0.9791057 TBM  
## 39 Lamiales Herbaceous perennial Angiosperm 1.0326716 MED  
## 40 Lamiales Herbaceous perennial Angiosperm 0.9677607 MED  
## 41 Lamiales Annual Angiosperm 1.6732773 TBM  
## 42 Gentianales Herbaceous perennial Angiosperm 1.1326931 TBM  
## 43 Asterales Herbaceous perennial Angiosperm 1.1230529 TBM  
## 44 Asterales Herbaceous perennial Angiosperm 0.6215339 TGS  
## 45 Asterales Herbaceous perennial Angiosperm 0.9919496 TGS  
## 46 Asterales Herbaceous perennial Angiosperm 1.0365163 TGS  
## 47 Asterales Herbaceous perennial Angiosperm 1.1283010 TGS  
## 48 Asterales Herbaceous perennial Angiosperm 1.3243933 TGS  
## 49 Asterales Herbaceous perennial Angiosperm 1.1443488 TCF  
## 50 Asterales Herbaceous perennial Angiosperm 1.8015241 TGS  
## 51 Asterales Herbaceous perennial Angiosperm 1.2362850 FGS  
## 52 Asterales Herbaceous perennial Angiosperm 1.0875591 TBM  
## 53 Asterales Herbaceous perennial Angiosperm 1.0558414 TBM  
## 54 Asterales Herbaceous perennial Angiosperm 1.4936542 TBM  
## 55 Asterales Herbaceous perennial Angiosperm 0.9146098 TGS  
## 56 Asterales Herbaceous perennial Angiosperm 1.0535111 TGS  
## 57 Asterales Herbaceous perennial Angiosperm 1.1119058 TGS  
## 58 Asterales Herbaceous perennial Angiosperm 0.6170490 MED  
## 59 Asterales Herbaceous perennial Angiosperm 0.7721355 TBM  
## 60 Asterales Herbaceous perennial Angiosperm 0.8874202 TBM  
## 61 Asterales Herbaceous perennial Angiosperm 0.9634498 MED  
## 62 Apiales Herbaceous perennial Angiosperm 0.7839479 TBM  
## 63 Apiales Herbaceous perennial Angiosperm 0.9832736 TBM  
## 64 Dipsacales Herbaceous perennial Angiosperm 1.2656266 TBM  
## 65 Dipsacales Herbaceous perennial Angiosperm 1.4304409 TBM  
## 66 Dipsacales Herbaceous perennial Angiosperm 1.2955549 TBM  
## 67 Dipsacales Herbaceous perennial Angiosperm 0.7613167 TBM  
## 68 Ericales Shrub Angiosperm 1.3372438 TMB  
## 69 Ericales Annual Angiosperm 0.6744272 TBM  
## 70 Ericales Herbaceous perennial Angiosperm 1.1426327 TBM  
## 71 Ericales Herbaceous perennial Angiosperm 0.8550317 TBM  
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## 73 Ericales Herbaceous perennial Angiosperm 0.8672650 TBM  
## 74 Ericales Herbaceous perennial Angiosperm 0.9802187 TBM  
## 75 Ericales Herbaceous perennial Angiosperm 0.8083969 TBM  
## 76 Ericales Herbaceous perennial Angiosperm 1.0164304 BOR  
## 77 Caryophyllales Herbaceous perennial Angiosperm 0.6241799 TGS  
## 78 Caryophyllales Shrub Angiosperm 1.7211020 DES  
## 79 Caryophyllales Succulent Angiosperm 1.0001012 TSC  
## 80 Caryophyllales Succulent Angiosperm 1.0001012 DES  
## 81 Caryophyllales Succulent Angiosperm 1.0448792 DES  
## 82 Caryophyllales Succulent Angiosperm 0.8096500 TGV  
## 83 Caryophyllales Succulent Angiosperm 1.2437146 DES  
## 84 Caryophyllales Succulent Angiosperm 0.7717743 DES  
## 85 Caryophyllales Succulent Angiosperm 0.8536424 DES  
## 86 Caryophyllales Succulent Angiosperm 0.9123507 DES  
## 87 Caryophyllales Succulent Angiosperm 1.0675543 DES  
## 88 Caryophyllales Herbaceous perennial Angiosperm 0.6939522 TBM  
## 89 Caryophyllales Herbaceous perennial Angiosperm 1.1056787 MED  
## 90 Caryophyllales Herbaceous perennial Angiosperm 0.8622434 MED  
## 91 Ranunculales Herbaceous perennial Angiosperm 0.6678511 TBM  
## 92 Ranunculales Herbaceous perennial Angiosperm 1.0111375 TBM  
## 93 Ranunculales Herbaceous perennial Angiosperm 0.9799315 TBM  
## 94 Ranunculales Herbaceous perennial Angiosperm 1.0953694 TBM  
## 95 Ranunculales Herbaceous perennial Angiosperm 1.0512885 TBM  
## 96 Ranunculales Herbaceous perennial Angiosperm 1.1280523 TBM  
## 97 Arecales Palm Angiosperm 1.1669544 TSC  
## 98 Arecales Palm Angiosperm 1.1789035 MED  
## 99 Arecales Palm Angiosperm 1.0295980 TGV  
## 100 Poales Herbaceous perennial Angiosperm 0.9987145 TCF  
## 101 Poales Herbaceous perennial Angiosperm 0.5545652 MON  
## 102 Poales Herbaceous perennial Angiosperm 1.0100578 TCF  
## 103 Poales Herbaceous perennial Angiosperm 1.7385142 DES  
## 104 Poales Epiphyte Angiosperm 1.0615691 TSC  
## 105 Asparagales Herbaceous perennial Angiosperm 0.9831117 TBM  
## 106 Asparagales Herbaceous perennial Angiosperm 1.0643108 TCF  
## 107 Asparagales Herbaceous perennial Angiosperm 1.0191296 TCF  
## 108 Asparagales Herbaceous perennial Angiosperm 1.0732602 TCF  
## 109 Asparagales Herbaceous perennial Angiosperm 1.1331204 TBM  
## 110 Liliales Herbaceous perennial Angiosperm 1.0406040 TBM  
## 111 Liliales Herbaceous perennial Angiosperm 1.0022867 TBM  
## 112 Liliales Herbaceous perennial Angiosperm 0.9735535 TBM  
## 113 Liliales Herbaceous perennial Angiosperm 0.9536967 TBM  
## 114 Liliales Herbaceous perennial Angiosperm 1.0089756 TBM  
## 115 Liliales Herbaceous perennial Angiosperm 0.9905149 TBM  
## 116 Liliales Herbaceous perennial Angiosperm 0.9847658 TBM  
## 117 Liliales Herbaceous perennial Angiosperm 1.0981481 TBM  
## 118 Liliales Herbaceous perennial Angiosperm 0.9909749 TBM  
## 119 Liliales Herbaceous perennial Angiosperm 1.0226717 TGS  
## 120 Piperales Herbaceous perennial Angiosperm 1.0447722 TBM  
## 121 Pinales Tree Gymnosperm 1.0184607 TBM  
## Binomial phylo  
## 1 Euphorbia\_fontqueriana Euphorbia\_fontqueriana  
## 2 Hypericum\_cumulicola Hypericum\_cumulicola  
## 3 Agrimonia\_eupatoria Agrimonia\_eupatoria  
## 4 Purshia\_subintegra Purshia\_subintegra  
## 5 Cucurbita\_pepo Cucurbita\_pepo  
## 6 Castanea\_dentata Castanea\_dentata  
## 7 Castanea\_dentata Castanea\_dentata  
## 8 Castanea\_dentata Castanea\_dentata  
## 9 Castanea\_dentata Castanea\_dentata  
## 10 Castanea\_dentata Castanea\_dentata  
## 11 Astragalus\_scaphoides Astragalus\_scaphoides  
## 12 Astragalus\_alopecurus Astragalus\_alopecurus  
## 13 Astragalus\_tremolsianus Astragalus\_tremolsianus  
## 14 Dorycnium\_spectabile Dorycnium\_spectabile  
## 15 Anthyllis\_vulneraria Anthyllis\_vulneraria  
## 16 Lupinus\_tidestromii Lupinus\_tidestromii  
## 17 Lupinus\_tidestromii Lupinus\_tidestromii  
## 18 Lupinus\_lepidus Lupinus\_lepidus  
## 19 Carapa\_guianensis Carapa\_guianensis  
## 20 Acer\_saccharum Acer\_saccharum  
## 21 Alliaria\_petiolata Alliaria\_petiolata  
## 22 Alliaria\_petiolata Alliaria\_petiolata  
## 23 Alliaria\_petiolata Alliaria\_petiolata  
## 24 Alliaria\_petiolata Alliaria\_petiolata  
## 25 Alliaria\_petiolata Alliaria\_petiolata  
## 26 Alliaria\_petiolata Alliaria\_petiolata  
## 27 Sphaeralcea\_coccinea Sphaeralcea\_coccinea  
## 28 Helianthemum\_polygonoides Helianthemum\_polygonoides  
## 29 Helianthemum\_teneriffae Helianthemum\_teneriffae  
## 30 Erodium\_paularense Erodium\_paularense  
## 31 Erodium\_paularense Erodium\_paularense  
## 32 Oenothera\_deltoides Oenothera\_deltoides  
## 33 Saxifraga\_tridactylites Saxifraga\_tridactylites  
## 34 Plantago\_coronopus Plantago\_coronopus  
## 35 Plantago\_coronopus Plantago\_coronopus  
## 36 Plantago\_coronopus Plantago\_coronopus  
## 37 Dracocephalum\_austriacum Dracocephalum\_austriacum  
## 38 Dracocephalum\_austriacum Dracocephalum\_austriacum  
## 39 Ramonda\_myconi Ramonda\_myconi  
## 40 Ramonda\_myconi Ramonda\_myconi  
## 41 Myosotis\_ramosissima Myosotis\_ramosissima  
## 42 Gentiana\_pneumonanthe Gentiana\_pneumonanthe  
## 43 Hypochaeris\_radicata Hypochaeris\_radicata  
## 44 Echinacea\_angustifolia Echinacea\_angustifolia  
## 45 Echinacea\_angustifolia Echinacea\_angustifolia  
## 46 Echinacea\_angustifolia Echinacea\_angustifolia  
## 47 Ratibida\_columnifera Ratibida\_columnifera  
## 48 Liatris\_scariosa Liatris\_scariosa  
## 49 Artemisia\_genipi Artemisia\_genipi  
## 50 Solidago\_mollis Solidago\_mollis  
## 51 Cirsium\_palustre Cirsium\_palustre  
## 52 Cirsium\_dissectum Cirsium\_dissectum  
## 53 Cirsium\_dissectum Cirsium\_dissectum  
## 54 Cirsium\_dissectum Cirsium\_dissectum  
## 55 Cirsium\_pitcheri Cirsium\_pitcheri  
## 56 Cirsium\_pitcheri Cirsium\_pitcheri  
## 57 Cirsium\_undulatum Cirsium\_undulatum  
## 58 Jurinea\_fontqueri Jurinea\_fontqueri  
## 59 Centaurea\_jacea Centaurea\_jacea  
## 60 Centaurea\_jacea Centaurea\_jacea  
## 61 Cheirolophus\_metlesicsii Cheirolophus\_metlesicsii  
## 62 Carum\_carvi Carum\_carvi  
## 63 Carum\_carvi Carum\_carvi  
## 64 Succisa\_pratensis Succisa\_pratensis  
## 65 Succisa\_pratensis Succisa\_pratensis  
## 66 Succisa\_pratensis Succisa\_pratensis  
## 67 Succisa\_pratensis Succisa\_pratensis  
## 68 Ardisia\_escallonioides Ardisia\_escallonioides  
## 69 Androsace\_elongata Androsace\_elongata  
## 70 Primula\_farinosa Primula\_farinosa  
## 71 Primula\_veris Primula\_veris  
## 72 Primula\_elatior Primula\_elatior  
## 73 Primula\_vulgaris Primula\_vulgaris  
## 74 Primula\_vulgaris Primula\_vulgaris  
## 75 Primula\_vulgaris Primula\_vulgaris  
## 76 Sarracenia\_purpurea Sarracenia\_purpurea  
## 77 Paronychia\_jamesii Paronychia\_jamesii  
## 78 Atriplex\_canescens Atriplex\_canescens  
## 79 Neobuxbaumia\_mezcalaensis Neobuxbaumia\_mezcalaensis  
## 80 Neobuxbaumia\_mezcalaensis Neobuxbaumia\_mezcalaensis  
## 81 Neobuxbaumia\_macrocephala Neobuxbaumia\_macrocephala  
## 82 Mammillaria\_huitzilopochtli Mammillaria\_huitzilopochtli  
## 83 Mammillaria\_huitzilopochtli Mammillaria\_huitzilopochtli  
## 84 Mammillaria\_solisioides Mammillaria\_solisioides  
## 85 Ariocarpus\_fissuratus Ariocarpus\_fissuratus  
## 86 Ariocarpus\_fissuratus Ariocarpus\_fissuratus  
## 87 Escobaria\_robbinsorum Escobaria\_robbinsorum  
## 88 Rumex\_rupestris Rumex\_rupestris  
## 89 Armeria\_caespitosa Armeria\_caespitosa  
## 90 Limonium\_erectum Limonium\_erectum  
## 91 Ranunculus\_peltatus Ranunculus\_peltatus  
## 92 Actaea\_spicata Actaea\_spicata  
## 93 Actaea\_spicata Actaea\_spicata  
## 94 Dicentra\_canadensis Dicentra\_canadensis  
## 95 Dicentra\_canadensis Dicentra\_canadensis  
## 96 Dicentra\_canadensis Dicentra\_canadensis  
## 97 Chamaedorea\_elegans Chamaedorea\_elegans  
## 98 Chamaedorea\_radicalis Chamaedorea\_radicalis  
## 99 Borassus\_aethiopum Borassus\_aethiopum  
## 100 Poa\_alpina Poa\_alpina  
## 101 Zea\_diploperennis Zea\_diploperennis  
## 102 Danthonia\_sericea Danthonia\_sericea  
## 103 Hilaria\_mutica Hilaria\_mutica  
## 104 Catopsis\_compacta Catopsis\_compacta  
## 105 Orchis\_purpurea Orchis\_purpurea  
## 106 Cypripedium\_fasciculatum Cypripedium\_fasciculatum  
## 107 Cypripedium\_fasciculatum Cypripedium\_fasciculatum  
## 108 Cypripedium\_fasciculatum Cypripedium\_fasciculatum  
## 109 Allium\_tricoccum Allium\_tricoccum  
## 110 Trillium\_grandiflorum Trillium\_grandiflorum  
## 111 Trillium\_grandiflorum Trillium\_grandiflorum  
## 112 Trillium\_grandiflorum Trillium\_grandiflorum  
## 113 Trillium\_grandiflorum Trillium\_grandiflorum  
## 114 Trillium\_grandiflorum Trillium\_grandiflorum  
## 115 Trillium\_grandiflorum Trillium\_grandiflorum  
## 116 Trillium\_grandiflorum Trillium\_grandiflorum  
## 117 Trillium\_grandiflorum Trillium\_grandiflorum  
## 118 Trillium\_grandiflorum Trillium\_grandiflorum  
## 119 Calochortus\_lyallii Calochortus\_lyallii  
## 120 Asarum\_canadense Asarum\_canadense  
## 121 Pinus\_strobus Pinus\_strobus

## 9.2. Selecting the best model

## 9.3. Determine the fixed effect of all models and response variables

Because we run multiple models representing the combination of several attributes (vital rates, ex. survival and reproduction) for the same fixed model, each element below is important to automatize the process. With each element created separated we can run a loop with a generic model where model(variable ~ fixEffect)

# Determines the fixed effect component  
fixEffect<-fixEffect<-"~LHPC.1 \* LHPC.2 + ClimPC.1 \* ClimPC.2 \* ClimPC.3"  
  
# Determines all variables of interest to make multiple models  
InterestingVars<-c("Survival","Growth","Shrinking","Reproduction","Clonality","Buffmx","Cumulative")  
  
  
traits<-traits\_glmm<- unique (grep(paste(InterestingVars,collapse="|"),   
 colnames(data\_model), value=TRUE))

## 9.4. OPTIMIZING GLMM MODELS

Because we run several models with and without phylogenetic correction it take a long time to run in a in-house computer. Moreover, a long script was created 5b - MCMCglmm run.R. Thus, to accelerate the model performance and save time we also created a jupyter notebook integrated with Google Collab 5b - MCMCglmm run.ipynb.

Most importantly, a partial output was created with the GLMM models in Data/MCMCglmm\_output.rds.

Next steps use this partial output to keep running the analyses.

# 10. Buffering paterns

final\_data\_meta<-final\_data%>%  
left\_join(.,MetadataClean%>%select(-lambda)%>%distinct(),by="ID")  
  
final\_data\_meta

## ID Reproduction\_SigElas Growth\_SigElas Shrinking\_SigElas  
## 1 Ephr.267\_629 -3.746532e-04 -7.572104e-04 3.269931e-05  
## 2 Hypr.463\_756 -6.467530e-02 -4.189061e-03 -1.993659e-03  
## 3 Agrm.300\_46 2.274530e-05 -2.648489e-03 5.880106e-05  
## 4 Prsh.362\_1204 3.710245e-05 6.848113e-03 -7.212616e-04  
## 5 Ccrb.457\_472 2.780779e-01 -4.533997e-04 0.000000e+00  
## 6 Cstn.134\_322 9.410967e-07 -3.264915e-04 2.075794e-05  
## 7 Cstn.134\_326 -1.011935e-07 -7.387550e-04 2.398223e-05  
## 8 Cstn.134\_325 1.007925e-07 -1.305185e-04 2.980198e-05  
## 9 Cstn.134\_324 -7.655142e-07 -3.928064e-05 3.473416e-05  
## 10 Cstn.134\_323 -1.846865e-06 -2.030624e-03 9.826631e-05  
## 11 Astr.326\_189 -1.301715e-02 5.216766e-03 -1.370287e-02  
## 12 Astr.409\_177 1.176005e-02 2.087632e-03 0.000000e+00  
## 13 Astr.267\_196 1.278097e-04 -4.118595e-03 3.892633e-05  
## 14 Dryc.267\_540 3.067388e-02 8.848441e-03 0.000000e+00  
## 15 Ant..355\_100 1.908372e-04 -1.420634e-04 1.226419e-03  
## 16 Lpns.132\_902 1.058989e-03 -1.189091e-02 2.629081e-03  
## 17 Lpns.132\_901 1.124107e-03 -6.153192e-03 3.406878e-03  
## 18 Lpn..55\_899 -4.611941e-02 3.033784e-02 9.327366e-04  
## 19 Crp2.123\_294 -7.193321e-07 2.644265e-04 0.000000e+00  
## 20 Acrs.330\_19 -1.942699e-03 -3.815111e-03 0.000000e+00  
## 21 All4.185\_58 9.441758e-02 -1.129481e-03 0.000000e+00  
## 22 All4.185\_56 9.409866e-02 -2.513995e-03 0.000000e+00  
## 23 All4.185\_62 3.897842e-02 -3.568100e-04 0.000000e+00  
## 24 All4.185\_55 1.651605e-01 -9.997637e-03 0.000000e+00  
## 25 All4.185\_59 1.699247e-01 -4.329829e-03 0.000000e+00  
## 26 All4.185\_65 1.461733e-01 -9.709006e-03 0.000000e+00  
## 27 Sphr.129\_1358 -2.104041e-01 0.000000e+00 0.000000e+00  
## 28 Hlnt.267\_711 -2.335690e-03 -1.148483e-02 1.611358e-03  
## 29 Hlnt.267\_712 -3.580157e-03 -3.124747e-02 8.387555e-04  
## 30 Erdm.267\_599 -2.754661e-05 -1.082883e-03 -1.066889e-04  
## 31 Erdm.267\_598 2.808797e-05 4.280003e-04 -6.524920e-05  
## 32 Ont..575\_1014 -3.797247e-02 -2.640438e-04 -1.654824e-06  
## 33 Sxfr.152\_1302 4.350709e-01 0.000000e+00 -1.068240e-01  
## 34 Pln2.608\_1122 2.861199e-03 -6.155718e-02 1.189334e-03  
## 35 Pln2.608\_1124 -1.185861e-02 -2.086196e-02 1.059105e-03  
## 36 Pln2.608\_1129 -6.571590e-03 -9.694594e-04 2.344591e-03  
## 37 Drc2.151\_550 -5.514313e-05 1.598278e-03 -1.286515e-04  
## 38 Drc2.151\_549 4.792627e-05 -1.991213e-03 -1.105230e-04  
## 39 Rmnd.445\_1217 -3.507665e-06 2.483465e-05 -8.568739e-06  
## 40 Rmnd.445\_1214 5.069338e-05 -1.280223e-02 5.437151e-04  
## 41 Myst.152\_983 6.352450e-01 0.000000e+00 2.104031e-03  
## 42 Gntn.423\_679 5.785807e-04 -3.895910e-03 9.044300e-04  
## 43 Hypc.282\_759 1.857057e-04 -8.573868e-04 1.252851e-02  
## 44 Echn.129\_555 -4.556823e-02 0.000000e+00 0.000000e+00  
## 45 Ech2.263\_557 -3.341240e-04 -2.446895e-04 1.211224e-06  
## 46 Ech2.263\_556 5.442867e-05 3.648008e-04 -9.845581e-05  
## 47 Rtbd.129\_1225 -6.581060e-01 0.000000e+00 0.000000e+00  
## 48 Ltrs.166\_862 -5.985893e-03 3.201929e-02 3.136667e-03  
## 49 Artm.355\_146 -3.480291e-05 1.380049e-05 1.180574e-03  
## 50 Sldg.129\_1354 -1.270544e-01 0.000000e+00 0.000000e+00  
## 51 Crsm.474\_389 -8.065638e-03 -1.568766e-02 0.000000e+00  
## 52 Crsm.283\_383 1.540169e-04 -1.194387e-04 -1.143753e-04  
## 53 Crsm.283\_384 3.489597e-04 -2.180634e-04 5.892436e-05  
## 54 Crsm.283\_386 5.062695e-04 6.639794e-03 1.117036e-02  
## 55 Crs3.41\_395 8.653618e-02 3.700410e-03 7.132525e-05  
## 56 Crs5.166\_400 8.155830e-02 7.619270e-04 1.274713e-04  
## 57 Crsm.129\_409 -2.326958e-02 0.000000e+00 0.000000e+00  
## 58 Jrnf.267\_786 -4.216837e-03 -1.427212e-04 1.230737e-04  
## 59 Cntr.282\_346 4.987168e-02 -4.278258e-03 -1.530113e-03  
## 60 Cntr.282\_347 2.742320e-02 3.520732e-03 -1.055724e-03  
## 61 Chrl.267\_374 -6.069221e-03 -1.206062e-03 0.000000e+00  
## 62 Crmc.301\_320 5.571422e-02 -1.885842e-03 7.835922e-04  
## 63 Crmc.301\_319 4.989620e-02 -8.745159e-03 -1.267489e-04  
## 64 Sccs.282\_1371 -2.506157e-04 1.272455e-03 1.058512e-03  
## 65 Sccs.282\_1370 5.875971e-04 3.624779e-04 -5.457551e-04  
## 66 Sccs.282\_1368 -6.744761e-05 1.534331e-03 -1.068427e-03  
## 67 Scc3.381\_1377 6.927251e-04 1.134496e-02 2.694870e-04  
## 68 Ards.431\_127 -2.818867e-04 -9.146217e-03 3.799730e-05  
## 69 Andr.152\_83 3.514658e-01 0.000000e+00 -3.849840e-02  
## 70 Prm4.582\_1157 -1.383515e-01 4.312519e-02 1.416895e-02  
## 71 Prm5.73\_1164 -7.772986e-06 1.600067e-03 1.700682e-03  
## 72 Prml.272\_1153 8.362892e-06 -7.918209e-04 -1.459930e-04  
## 73 Prml.596\_1165 3.602506e-04 1.076073e-02 1.101186e-03  
## 74 Prm2.170\_1169 -1.327601e-02 7.679306e-04 5.229724e-04  
## 75 Prm3.591\_1170 -4.455454e-04 2.412247e-03 3.129632e-04  
## 76 Srr2.571\_1298 -1.243162e-05 1.833618e-04 5.677130e-07  
## 77 Prny.129\_1065 -1.238293e-01 0.000000e+00 0.000000e+00  
## 78 Atrp.603\_217 2.355208e-04 -9.955307e-02 6.960505e-04  
## 79 Nbxb.182\_991 6.478582e-05 1.096793e-03 -2.204655e-05  
## 80 Nbx2.183\_992 6.889012e-05 1.764007e-03 -2.011543e-05  
## 81 Nbx3.183\_990 -4.282122e-06 -1.080990e-04 -8.074914e-05  
## 82 Mmml.193\_925 -1.337765e-06 7.099273e-04 1.307458e-03  
## 83 Mmm2.194\_928 -3.284005e-04 4.792671e-03 1.384336e-04  
## 84 Mmml.490\_935 -1.374624e-03 3.370801e-04 1.961760e-05  
## 85 Arcr.350\_132 -1.682590e-05 9.715924e-04 1.293279e-05  
## 86 Arcr.350\_131 -4.309725e-06 -4.129180e-04 3.501265e-04  
## 87 Cryp.511\_463 -9.527210e-06 -1.126878e-03 0.000000e+00  
## 88 Rmxr.267\_1261 1.198250e-04 1.785600e-03 -3.525705e-04  
## 89 Armr.208\_139 -2.174559e-03 -2.217982e-03 -7.709862e-05  
## 90 Lmnm.267\_871 -6.700071e-03 2.738740e-03 -6.570648e-04  
## 91 Rnnc.266\_1222 -4.509389e-02 -2.512034e-02 1.903172e-03  
## 92 Acts.204\_27 -7.254452e-05 2.080658e-03 4.607404e-04  
## 93 Acts.204\_28 -6.588281e-05 9.105740e-04 -2.351034e-04  
## 94 Dcnt.331\_511 -3.774857e-05 -1.493787e-04 -2.862153e-06  
## 95 Dcnt.331\_510 1.842111e-04 1.161441e-03 -1.939162e-04  
## 96 Dcnt.331\_509 -4.033717e-04 1.411501e-03 4.228909e-04  
## 97 Chmd.594\_367 -3.817657e-04 4.294244e-05 0.000000e+00  
## 98 Chmd.172\_368 3.176458e-04 2.708267e-03 1.582705e-03  
## 99 Brss.36\_238 -9.842322e-06 6.164722e-05 4.547185e-06  
## 100 Plpn.355\_1136 -9.921824e-05 2.448080e-03 2.793806e-04  
## 101 Zdpl.500\_1534 -1.057153e-04 1.343679e-02 9.896167e-04  
## 102 Dnth.384\_499 -3.826597e-03 1.996066e-03 2.438940e-03  
## 103 Hlrm.601\_725 -1.551924e-03 -2.504789e-02 1.198529e-03  
## 104 Ctps.143\_328 -8.939245e-03 3.979938e-04 -4.361848e-04  
## 105 Orch.273\_1029 -1.479776e-04 3.981909e-04 8.641597e-04  
## 106 Cypr.576\_483 -9.207344e-05 4.108961e-04 -3.307495e-04  
## 107 Cypr.576\_482 -1.186338e-04 2.274123e-03 1.937584e-03  
## 108 Cypr.576\_484 -4.596083e-05 -1.137449e-04 -5.377853e-04  
## 109 Allm.402\_69 2.766143e-03 -1.017325e-03 1.863293e-04  
## 110 Trll.304\_1438 0.000000e+00 -9.770756e-05 1.595867e-05  
## 111 Trll.304\_1442 0.000000e+00 7.217425e-04 -7.271393e-06  
## 112 Trll.304\_1446 0.000000e+00 6.397791e-04 -4.955547e-05  
## 113 Trll.304\_1443 0.000000e+00 1.018407e-04 -1.959553e-04  
## 114 Trll.304\_1437 0.000000e+00 -5.688097e-04 -1.698155e-04  
## 115 Trll.304\_1435 0.000000e+00 2.265819e-05 0.000000e+00  
## 116 Trll.304\_1439 0.000000e+00 2.564256e-04 2.294640e-05  
## 117 Trll.304\_1441 0.000000e+00 -1.568601e-03 3.146574e-07  
## 118 Trll.304\_1444 0.000000e+00 3.708480e-04 3.718267e-05  
## 119 Clch.382\_287 -4.962345e-04 6.965824e-04 3.703569e-04  
## 120 Asrm.131\_148 -6.751073e-03 1.041108e-03 0.000000e+00  
## 121 Pnss.391\_1116 8.702378e-06 1.773344e-04 0.000000e+00  
## Clonality\_SigElas Survival\_SigElas Cumulative\_SigElas Reproduction\_Base  
## 1 0.000000e+00 -1.492507e-03 -0.0025916716 0.0208575272  
## 2 0.000000e+00 -1.199857e-01 -0.1908436699 0.1574231567  
## 3 0.000000e+00 -6.514767e-03 -0.0090817103 0.0187942564  
## 4 0.000000e+00 6.431885e-02 0.0704828041 0.0100989031  
## 5 0.000000e+00 -7.402989e-04 0.2768842385 0.0000000000  
## 6 0.000000e+00 -3.302788e-04 -0.0006350713 0.0042349408  
## 7 0.000000e+00 -1.278424e-03 -0.0019932976 0.0046392387  
## 8 0.000000e+00 -4.386394e-04 -0.0005392551 0.0011490011  
## 9 0.000000e+00 -2.161637e-04 -0.0002214757 0.0051360454  
## 10 0.000000e+00 -2.491582e-03 -0.0044257874 0.0062306310  
## 11 0.000000e+00 -1.907617e-02 -0.0405794188 0.1590745115  
## 12 0.000000e+00 4.929481e-02 0.0631424979 0.0584920277  
## 13 0.000000e+00 -1.147877e-04 -0.0040666465 0.0319563555  
## 14 0.000000e+00 1.209782e-01 0.1605005273 0.0741727391  
## 15 0.000000e+00 -6.002037e-03 -0.0047268433 0.0405977458  
## 16 0.000000e+00 -1.122510e-03 -0.0093253474 0.0829108661  
## 17 0.000000e+00 -7.458346e-03 -0.0090805532 0.0770128960  
## 18 0.000000e+00 -1.087097e-01 -0.1235585541 0.3257759679  
## 19 0.000000e+00 1.196359e-03 0.0014600660 0.0052306828  
## 20 0.000000e+00 -8.748851e-03 -0.0145066615 0.0516656630  
## 21 0.000000e+00 -5.179131e-03 0.0881089646 0.0000000000  
## 22 0.000000e+00 3.004808e-03 0.0945894720 0.0000000000  
## 23 0.000000e+00 -9.294972e-03 0.0293266359 0.0000000000  
## 24 0.000000e+00 -3.394509e-02 0.1212177982 0.0000000000  
## 25 0.000000e+00 3.813056e-02 0.2037254736 0.0000000000  
## 26 0.000000e+00 -9.146317e-02 0.0450010817 0.0000000000  
## 27 0.000000e+00 -4.226229e-01 -0.6330270154 0.6677830504  
## 28 0.000000e+00 -1.087410e-02 -0.0230832569 0.0530603772  
## 29 0.000000e+00 -7.192719e-02 -0.1059160671 0.1254696234  
## 30 0.000000e+00 -9.970538e-04 -0.0022141725 0.0098806075  
## 31 0.000000e+00 -1.383320e-03 -0.0009924813 0.0131953830  
## 32 0.000000e+00 -6.886427e-02 -0.1071024312 0.0782870048  
## 33 0.000000e+00 -1.145268e-01 0.2137200951 0.0000000000  
## 34 0.000000e+00 -1.296219e-01 -0.1871285211 0.1806201390  
## 35 0.000000e+00 -6.666257e-02 -0.0983240409 0.1784938543  
## 36 0.000000e+00 -4.696490e-02 -0.0521613555 0.1371370729  
## 37 0.000000e+00 6.214475e-03 0.0076289579 0.0146967690  
## 38 0.000000e+00 -2.006373e-03 -0.0040601833 0.0257270307  
## 39 0.000000e+00 8.781801e-05 0.0001005763 0.0183693660  
## 40 0.000000e+00 -2.205962e-02 -0.0342674372 0.0109517287  
## 41 0.000000e+00 -2.059389e-03 0.6352896581 0.0000000000  
## 42 0.000000e+00 -8.605643e-03 -0.0110185425 0.0591399887  
## 43 9.106199e-04 -1.086539e-02 0.0019020587 0.0601162813  
## 44 0.000000e+00 -1.124150e-01 -0.1579832558 0.3886782543  
## 45 0.000000e+00 -4.998179e-04 -0.0010774201 0.0180489979  
## 46 0.000000e+00 4.976895e-04 0.0008184631 0.0272615749  
## 47 0.000000e+00 -1.355710e+00 -2.0138158723 1.1375038324  
## 48 0.000000e+00 1.216314e-02 0.0413332040 0.0840052449  
## 49 0.000000e+00 -2.632782e-03 -0.0014732110 0.0381488743  
## 50 0.000000e+00 -2.734569e-01 -0.4005113269 0.6514233962  
## 51 0.000000e+00 -3.054799e-02 -0.0543012894 0.1280766816  
## 52 1.807953e-01 -8.720921e-03 0.1719946290 0.0000000000  
## 53 7.802471e-02 -4.518761e-03 0.0736957665 0.0000000000  
## 54 2.395295e-01 -1.696512e-01 0.0881946579 0.0000000000  
## 55 0.000000e+00 8.134306e-03 0.0984422249 0.0000000000  
## 56 0.000000e+00 -9.336925e-04 0.0815140053 0.0000000000  
## 57 0.000000e+00 -4.756358e-02 -0.0708331612 0.4547379525  
## 58 0.000000e+00 -2.828022e-02 -0.0325167026 0.1146798428  
## 59 2.626497e-01 -2.402223e-02 0.2826907289 0.0000000000  
## 60 4.262420e-01 -7.199570e-02 0.3841345465 0.0000000000  
## 61 0.000000e+00 -1.375033e-02 -0.0210256103 0.1066981183  
## 62 0.000000e+00 -8.400276e-03 0.0462116981 0.0000000000  
## 63 0.000000e+00 -4.276458e-03 0.0367478326 0.0000000000  
## 64 8.462191e-04 1.191313e-03 0.0041178833 0.0442656069  
## 65 2.201031e-05 1.613227e-03 0.0020395569 0.0588650721  
## 66 1.797835e-04 1.966254e-03 0.0025444941 0.0547330460  
## 67 0.000000e+00 4.990288e-02 0.0622100563 0.0406600099  
## 68 0.000000e+00 1.951426e-02 0.0101241581 0.0484153522  
## 69 0.000000e+00 -9.305599e-02 0.2199114054 0.0000000000  
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## 71 0.000000e+00 -7.504536e-03 -0.0042115602 0.0480514082  
## 72 0.000000e+00 -2.314389e-03 -0.0032438397 0.0326831824  
## 73 0.000000e+00 -4.275384e-02 -0.0305316733 0.0302341211  
## 74 0.000000e+00 -1.809123e-02 -0.0300763392 0.0686846184  
## 75 0.000000e+00 -5.575161e-05 0.0022239136 0.0460930633  
## 76 0.000000e+00 2.331020e-04 0.0004045999 0.0206966824  
## 77 0.000000e+00 -2.811162e-01 -0.4049455351 0.5248679129  
## 78 0.000000e+00 -1.367290e-01 -0.2353505230 0.0278021143  
## 79 0.000000e+00 1.594839e-03 0.0027343721 0.0060150092  
## 80 0.000000e+00 -3.172368e-03 -0.0013595864 0.0065561255  
## 81 0.000000e+00 8.680372e-04 0.0006749069 0.0116839089  
## 82 0.000000e+00 -8.349851e-05 0.0019325491 0.0001958907  
## 83 0.000000e+00 8.959835e-03 0.0135625394 0.0663375594  
## 84 0.000000e+00 -3.171483e-03 -0.0041894093 0.0170813096  
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## 86 0.000000e+00 -3.169151e-02 -0.0317586117 0.0028227417  
## 87 0.000000e+00 -1.048319e-03 -0.0021847250 0.0256800228  
## 88 0.000000e+00 -1.200429e-02 -0.0104514359 0.0195919196  
## 89 0.000000e+00 -5.819248e-03 -0.0102888869 0.0643206097  
## 90 0.000000e+00 -4.083153e-03 -0.0087015483 0.0805434729  
## 91 0.000000e+00 -1.307869e-01 -0.1990979463 0.2774854882  
## 92 0.000000e+00 5.421641e-03 0.0078904944 0.0278940086  
## 93 0.000000e+00 5.401356e-03 0.0060109438 0.0157481089  
## 94 -7.275529e-05 -1.323052e-05 -0.0002759752 0.0035427636  
## 95 2.233719e-04 -9.700826e-06 0.0013654069 0.0102294121  
## 96 3.039467e-04 6.954876e-04 0.0024304547 0.0205109477  
## 97 -2.120882e-05 -2.245672e-04 -0.0005845992 0.0232502019  
## 98 0.000000e+00 -3.716247e-04 0.0042369927 0.0271430776  
## 99 0.000000e+00 4.172605e-04 0.0004736126 0.0098350576  
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## 101 0.000000e+00 7.758207e-03 0.0220788988 0.0343599847  
## 102 0.000000e+00 -3.591053e-02 -0.0353021194 0.0546882635  
## 103 0.000000e+00 -8.005753e-02 -0.1054588184 0.0658793777  
## 104 0.000000e+00 -1.272564e-02 -0.0217030794 0.0454652527  
## 105 0.000000e+00 -5.077108e-03 -0.0039627351 0.0198246100  
## 106 0.000000e+00 -1.337868e-03 -0.0013497951 0.0279596217  
## 107 0.000000e+00 -1.334057e-04 0.0039596679 0.0260059423  
## 108 0.000000e+00 -2.273735e-03 -0.0029712256 0.0257139012  
## 109 2.708920e-01 -2.358525e-03 0.2704686714 0.0000000000  
## 110 0.000000e+00 -1.731355e-03 -0.0018131038 0.0076042551  
## 111 0.000000e+00 -1.970706e-04 0.0005174006 0.0131320524  
## 112 0.000000e+00 1.151916e-03 0.0017421393 0.0016302185  
## 113 0.000000e+00 -8.259829e-04 -0.0009200976 0.0075877066  
## 114 0.000000e+00 -7.087578e-04 -0.0014473830 0.0181232486  
## 115 0.000000e+00 -5.200273e-04 -0.0004973691 0.0080675020  
## 116 0.000000e+00 -4.206070e-04 -0.0001412349 0.0088870471  
## 117 0.000000e+00 -4.055232e-03 -0.0056235191 0.0209670439  
## 118 0.000000e+00 3.065281e-05 0.0004386835 0.0062736872  
## 119 0.000000e+00 -1.646235e-03 -0.0010755302 0.0298040064  
## 120 -1.010784e-03 -2.229265e-02 -0.0290133976 0.0516794999  
## 121 0.000000e+00 9.126873e-04 0.0010987241 0.0044381842  
## Growth\_Base Shrinking\_Base Clonality\_Base Survival\_Base Cumulative\_Base  
## 1 0.017781476 -0.0040658388 0.000000000 1.03620846 1.0707816  
## 2 0.291021640 -0.0235077738 0.000000000 1.22124002 1.6461770  
## 3 0.046532915 -0.0252377704 0.000000000 0.99849590 1.0385853  
## 4 0.123153808 -0.1211425363 0.000000000 2.22153669 2.2336469  
## 5 0.227465719 0.0000000000 0.000000000 0.31028144 0.5377472  
## 6 0.022956031 -0.0169400089 0.000000000 1.01244470 1.0226957  
## 7 0.024670040 -0.0066842007 0.000000000 0.98314050 1.0057656  
## 8 0.021885167 -0.0459680732 0.000000000 1.04099839 1.0180645  
## 9 0.029506109 -0.0157584576 0.000000000 0.97712079 0.9960045  
## 10 0.030017554 -0.0278808876 0.000000000 1.03087155 1.0392388  
## 11 0.148486462 -0.1787462820 0.000000000 0.98717326 1.1159879  
## 12 0.221682266 0.0000000000 0.000000000 0.64633146 0.9265058  
## 13 0.048060150 -0.0220012523 0.000000000 0.96090237 1.0189176  
## 14 0.150528002 0.0000000000 0.000000000 0.71863947 0.9433402  
## 15 0.135504333 -0.0542912135 0.000000000 1.01154790 1.1333588  
## 16 0.151524711 -0.0335898645 0.000000000 0.95637650 1.1572222  
## 17 0.131612228 -0.0468899761 0.000000000 0.96817896 1.1299141  
## 18 0.323320075 -0.0109667062 0.000000000 1.59009900 2.2282283  
## 19 0.025705011 0.0000000000 0.000000000 1.07303795 1.1039736  
## 20 0.077070222 0.0000000000 0.000000000 0.97785757 1.1065935  
## 21 0.068110375 0.0000000000 0.000000000 0.79927550 0.8673859  
## 22 0.120071752 0.0000000000 0.000000000 1.03441703 1.1544888  
## 23 0.017402154 0.0000000000 0.000000000 1.22880092 1.2462031  
## 24 0.124064805 0.0000000000 0.000000000 0.80641755 0.9304824  
## 25 0.119606632 0.0000000000 0.000000000 0.91152088 1.0311275  
## 26 0.102090469 0.0000000000 0.000000000 0.82794900 0.9300395  
## 27 0.000000000 0.0000000000 0.000000000 1.51032393 2.1781070  
## 28 0.196690337 -0.0183160611 0.000000000 1.06272781 1.2941625  
## 29 0.230190580 -0.0084022304 0.000000000 1.06742358 1.4146815  
## 30 0.045247924 -0.0451766662 0.000000000 1.03927339 1.0492253  
## 31 0.038922030 -0.0326056406 0.000000000 1.00949956 1.0290113  
## 32 -0.030593473 -0.0001670247 0.000000000 1.22658918 1.2741157  
## 33 0.000000000 0.2629095281 0.000000000 0.30404508 0.5669546  
## 34 0.326295790 -0.0295399738 0.000000000 1.30948060 1.7868566  
## 35 0.279340611 -0.0602550298 0.000000000 1.07791415 1.4754936  
## 36 0.239336493 -0.0622901604 0.000000000 0.99828306 1.3124665  
## 37 0.065332427 -0.0149823337 0.000000000 1.05571168 1.1207585  
## 38 0.091023884 -0.0328602230 0.000000000 1.00685253 1.0907432  
## 39 0.062215130 -0.0417155300 0.000000000 0.95843770 0.9973067  
## 40 0.096199075 -0.0587740376 0.000000000 1.06774405 1.1161208  
## 41 0.000000000 0.0115234209 0.000000000 0.03209838 0.0436218  
## 42 0.099974244 -0.0627958489 0.000000000 0.94980496 1.0461233  
## 43 0.164456841 -0.1810876763 0.012214464 1.23914955 1.2948495  
## 44 0.000000000 0.0000000000 0.000000000 1.23599012 1.6246684  
## 45 0.039190766 -0.0009753174 0.000000000 0.97744271 1.0337072  
## 46 0.050889005 -0.0042012425 0.000000000 0.97562538 1.0495747  
## 47 0.000000000 0.0000000000 0.000000000 2.45764352 3.5951474  
## 48 0.134589297 0.0289033902 0.000000000 0.96562966 1.2131276  
## 49 0.118713556 -0.0628747860 0.000000000 0.95838311 1.0523708  
## 50 0.000000000 0.0000000000 0.000000000 1.43506497 2.0864884  
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## 55 0.113529808 -0.0041325400 0.000000000 0.81297575 0.9223730  
## 56 0.217607014 -0.0028378709 0.000000000 0.64000095 0.8547701  
## 57 0.000000000 0.0000000000 0.000000000 1.07825094 1.5329889  
## 58 -0.001372050 0.0001373277 0.000000000 1.35556564 1.4690108  
## 59 0.026680203 -0.0154953162 0.030787899 0.98226863 1.0242414  
## 60 0.047808690 -0.0229034305 0.055981476 0.72853318 0.8094199  
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## 64 0.103048068 -0.0900381779 0.034161470 0.88920956 0.9806465  
## 65 0.138403085 -0.1361218754 0.027447941 0.79105726 0.8796515  
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## 67 0.187984472 -0.1306052695 0.000000000 1.55177268 1.6498119  
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## 72 0.055320836 -0.0218010111 0.000000000 0.97139525 1.0375983  
## 73 0.243400369 -0.0554456229 0.000000000 1.18163904 1.3998279  
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## 78 0.216144518 -0.0458118616 0.000000000 1.31993191 1.5180667  
## 79 0.159642083 -0.0040220568 0.000000000 1.64401260 1.8056476  
## 80 0.193937066 -0.0042020252 0.000000000 2.38888247 2.5851736  
## 81 0.078342692 -0.0084147900 0.000000000 1.05781380 1.1394256  
## 82 -0.050405568 0.0263010878 0.000000000 1.29906693 1.2751583  
## 83 0.103417058 -0.0056524778 0.000000000 0.93769479 1.1017969  
## 84 0.041711295 -0.0004832786 0.000000000 1.23150437 1.2898137  
## 85 0.024950349 -0.0115239683 0.000000000 1.07769763 1.0968020  
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## 90 0.116189830 -0.0346288606 0.000000000 1.07023951 1.2323440  
## 91 0.398259365 -0.2083035597 0.000000000 1.35634656 1.8237879  
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## 93 0.093431309 -0.0393049347 0.000000000 1.09558933 1.1654638  
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## 98 0.132674155 -0.0394176495 0.000000000 1.00333242 1.1237320  
## 99 0.033062103 -0.0053357852 0.000000000 0.99004996 1.0276113  
## 100 0.129928283 -0.0783082269 0.027819520 1.01306307 1.1043726  
## 101 0.182006831 -0.1422626605 0.000000000 1.19951011 1.2736143  
## 102 0.174640656 -0.0753612293 0.000000000 0.99973661 1.1537043  
## 103 0.246035305 -0.1900279065 0.000000000 1.28762943 1.4095162  
## 104 0.133373439 -0.0303284455 0.000000000 0.99427635 1.1427866  
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## 106 0.045580418 -0.0131448866 0.000000000 1.00702250 1.0674177  
## 107 0.046465967 -0.0221385594 0.000000000 1.04470643 1.0950398  
## 108 0.037802608 -0.0076329839 0.000000000 1.03810595 1.0939895  
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## Buffmx MatRep LHPC.1 LHPC.2 ClimPC.1 ClimPC.2  
## 1 1.0004237 4 1.32464828 0.537854879 0.1901416531 -0.28772696  
## 2 1.1469247 53 -1.42492399 -0.649069599 -1.7561907820 0.04956925  
## 3 1.0117730 4 0.56077336 0.164523234 1.8598982808 -0.06178840  
## 4 1.0988250 7 -0.96962137 -0.340730299 0.4375307731 2.67206519  
## 5 1.0172371 3 1.09629297 0.389760264 -0.7730831616 0.34794691  
## 6 0.9975678 4 -0.55655519 -0.813525720 1.4472669041 -1.00114517  
## 7 1.0013987 4 -1.06729001 -0.261477978 1.2858271979 -0.89654864  
## 8 1.0010531 4 2.37514805 -1.099652568 1.0944563796 -1.24164970  
## 9 0.9976748 4 2.34539416 -1.157483245 1.1425652992 -1.16795116  
## 10 1.0062788 4 0.21879672 -0.185191173 1.1212553499 -1.13208352  
## 11 1.1022898 5 0.33967682 -0.204267535 1.6907544333 1.99312203  
## 12 1.0064223 6 0.58654442 1.552895288 0.4760451051 -0.32094170  
## 13 1.0045646 3 2.68610180 -1.508329446 0.1855146450 0.65577927  
## 14 1.0902586 4 2.13295782 0.859818742 -0.1224602535 0.86297646  
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## 16 1.0579087 5 -0.38478405 -0.092261418 -0.2316797050 0.95835523  
## 17 1.0110815 6 1.50838482 0.269527637 -0.2223902021 0.89572714  
## 18 1.9381641 17 0.62209109 -0.432490111 0.8774241269 -1.13693440  
## 19 0.9954316 5 1.00434501 0.295205182 -2.3926197845 -0.18185305  
## 20 1.0169975 4 1.35067955 -0.954406230 2.0755021947 0.95538347  
## 21 1.0414770 3 -0.12053648 0.342208089 1.1086906247 -0.46406791  
## 22 1.0671800 3 0.65426452 1.301049021 1.2417517508 0.82778456  
## 23 1.0141861 3 2.13426916 -0.807632593 1.2283556324 -0.35890996  
## 24 1.1081790 3 1.89249324 0.989150312 1.0126619397 0.12345998  
## 25 1.3555067 3 -0.26206038 0.259625422 1.0181982496 -0.44286222  
## 26 1.2751194 3 1.64771068 0.290618241 1.1150215913 -0.48773093  
## 27 1.1199191 26 -4.62204819 0.597566619 2.4257757354 2.21229460  
## 28 1.0095946 5 -2.83595721 2.971082188 0.0645731944 0.94284066  
## 29 1.0948962 3 -0.34423198 1.409778546 -0.4073604547 0.58685928  
## 30 1.0029059 5 -0.18148396 -0.020375412 0.1418401072 0.56464639  
## 31 1.0013082 5 0.11793730 -0.034542972 -0.0134516680 0.61697753  
## 32 1.0016803 12 2.30548757 2.560948144 -0.2355186453 1.72796797  
## 33 1.0881019 6 1.72460210 0.590967280 0.7395830604 -0.26063871  
## 34 1.1898041 3 -0.07774510 -0.316277460 -0.6879615697 2.10077564  
## 35 1.0598832 3 -0.43331618 -0.390104238 -0.6894463627 -0.46803216  
## 36 1.1273793 3 -0.07259981 -0.497804902 0.7626892441 -1.02418802  
## 37 1.0064561 3 1.38217819 -0.087009229 0.9505472946 0.25373062  
## 38 1.0011119 3 0.28268740 0.199731108 0.9529629675 0.36575851  
## 39 1.0017544 3 1.79724754 1.340636343 0.5968969616 0.46873583  
## 40 1.0100856 6 0.02348962 0.089457485 0.8265089105 0.29215625  
## 41 1.0617870 3 2.04385585 0.943217705 0.7395830604 -0.26063871  
## 42 1.0819747 3 -4.13027561 1.133271320 0.7619565639 -0.18606683  
## 43 1.0520314 3 -1.07358046 0.040761906 0.4863720564 -0.20995834  
## 44 1.1249988 30 0.41477648 0.299127306 2.2871049397 2.41124712  
## 45 0.9966785 5 0.18242622 0.276822341 0.5918071001 0.09849035  
## 46 1.0017862 3 -1.33815439 -1.158104197 0.2767905277 -0.64299861  
## 47 1.1427458 14 -2.29821434 -0.517832263 2.4257757354 2.21229460  
## 48 1.1040372 5 1.47004816 0.722283861 1.3884443409 -0.35922791  
## 49 1.0111736 3 1.87801910 0.282782785 0.9097750097 -2.39020122  
## 50 1.1766299 19 -4.23747569 0.323511508 2.4257757354 2.21229460  
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## 52 1.0064660 3 -3.08938703 0.215411257 0.4014577875 -0.18865705  
## 53 1.0222895 3 2.77729996 -0.744645144 0.4681051969 -0.21333330  
## 54 1.1123591 3 1.21352791 -0.371621315 0.4667961789 -0.21919017  
## 55 1.0699287 4 -0.10507296 -0.826523034 0.9451028628 -0.59948045  
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## 57 1.1238899 25 0.82647843 -1.007634897 2.2871049397 2.41124712  
## 58 1.0203434 4 0.87005479 0.671516129 -0.4681933238 0.06649261  
## 59 1.0022460 4 1.60244842 -0.868181765 0.4014577875 -0.18865705  
## 60 1.0170315 4 0.44521397 -0.640920856 0.4681051969 -0.21333330  
## 61 1.0006248 3 0.44057252 -0.616964686 -0.1397928929 0.53624725  
## 62 1.0144133 3 0.87544995 -0.307634285 1.0769134011 -0.69736036  
## 63 1.0081205 3 1.28762421 -0.894993575 1.5329901236 -1.12182273  
## 64 1.0137131 4 -4.23747569 0.323511508 0.4302852079 -0.24179492  
## 65 1.0124443 3 -4.96112780 0.549810577 0.4681051969 -0.21333330  
## 66 0.9987339 4 -4.62629978 0.596240214 0.4014577875 -0.18865705  
## 67 1.0643938 15 0.16203807 0.012146991 1.8156994500 0.02731675  
## 68 1.0282270 3 -0.45828842 -0.257370385 -2.2039661972 -0.43245497  
## 69 1.2549325 5 -1.48937190 -0.851180889 0.7395830604 -0.26063871  
## 70 1.0963114 3 0.42060089 0.846082394 1.3902869769 -0.07324338  
## 71 1.0528927 12 1.41128425 -0.625449275 0.3891227737 -0.17737344  
## 72 1.0043468 5 0.81871825 -0.579572921 0.3475026740 -0.77983148  
## 73 1.2005358 10 1.50162477 -0.738864602 -0.2549818707 -0.92466195  
## 74 1.0136580 14 0.41502047 -0.532623775 -0.0002088708 -0.78039694  
## 75 1.0062161 24 2.06022126 -0.954533847 -0.7425642082 -1.34483703  
## 76 1.0001203 4 -4.34768652 0.310739550 0.9599472516 -0.87928286  
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## 78 1.1415555 3 -2.09548698 -0.294589929 -0.6145513071 2.70427584  
## 79 0.9857018 3 -0.32716913 -0.179802414 -1.3738783145 0.37527046  
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## 82 1.0026622 5 0.36538940 -0.179072345 -1.5952953930 1.02210963  
## 83 1.0040824 5 0.46331537 0.137758712 -1.6917671379 0.86555414  
## 84 0.9991667 3 0.88092508 2.144336179 -1.6309258120 0.38437375  
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## 87 1.0052818 5 1.53069143 -0.833409703 0.7670786060 1.90505915  
## 88 1.0143370 4 -1.45321573 -0.801290883 -0.6197935504 -0.30374064  
## 89 1.0133921 24 -0.03599821 0.248647534 0.0290749929 0.21792912  
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## 95 1.0031133 6 -0.22657292 -0.270479797 0.3770234619 0.06830037  
## 96 1.0048691 6 -1.29266891 -0.727598290 0.4736846285 0.10346305  
## 97 1.0040503 6 0.87637358 0.024204126 -3.6880681000 -1.75233219  
## 98 1.0115493 14 -1.25296387 -0.305498084 -1.2433093245 1.12819762  
## 99 1.0001780 4 0.93360200 0.039306015 -2.3197370835 0.27446076  
## 100 1.0040632 5 -0.48113223 -0.267143995 0.9097750097 -2.39020122  
## 101 1.0422046 11 1.11591045 -0.224008873 -1.0543613796 0.73770969  
## 102 1.0713503 3 -3.11960903 0.615379811 0.2801875797 0.21788596  
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## 104 1.0132490 3 -1.06761350 -0.556191663 -1.8739491435 -0.45318379  
## 105 1.0043283 16 -1.24316113 -0.737201942 0.7979207719 -0.33450502  
## 106 1.0047770 7 -1.16028746 0.577307150 0.3430433599 1.61505992  
## 107 1.0181906 7 -2.70732004 1.708784793 0.4949018701 2.25916732  
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## 109 1.0117780 4 -1.29887476 -0.383840462 1.4732264132 -1.63849580  
## 110 1.0014665 5 -0.11102808 -0.001042222 0.5057094428 -0.87317673  
## 111 0.9991554 5 -0.11288327 -0.263697643 0.6055468241 -0.77949621  
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## 113 0.9974504 3 -0.16314967 0.243580718 0.5731929552 -0.84398631  
## 114 1.0012208 5 -0.35598966 0.239821971 0.4951619353 -0.85904086  
## 115 1.0036398 3 -0.03661108 -0.264173768 0.5134626127 -0.82758632  
## 116 0.9997875 7 -0.28062667 -0.043255956 0.5082677717 -0.86911082  
## 117 0.9995278 3 -0.28035214 -0.155445924 0.6076304668 -0.74343628  
## 118 1.0010317 4 -0.21225711 -0.001855859 0.6734935916 -0.66963609  
## 119 1.0061722 32 2.16602800 -0.257929140 2.0927212323 -0.52744279  
## 120 1.0207404 14 0.63911719 0.437562271 2.8220623624 -1.68655232  
## 121 0.9959259 9 2.05580076 0.097852476 0.5888131058 -1.28451621  
## ClimPC.3 SpeciesAccepted.x Kingdom.x Phylum.x  
## 1 -0.32364884 Euphorbia fontqueriana Plantae Magnoliophyta  
## 2 0.52991276 Hypericum cumulicola Plantae Magnoliophyta  
## 3 0.11224260 Agrimonia eupatoria Plantae Magnoliophyta  
## 4 0.96562898 Purshia subintegra Plantae Magnoliophyta  
## 5 0.40958101 Cucurbita pepo Plantae Magnoliophyta  
## 6 0.36312670 Castanea dentata Plantae Tracheophyta  
## 7 0.03574476 Castanea dentata Plantae Tracheophyta  
## 8 0.01949560 Castanea dentata Plantae Tracheophyta  
## 9 0.00961047 Castanea dentata Plantae Tracheophyta  
## 10 0.10430753 Castanea dentata Plantae Tracheophyta  
## 11 -0.88785777 Astragalus scaphoides Plantae Magnoliophyta  
## 12 -0.12789129 Astragalus alopecurus Plantae Magnoliophyta  
## 13 -0.28465691 Astragalus tremolsianus Plantae Magnoliophyta  
## 14 -0.17848110 Dorycnium spectabile Plantae Magnoliophyta  
## 15 0.62282181 Anthyllis vulneraria Plantae Magnoliophyta  
## 16 0.21723754 Lupinus tidestromii Plantae Magnoliophyta  
## 17 0.17701314 Lupinus tidestromii Plantae Magnoliophyta  
## 18 1.62120290 Lupinus lepidus Plantae Magnoliophyta  
## 19 0.59888797 Carapa guianensis Plantae Magnoliophyta  
## 20 1.32691290 Acer saccharum Plantae Magnoliophyta  
## 21 -0.20821291 Alliaria petiolata Plantae Magnoliophyta  
## 22 0.44571374 Alliaria petiolata Plantae Magnoliophyta  
## 23 -0.32905057 Alliaria petiolata Plantae Magnoliophyta  
## 24 0.06007740 Alliaria petiolata Plantae Magnoliophyta  
## 25 -0.33302275 Alliaria petiolata Plantae Magnoliophyta  
## 26 -0.43707692 Alliaria petiolata Plantae Magnoliophyta  
## 27 1.20748053 Sphaeralcea coccinea Plantae Magnoliophyta  
## 28 0.03310394 Helianthemum polygonoides Plantae Magnoliophyta  
## 29 -0.39610567 Helianthemum teneriffae Plantae Magnoliophyta  
## 30 -0.07098295 Erodium paularense Plantae Magnoliophyta  
## 31 -0.02090477 Erodium paularense Plantae Magnoliophyta  
## 32 0.55070377 Oenothera deltoides Plantae Magnoliophyta  
## 33 -0.59497021 Saxifraga tridactylites Plantae Magnoliophyta  
## 34 1.02619889 Plantago coronopus Plantae Magnoliophyta  
## 35 0.07901195 Plantago coronopus Plantae Magnoliophyta  
## 36 -0.31691032 Plantago coronopus Plantae Magnoliophyta  
## 37 -0.36804073 Dracocephalum austriacum Plantae Magnoliophyta  
## 38 -0.36555976 Dracocephalum austriacum Plantae Magnoliophyta  
## 39 0.40369338 Ramonda myconi Plantae Magnoliophyta  
## 40 0.53507414 Ramonda myconi Plantae Magnoliophyta  
## 41 -0.59497021 Myosotis ramosissima Plantae Magnoliophyta  
## 42 -0.02771252 Gentiana pneumonanthe Plantae Magnoliophyta  
## 43 -0.37533525 Hypochaeris radicata Plantae Magnoliophyta  
## 44 1.25690733 Echinacea angustifolia Plantae Magnoliophyta  
## 45 -0.05782457 Echinacea angustifolia Plantae Magnoliophyta  
## 46 -0.31952387 Echinacea angustifolia Plantae Magnoliophyta  
## 47 1.20748053 Ratibida columnifera Plantae Magnoliophyta  
## 48 -0.01312157 Liatris scariosa Plantae Magnoliophyta  
## 49 0.62282181 Artemisia genipi Plantae Magnoliophyta  
## 50 1.20748053 Solidago mollis Plantae Magnoliophyta  
## 51 -0.78333529 Cirsium palustre Plantae Magnoliophyta  
## 52 -0.38653722 Cirsium dissectum Plantae Magnoliophyta  
## 53 -0.37798458 Cirsium dissectum Plantae Magnoliophyta  
## 54 -0.31861025 Cirsium dissectum Plantae Magnoliophyta  
## 55 0.12070552 Cirsium pitcheri Plantae Magnoliophyta  
## 56 0.12318110 Cirsium pitcheri Plantae Magnoliophyta  
## 57 1.25690733 Cirsium undulatum Plantae Magnoliophyta  
## 58 -0.21288706 Jurinea fontqueri Plantae Magnoliophyta  
## 59 -0.38653722 Centaurea jacea Plantae Magnoliophyta  
## 60 -0.37798458 Centaurea jacea Plantae Magnoliophyta  
## 61 -0.42230483 Cheirolophus metlesicsii Plantae Magnoliophyta  
## 62 -1.47238536 Carum carvi Plantae Magnoliophyta  
## 63 -0.83812394 Carum carvi Plantae Magnoliophyta  
## 64 -0.36925265 Succisa pratensis Plantae Magnoliophyta  
## 65 -0.37798458 Succisa pratensis Plantae Magnoliophyta  
## 66 -0.38653722 Succisa pratensis Plantae Magnoliophyta  
## 67 -0.03538656 Succisa pratensis Plantae Magnoliophyta  
## 68 0.32090193 Ardisia escallonioides Plantae Magnoliophyta  
## 69 -0.59497021 Androsace elongata Plantae Magnoliophyta  
## 70 -0.37001193 Primula farinosa Plantae Tracheophyta  
## 71 -0.29741967 Primula veris Plantae Magnoliophyta  
## 72 -0.34411841 Primula elatior Plantae Magnoliophyta  
## 73 -0.86292672 Primula vulgaris Plantae Magnoliophyta  
## 74 -0.78443947 Primula vulgaris Plantae Magnoliophyta  
## 75 -0.11362628 Primula vulgaris Plantae Magnoliophyta  
## 76 -0.56193794 Sarracenia purpurea Plantae Magnoliophyta  
## 77 1.25690733 Paronychia jamesii Plantae Magnoliophyta  
## 78 0.86974688 Atriplex canescens Plantae Tracheophyta  
## 79 -0.30163189 Neobuxbaumia mezcalaensis Plantae Magnoliophyta  
## 80 -0.30163189 Neobuxbaumia mezcalaensis Plantae Magnoliophyta  
## 81 -0.30163189 Neobuxbaumia macrocephala Plantae Magnoliophyta  
## 82 0.21559050 Mammillaria huitzilopochtli Plantae Magnoliophyta  
## 83 0.20846126 Mammillaria huitzilopochtli Plantae Magnoliophyta  
## 84 -0.24287384 Mammillaria solisioides Plantae Magnoliophyta  
## 85 0.95716696 Ariocarpus fissuratus Plantae Magnoliophyta  
## 86 0.94874098 Ariocarpus fissuratus Plantae Magnoliophyta  
## 87 0.98725395 Escobaria robbinsorum Plantae Magnoliophyta  
## 88 0.21859866 Rumex rupestris Plantae Magnoliophyta  
## 89 0.04057466 Armeria caespitosa Plantae Magnoliophyta  
## 90 -0.02332064 Limonium erectum Plantae Magnoliophyta  
## 91 0.32163290 Ranunculus peltatus Plantae Magnoliophyta  
## 92 0.03820071 Actaea spicata Plantae Magnoliophyta  
## 93 0.06856271 Actaea spicata Plantae Magnoliophyta  
## 94 0.04085176 Dicentra canadensis Plantae Tracheophyta  
## 95 0.02851837 Dicentra canadensis Plantae Tracheophyta  
## 96 -0.09195498 Dicentra canadensis Plantae Tracheophyta  
## 97 2.02884510 Chamaedorea elegans Plantae Magnoliophyta  
## 98 0.74686358 Chamaedorea radicalis Plantae Magnoliophyta  
## 99 0.25868305 Borassus aethiopum Plantae Magnoliophyta  
## 100 0.62282181 Poa alpina Plantae Magnoliophyta  
## 101 0.79148913 Zea diploperennis Plantae Magnoliophyta  
## 102 0.18110723 Danthonia sericea Plantae Magnoliophyta  
## 103 0.76691034 Hilaria mutica Plantae Magnoliophyta  
## 104 -0.14444214 Catopsis compacta Plantae Magnoliophyta  
## 105 -0.03864572 Orchis purpurea Plantae Magnoliophyta  
## 106 0.91408058 Cypripedium fasciculatum Plantae Magnoliophyta  
## 107 0.83829973 Cypripedium fasciculatum Plantae Magnoliophyta  
## 108 0.65950726 Cypripedium fasciculatum Plantae Magnoliophyta  
## 109 0.55521569 Allium tricoccum Plantae Magnoliophyta  
## 110 -0.25452323 Trillium grandiflorum Plantae Magnoliophyta  
## 111 -0.35605880 Trillium grandiflorum Plantae Magnoliophyta  
## 112 -0.25529127 Trillium grandiflorum Plantae Magnoliophyta  
## 113 -0.31908468 Trillium grandiflorum Plantae Magnoliophyta  
## 114 -0.27161723 Trillium grandiflorum Plantae Magnoliophyta  
## 115 -0.33631872 Trillium grandiflorum Plantae Magnoliophyta  
## 116 -0.28504364 Trillium grandiflorum Plantae Magnoliophyta  
## 117 -0.35436699 Trillium grandiflorum Plantae Magnoliophyta  
## 118 -0.40946570 Trillium grandiflorum Plantae Magnoliophyta  
## 119 1.62879830 Calochortus lyallii Plantae Magnoliophyta  
## 120 1.66817327 Asarum canadense Plantae Magnoliophyta  
## 121 0.11992176 Pinus strobus Plantae Pinophyta  
## Class.x Order.x OrganismType.x AngioGymno.x lambda  
## 1 Magnoliopsida Malpighiales Succulent Angiosperm 0.9779625  
## 2 Magnoliopsida Theales Herbaceous perennial Angiosperm 1.0243679  
## 3 Magnoliopsida Rosales Herbaceous perennial Angiosperm 0.9283973  
## 4 Magnoliopsida Rosales Shrub Angiosperm 0.9751571  
## 5 Magnoliopsida Curcurbitales Annual Angiosperm 1.2408827  
## 6 Magnoliopsida Fagales Tree Angiosperm 1.0088920  
## 7 Magnoliopsida Fagales Tree Angiosperm 1.0067955  
## 8 Magnoliopsida Fagales Tree Angiosperm 0.9940440  
## 9 Magnoliopsida Fagales Tree Angiosperm 0.9934334  
## 10 Magnoliopsida Fagales Tree Angiosperm 0.9818987  
## 11 Magnoliopsida Fabales Herbaceous perennial Angiosperm 1.5999061  
## 12 Magnoliopsida Fabales Herbaceous perennial Angiosperm 1.5506323  
## 13 Magnoliopsida Fabales Herbaceous perennial Angiosperm 1.0965123  
## 14 Magnoliopsida Fabales Herbaceous perennial Angiosperm 1.9158723  
## 15 Magnoliopsida Fabales Herbaceous perennial Angiosperm 1.0510285  
## 16 Magnoliopsida Fabales Herbaceous perennial Angiosperm 1.0111035  
## 17 Magnoliopsida Fabales Herbaceous perennial Angiosperm 0.9262035  
## 18 Magnoliopsida Fabales Herbaceous perennial Angiosperm 0.9799277  
## 19 Magnoliopsida Sapindales Tree Angiosperm 0.9956000  
## 20 Magnoliopsida Sapindales Tree Angiosperm 0.9644052  
## 21 Magnoliopsida Brassicales Herbaceous perennial Angiosperm 1.0239866  
## 22 Magnoliopsida Brassicales Herbaceous perennial Angiosperm 1.4037297  
## 23 Magnoliopsida Brassicales Herbaceous perennial Angiosperm 0.7869247  
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## 25 Magnoliopsida Brassicales Herbaceous perennial Angiosperm 0.9716492  
## 26 Magnoliopsida Brassicales Herbaceous perennial Angiosperm 1.3648033  
## 27 Magnoliopsida Malvales Herbaceous perennial Angiosperm 0.7611410  
## 28 Magnoliopsida Malvales Herbaceous perennial Angiosperm 0.9308673  
## 29 Magnoliopsida Malvales Herbaceous perennial Angiosperm 1.5407796  
## 30 Magnoliopsida Geraniales Herbaceous perennial Angiosperm 0.9575419  
## 31 Magnoliopsida Geraniales Herbaceous perennial Angiosperm 1.0879999  
## 32 Magnoliopsida Myrtales Herbaceous perennial Angiosperm 0.8553326  
## 33 Magnoliopsida Saxifragales Annual Angiosperm 1.8316693  
## 34 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 0.5322755  
## 35 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 1.1257721  
## 36 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 1.7314892  
## 37 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 0.9656341  
## 38 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 0.9791057  
## 39 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 1.0326716  
## 40 Magnoliopsida Lamiales Herbaceous perennial Angiosperm 0.9677607  
## 41 Magnoliopsida Lamiales Annual Angiosperm 1.6732773  
## 42 Magnoliopsida Gentianales Herbaceous perennial Angiosperm 1.1326931  
## 43 Magnoliopsida Asterales Herbaceous perennial Angiosperm 1.1230529  
## 44 Magnoliopsida Asterales Herbaceous perennial Angiosperm 0.6215339  
## 45 Magnoliopsida Asterales Herbaceous perennial Angiosperm 0.9919496  
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## 66 Magnoliopsida Dipsacales Herbaceous perennial Angiosperm 1.2955549  
## 67 Magnoliopsida Dipsacales Herbaceous perennial Angiosperm 0.7613167  
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## 69 Magnoliopsida Ericales Annual Angiosperm 0.6744272  
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## 74 Magnoliopsida Ericales Herbaceous perennial Angiosperm 0.9802187  
## 75 Magnoliopsida Ericales Herbaceous perennial Angiosperm 0.8083969  
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## 77 Magnoliopsida Caryophyllales Herbaceous perennial Angiosperm 0.6241799  
## 78 Magnoliopsida Caryophyllales Shrub Angiosperm 1.7211020  
## 79 Magnoliopsida Caryophyllales Succulent Angiosperm 1.0001012  
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## 83 Magnoliopsida Caryophyllales Succulent Angiosperm 1.2437146  
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## 90 Magnoliopsida Caryophyllales Herbaceous perennial Angiosperm 0.8622434  
## 91 Magnoliopsida Ranunculales Herbaceous perennial Angiosperm 0.6678511  
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## 98 Liliopsida Arecales Palm Angiosperm 1.1789035  
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## 100 Liliopsida Poales Herbaceous perennial Angiosperm 0.9987145  
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## 104 Liliopsida Poales Epiphyte Angiosperm 1.0615691  
## 105 Liliopsida Asparagales Herbaceous perennial Angiosperm 0.9831117  
## 106 Liliopsida Asparagales Herbaceous perennial Angiosperm 1.0643108  
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## 110 Liliopsida Liliales Herbaceous perennial Angiosperm 1.0406040  
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## 119 Liliopsida Liliales Herbaceous perennial Angiosperm 1.0226717  
## 120 Magnoliopsida Piperales Herbaceous perennial Angiosperm 1.0447722  
## 121 Pinopsida Pinales Tree Gymnosperm 1.0184607  
## Ecoregion.x Binomial.x phylo  
## 1 MED Euphorbia\_fontqueriana Euphorbia\_fontqueriana  
## 2 TCF Hypericum\_cumulicola Hypericum\_cumulicola  
## 3 FGS Agrimonia\_eupatoria Agrimonia\_eupatoria  
## 4 DES Purshia\_subintegra Purshia\_subintegra  
## 5 TBM Cucurbita\_pepo Cucurbita\_pepo  
## 6 TBM Castanea\_dentata Castanea\_dentata  
## 7 TBM Castanea\_dentata Castanea\_dentata  
## 8 TBM Castanea\_dentata Castanea\_dentata  
## 9 TBM Castanea\_dentata Castanea\_dentata  
## 10 TBM Castanea\_dentata Castanea\_dentata  
## 11 DES Astragalus\_scaphoides Astragalus\_scaphoides  
## 12 TBM Astragalus\_alopecurus Astragalus\_alopecurus  
## 13 MED Astragalus\_tremolsianus Astragalus\_tremolsianus  
## 14 MED Dorycnium\_spectabile Dorycnium\_spectabile  
## 15 TBM Anthyllis\_vulneraria Anthyllis\_vulneraria  
## 16 DES Lupinus\_tidestromii Lupinus\_tidestromii  
## 17 DES Lupinus\_tidestromii Lupinus\_tidestromii  
## 18 TCF Lupinus\_lepidus Lupinus\_lepidus  
## 19 TMB Carapa\_guianensis Carapa\_guianensis  
## 20 TBM Acer\_saccharum Acer\_saccharum  
## 21 TBM Alliaria\_petiolata Alliaria\_petiolata  
## 22 TBM Alliaria\_petiolata Alliaria\_petiolata  
## 23 TBM Alliaria\_petiolata Alliaria\_petiolata  
## 24 TBM Alliaria\_petiolata Alliaria\_petiolata  
## 25 TBM Alliaria\_petiolata Alliaria\_petiolata  
## 26 TBM Alliaria\_petiolata Alliaria\_petiolata  
## 27 TGS Sphaeralcea\_coccinea Sphaeralcea\_coccinea  
## 28 MED Helianthemum\_polygonoides Helianthemum\_polygonoides  
## 29 MED Helianthemum\_teneriffae Helianthemum\_teneriffae  
## 30 MED Erodium\_paularense Erodium\_paularense  
## 31 MED Erodium\_paularense Erodium\_paularense  
## 32 DES Oenothera\_deltoides Oenothera\_deltoides  
## 33 TBM Saxifraga\_tridactylites Saxifraga\_tridactylites  
## 34 MED Plantago\_coronopus Plantago\_coronopus  
## 35 TBM Plantago\_coronopus Plantago\_coronopus  
## 36 TBM Plantago\_coronopus Plantago\_coronopus  
## 37 TBM Dracocephalum\_austriacum Dracocephalum\_austriacum  
## 38 TBM Dracocephalum\_austriacum Dracocephalum\_austriacum  
## 39 MED Ramonda\_myconi Ramonda\_myconi  
## 40 MED Ramonda\_myconi Ramonda\_myconi  
## 41 TBM Myosotis\_ramosissima Myosotis\_ramosissima  
## 42 TBM Gentiana\_pneumonanthe Gentiana\_pneumonanthe  
## 43 TBM Hypochaeris\_radicata Hypochaeris\_radicata  
## 44 TGS Echinacea\_angustifolia Echinacea\_angustifolia  
## 45 TGS Echinacea\_angustifolia Echinacea\_angustifolia  
## 46 TGS Echinacea\_angustifolia Echinacea\_angustifolia  
## 47 TGS Ratibida\_columnifera Ratibida\_columnifera  
## 48 TGS Liatris\_scariosa Liatris\_scariosa  
## 49 TCF Artemisia\_genipi Artemisia\_genipi  
## 50 TGS Solidago\_mollis Solidago\_mollis  
## 51 FGS Cirsium\_palustre Cirsium\_palustre  
## 52 TBM Cirsium\_dissectum Cirsium\_dissectum  
## 53 TBM Cirsium\_dissectum Cirsium\_dissectum  
## 54 TBM Cirsium\_dissectum Cirsium\_dissectum  
## 55 TGS Cirsium\_pitcheri Cirsium\_pitcheri  
## 56 TGS Cirsium\_pitcheri Cirsium\_pitcheri  
## 57 TGS Cirsium\_undulatum Cirsium\_undulatum  
## 58 MED Jurinea\_fontqueri Jurinea\_fontqueri  
## 59 TBM Centaurea\_jacea Centaurea\_jacea  
## 60 TBM Centaurea\_jacea Centaurea\_jacea  
## 61 MED Cheirolophus\_metlesicsii Cheirolophus\_metlesicsii  
## 62 TBM Carum\_carvi Carum\_carvi  
## 63 TBM Carum\_carvi Carum\_carvi  
## 64 TBM Succisa\_pratensis Succisa\_pratensis  
## 65 TBM Succisa\_pratensis Succisa\_pratensis  
## 66 TBM Succisa\_pratensis Succisa\_pratensis  
## 67 TBM Succisa\_pratensis Succisa\_pratensis  
## 68 TMB Ardisia\_escallonioides Ardisia\_escallonioides  
## 69 TBM Androsace\_elongata Androsace\_elongata  
## 70 TBM Primula\_farinosa Primula\_farinosa  
## 71 TBM Primula\_veris Primula\_veris  
## 72 TBM Primula\_elatior Primula\_elatior  
## 73 TBM Primula\_vulgaris Primula\_vulgaris  
## 74 TBM Primula\_vulgaris Primula\_vulgaris  
## 75 TBM Primula\_vulgaris Primula\_vulgaris  
## 76 BOR Sarracenia\_purpurea Sarracenia\_purpurea  
## 77 TGS Paronychia\_jamesii Paronychia\_jamesii  
## 78 DES Atriplex\_canescens Atriplex\_canescens  
## 79 TSC Neobuxbaumia\_mezcalaensis Neobuxbaumia\_mezcalaensis  
## 80 DES Neobuxbaumia\_mezcalaensis Neobuxbaumia\_mezcalaensis  
## 81 DES Neobuxbaumia\_macrocephala Neobuxbaumia\_macrocephala  
## 82 TGV Mammillaria\_huitzilopochtli Mammillaria\_huitzilopochtli  
## 83 DES Mammillaria\_huitzilopochtli Mammillaria\_huitzilopochtli  
## 84 DES Mammillaria\_solisioides Mammillaria\_solisioides  
## 85 DES Ariocarpus\_fissuratus Ariocarpus\_fissuratus  
## 86 DES Ariocarpus\_fissuratus Ariocarpus\_fissuratus  
## 87 DES Escobaria\_robbinsorum Escobaria\_robbinsorum  
## 88 TBM Rumex\_rupestris Rumex\_rupestris  
## 89 MED Armeria\_caespitosa Armeria\_caespitosa  
## 90 MED Limonium\_erectum Limonium\_erectum  
## 91 TBM Ranunculus\_peltatus Ranunculus\_peltatus  
## 92 TBM Actaea\_spicata Actaea\_spicata  
## 93 TBM Actaea\_spicata Actaea\_spicata  
## 94 TBM Dicentra\_canadensis Dicentra\_canadensis  
## 95 TBM Dicentra\_canadensis Dicentra\_canadensis  
## 96 TBM Dicentra\_canadensis Dicentra\_canadensis  
## 97 TSC Chamaedorea\_elegans Chamaedorea\_elegans  
## 98 MED Chamaedorea\_radicalis Chamaedorea\_radicalis  
## 99 TGV Borassus\_aethiopum Borassus\_aethiopum  
## 100 TCF Poa\_alpina Poa\_alpina  
## 101 MON Zea\_diploperennis Zea\_diploperennis  
## 102 TCF Danthonia\_sericea Danthonia\_sericea  
## 103 DES Hilaria\_mutica Hilaria\_mutica  
## 104 TSC Catopsis\_compacta Catopsis\_compacta  
## 105 TBM Orchis\_purpurea Orchis\_purpurea  
## 106 TCF Cypripedium\_fasciculatum Cypripedium\_fasciculatum  
## 107 TCF Cypripedium\_fasciculatum Cypripedium\_fasciculatum  
## 108 TCF Cypripedium\_fasciculatum Cypripedium\_fasciculatum  
## 109 TBM Allium\_tricoccum Allium\_tricoccum  
## 110 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 111 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 112 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 113 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 114 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 115 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 116 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 117 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 118 TBM Trillium\_grandiflorum Trillium\_grandiflorum  
## 119 TGS Calochortus\_lyallii Calochortus\_lyallii  
## 120 TBM Asarum\_canadense Asarum\_canadense  
## 121 TBM Pinus\_strobus Pinus\_strobus  
## SpeciesAccepted.y Kingdom.y Phylum.y Class.y  
## 1 Euphorbia fontqueriana Plantae Magnoliophyta Magnoliopsida  
## 2 Hypericum cumulicola Plantae Magnoliophyta Magnoliopsida  
## 3 Agrimonia eupatoria Plantae Magnoliophyta Magnoliopsida  
## 4 Purshia subintegra Plantae Magnoliophyta Magnoliopsida  
## 5 Cucurbita pepo Plantae Magnoliophyta Magnoliopsida  
## 6 Castanea dentata Plantae Tracheophyta Magnoliopsida  
## 7 Castanea dentata Plantae Tracheophyta Magnoliopsida  
## 8 Castanea dentata Plantae Tracheophyta Magnoliopsida  
## 9 Castanea dentata Plantae Tracheophyta Magnoliopsida  
## 10 Castanea dentata Plantae Tracheophyta Magnoliopsida  
## 11 Astragalus scaphoides Plantae Magnoliophyta Magnoliopsida  
## 12 Astragalus alopecurus Plantae Magnoliophyta Magnoliopsida  
## 13 Astragalus tremolsianus Plantae Magnoliophyta Magnoliopsida  
## 14 Dorycnium spectabile Plantae Magnoliophyta Magnoliopsida  
## 15 Anthyllis vulneraria Plantae Magnoliophyta Magnoliopsida  
## 16 Lupinus tidestromii Plantae Magnoliophyta Magnoliopsida  
## 17 Lupinus tidestromii Plantae Magnoliophyta Magnoliopsida  
## 18 Lupinus lepidus Plantae Magnoliophyta Magnoliopsida  
## 19 Carapa guianensis Plantae Magnoliophyta Magnoliopsida  
## 20 Acer saccharum Plantae Magnoliophyta Magnoliopsida  
## 21 Alliaria petiolata Plantae Magnoliophyta Magnoliopsida  
## 22 Alliaria petiolata Plantae Magnoliophyta Magnoliopsida  
## 23 Alliaria petiolata Plantae Magnoliophyta Magnoliopsida  
## 24 Alliaria petiolata Plantae Magnoliophyta Magnoliopsida  
## 25 Alliaria petiolata Plantae Magnoliophyta Magnoliopsida  
## 26 Alliaria petiolata Plantae Magnoliophyta Magnoliopsida  
## 27 Sphaeralcea coccinea Plantae Magnoliophyta Magnoliopsida  
## 28 Helianthemum polygonoides Plantae Magnoliophyta Magnoliopsida  
## 29 Helianthemum teneriffae Plantae Magnoliophyta Magnoliopsida  
## 30 Erodium paularense Plantae Magnoliophyta Magnoliopsida  
## 31 Erodium paularense Plantae Magnoliophyta Magnoliopsida  
## 32 Oenothera deltoides Plantae Magnoliophyta Magnoliopsida  
## 33 Saxifraga tridactylites Plantae Magnoliophyta Magnoliopsida  
## 34 Plantago coronopus Plantae Magnoliophyta Magnoliopsida  
## 35 Plantago coronopus Plantae Magnoliophyta Magnoliopsida  
## 36 Plantago coronopus Plantae Magnoliophyta Magnoliopsida  
## 37 Dracocephalum austriacum Plantae Magnoliophyta Magnoliopsida  
## 38 Dracocephalum austriacum Plantae Magnoliophyta Magnoliopsida  
## 39 Ramonda myconi Plantae Magnoliophyta Magnoliopsida  
## 40 Ramonda myconi Plantae Magnoliophyta Magnoliopsida  
## 41 Myosotis ramosissima Plantae Magnoliophyta Magnoliopsida  
## 42 Gentiana pneumonanthe Plantae Magnoliophyta Magnoliopsida  
## 43 Hypochaeris radicata Plantae Magnoliophyta Magnoliopsida  
## 44 Echinacea angustifolia Plantae Magnoliophyta Magnoliopsida  
## 45 Echinacea angustifolia Plantae Magnoliophyta Magnoliopsida  
## 46 Echinacea angustifolia Plantae Magnoliophyta Magnoliopsida  
## 47 Ratibida columnifera Plantae Magnoliophyta Magnoliopsida  
## 48 Liatris scariosa Plantae Magnoliophyta Magnoliopsida  
## 49 Artemisia genipi Plantae Magnoliophyta Magnoliopsida  
## 50 Solidago mollis Plantae Magnoliophyta Magnoliopsida  
## 51 Cirsium palustre Plantae Magnoliophyta Magnoliopsida  
## 52 Cirsium dissectum Plantae Magnoliophyta Magnoliopsida  
## 53 Cirsium dissectum Plantae Magnoliophyta Magnoliopsida  
## 54 Cirsium dissectum Plantae Magnoliophyta Magnoliopsida  
## 55 Cirsium pitcheri Plantae Magnoliophyta Magnoliopsida  
## 56 Cirsium pitcheri Plantae Magnoliophyta Magnoliopsida  
## 57 Cirsium undulatum Plantae Magnoliophyta Magnoliopsida  
## 58 Jurinea fontqueri Plantae Magnoliophyta Magnoliopsida  
## 59 Centaurea jacea Plantae Magnoliophyta Magnoliopsida  
## 60 Centaurea jacea Plantae Magnoliophyta Magnoliopsida  
## 61 Cheirolophus metlesicsii Plantae Magnoliophyta Magnoliopsida  
## 62 Carum carvi Plantae Magnoliophyta Magnoliopsida  
## 63 Carum carvi Plantae Magnoliophyta Magnoliopsida  
## 64 Succisa pratensis Plantae Magnoliophyta Magnoliopsida  
## 65 Succisa pratensis Plantae Magnoliophyta Magnoliopsida  
## 66 Succisa pratensis Plantae Magnoliophyta Magnoliopsida  
## 67 Succisa pratensis Plantae Magnoliophyta Magnoliopsida  
## 68 Ardisia escallonioides Plantae Magnoliophyta Magnoliopsida  
## 69 Androsace elongata Plantae Magnoliophyta Magnoliopsida  
## 70 Primula farinosa Plantae Tracheophyta Magnoliopsida  
## 71 Primula veris Plantae Magnoliophyta Magnoliopsida  
## 72 Primula elatior Plantae Magnoliophyta Magnoliopsida  
## 73 Primula vulgaris Plantae Magnoliophyta Magnoliopsida  
## 74 Primula vulgaris Plantae Magnoliophyta Magnoliopsida  
## 75 Primula vulgaris Plantae Magnoliophyta Magnoliopsida  
## 76 Sarracenia purpurea Plantae Magnoliophyta Magnoliopsida  
## 77 Paronychia jamesii Plantae Magnoliophyta Magnoliopsida  
## 78 Atriplex canescens Plantae Tracheophyta Magnoliopsida  
## 79 Neobuxbaumia mezcalaensis Plantae Magnoliophyta Magnoliopsida  
## 80 Neobuxbaumia mezcalaensis Plantae Magnoliophyta Magnoliopsida  
## 81 Neobuxbaumia macrocephala Plantae Magnoliophyta Magnoliopsida  
## 82 Mammillaria huitzilopochtli Plantae Magnoliophyta Magnoliopsida  
## 83 Mammillaria huitzilopochtli Plantae Magnoliophyta Magnoliopsida  
## 84 Mammillaria solisioides Plantae Magnoliophyta Magnoliopsida  
## 85 Ariocarpus fissuratus Plantae Magnoliophyta Magnoliopsida  
## 86 Ariocarpus fissuratus Plantae Magnoliophyta Magnoliopsida  
## 87 Escobaria robbinsorum Plantae Magnoliophyta Magnoliopsida  
## 88 Rumex rupestris Plantae Magnoliophyta Magnoliopsida  
## 89 Armeria caespitosa Plantae Magnoliophyta Magnoliopsida  
## 90 Limonium erectum Plantae Magnoliophyta Magnoliopsida  
## 91 Ranunculus peltatus Plantae Magnoliophyta Magnoliopsida  
## 92 Actaea spicata Plantae Magnoliophyta Magnoliopsida  
## 93 Actaea spicata Plantae Magnoliophyta Magnoliopsida  
## 94 Dicentra canadensis Plantae Tracheophyta Magnoliopsida  
## 95 Dicentra canadensis Plantae Tracheophyta Magnoliopsida  
## 96 Dicentra canadensis Plantae Tracheophyta Magnoliopsida  
## 97 Chamaedorea elegans Plantae Magnoliophyta Liliopsida  
## 98 Chamaedorea radicalis Plantae Magnoliophyta Liliopsida  
## 99 Borassus aethiopum Plantae Magnoliophyta Liliopsida  
## 100 Poa alpina Plantae Magnoliophyta Liliopsida  
## 101 Zea diploperennis Plantae Magnoliophyta Liliopsida  
## 102 Danthonia sericea Plantae Magnoliophyta Liliopsida  
## 103 Hilaria mutica Plantae Magnoliophyta Liliopsida  
## 104 Catopsis compacta Plantae Magnoliophyta Liliopsida  
## 105 Orchis purpurea Plantae Magnoliophyta Liliopsida  
## 106 Cypripedium fasciculatum Plantae Magnoliophyta Liliopsida  
## 107 Cypripedium fasciculatum Plantae Magnoliophyta Liliopsida  
## 108 Cypripedium fasciculatum Plantae Magnoliophyta Liliopsida  
## 109 Allium tricoccum Plantae Magnoliophyta Liliopsida  
## 110 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 111 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 112 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 113 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 114 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 115 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 116 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 117 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 118 Trillium grandiflorum Plantae Magnoliophyta Liliopsida  
## 119 Calochortus lyallii Plantae Magnoliophyta Liliopsida  
## 120 Asarum canadense Plantae Magnoliophyta Magnoliopsida  
## 121 Pinus strobus Plantae Pinophyta Pinopsida  
## Order.y OrganismType.y AngioGymno.y Ecoregion.y  
## 1 Malpighiales Succulent Angiosperm MED  
## 2 Theales Herbaceous perennial Angiosperm TCF  
## 3 Rosales Herbaceous perennial Angiosperm FGS  
## 4 Rosales Shrub Angiosperm DES  
## 5 Curcurbitales Annual Angiosperm TBM  
## 6 Fagales Tree Angiosperm TBM  
## 7 Fagales Tree Angiosperm TBM  
## 8 Fagales Tree Angiosperm TBM  
## 9 Fagales Tree Angiosperm TBM  
## 10 Fagales Tree Angiosperm TBM  
## 11 Fabales Herbaceous perennial Angiosperm DES  
## 12 Fabales Herbaceous perennial Angiosperm TBM  
## 13 Fabales Herbaceous perennial Angiosperm MED  
## 14 Fabales Herbaceous perennial Angiosperm MED  
## 15 Fabales Herbaceous perennial Angiosperm TBM  
## 16 Fabales Herbaceous perennial Angiosperm DES  
## 17 Fabales Herbaceous perennial Angiosperm DES  
## 18 Fabales Herbaceous perennial Angiosperm TCF  
## 19 Sapindales Tree Angiosperm TMB  
## 20 Sapindales Tree Angiosperm TBM  
## 21 Brassicales Herbaceous perennial Angiosperm TBM  
## 22 Brassicales Herbaceous perennial Angiosperm TBM  
## 23 Brassicales Herbaceous perennial Angiosperm TBM  
## 24 Brassicales Herbaceous perennial Angiosperm TBM  
## 25 Brassicales Herbaceous perennial Angiosperm TBM  
## 26 Brassicales Herbaceous perennial Angiosperm TBM  
## 27 Malvales Herbaceous perennial Angiosperm TGS  
## 28 Malvales Herbaceous perennial Angiosperm MED  
## 29 Malvales Herbaceous perennial Angiosperm MED  
## 30 Geraniales Herbaceous perennial Angiosperm MED  
## 31 Geraniales Herbaceous perennial Angiosperm MED  
## 32 Myrtales Herbaceous perennial Angiosperm DES  
## 33 Saxifragales Annual Angiosperm TBM  
## 34 Lamiales Herbaceous perennial Angiosperm MED  
## 35 Lamiales Herbaceous perennial Angiosperm TBM  
## 36 Lamiales Herbaceous perennial Angiosperm TBM  
## 37 Lamiales Herbaceous perennial Angiosperm TBM  
## 38 Lamiales Herbaceous perennial Angiosperm TBM  
## 39 Lamiales Herbaceous perennial Angiosperm MED  
## 40 Lamiales Herbaceous perennial Angiosperm MED  
## 41 Lamiales Annual Angiosperm TBM  
## 42 Gentianales Herbaceous perennial Angiosperm TBM  
## 43 Asterales Herbaceous perennial Angiosperm TBM  
## 44 Asterales Herbaceous perennial Angiosperm TGS  
## 45 Asterales Herbaceous perennial Angiosperm TGS  
## 46 Asterales Herbaceous perennial Angiosperm TGS  
## 47 Asterales Herbaceous perennial Angiosperm TGS  
## 48 Asterales Herbaceous perennial Angiosperm TGS  
## 49 Asterales Herbaceous perennial Angiosperm TCF  
## 50 Asterales Herbaceous perennial Angiosperm TGS  
## 51 Asterales Herbaceous perennial Angiosperm FGS  
## 52 Asterales Herbaceous perennial Angiosperm TBM  
## 53 Asterales Herbaceous perennial Angiosperm TBM  
## 54 Asterales Herbaceous perennial Angiosperm TBM  
## 55 Asterales Herbaceous perennial Angiosperm TGS  
## 56 Asterales Herbaceous perennial Angiosperm TGS  
## 57 Asterales Herbaceous perennial Angiosperm TGS  
## 58 Asterales Herbaceous perennial Angiosperm MED  
## 59 Asterales Herbaceous perennial Angiosperm TBM  
## 60 Asterales Herbaceous perennial Angiosperm TBM  
## 61 Asterales Herbaceous perennial Angiosperm MED  
## 62 Apiales Herbaceous perennial Angiosperm TBM  
## 63 Apiales Herbaceous perennial Angiosperm TBM  
## 64 Dipsacales Herbaceous perennial Angiosperm TBM  
## 65 Dipsacales Herbaceous perennial Angiosperm TBM  
## 66 Dipsacales Herbaceous perennial Angiosperm TBM  
## 67 Dipsacales Herbaceous perennial Angiosperm TBM  
## 68 Ericales Shrub Angiosperm TMB  
## 69 Ericales Annual Angiosperm TBM  
## 70 Ericales Herbaceous perennial Angiosperm TBM  
## 71 Ericales Herbaceous perennial Angiosperm TBM  
## 72 Ericales Herbaceous perennial Angiosperm TBM  
## 73 Ericales Herbaceous perennial Angiosperm TBM  
## 74 Ericales Herbaceous perennial Angiosperm TBM  
## 75 Ericales Herbaceous perennial Angiosperm TBM  
## 76 Ericales Herbaceous perennial Angiosperm BOR  
## 77 Caryophyllales Herbaceous perennial Angiosperm TGS  
## 78 Caryophyllales Shrub Angiosperm DES  
## 79 Caryophyllales Succulent Angiosperm TSC  
## 80 Caryophyllales Succulent Angiosperm DES  
## 81 Caryophyllales Succulent Angiosperm DES  
## 82 Caryophyllales Succulent Angiosperm TGV  
## 83 Caryophyllales Succulent Angiosperm DES  
## 84 Caryophyllales Succulent Angiosperm DES  
## 85 Caryophyllales Succulent Angiosperm DES  
## 86 Caryophyllales Succulent Angiosperm DES  
## 87 Caryophyllales Succulent Angiosperm DES  
## 88 Caryophyllales Herbaceous perennial Angiosperm TBM  
## 89 Caryophyllales Herbaceous perennial Angiosperm MED  
## 90 Caryophyllales Herbaceous perennial Angiosperm MED  
## 91 Ranunculales Herbaceous perennial Angiosperm TBM  
## 92 Ranunculales Herbaceous perennial Angiosperm TBM  
## 93 Ranunculales Herbaceous perennial Angiosperm TBM  
## 94 Ranunculales Herbaceous perennial Angiosperm TBM  
## 95 Ranunculales Herbaceous perennial Angiosperm TBM  
## 96 Ranunculales Herbaceous perennial Angiosperm TBM  
## 97 Arecales Palm Angiosperm TSC  
## 98 Arecales Palm Angiosperm MED  
## 99 Arecales Palm Angiosperm TGV  
## 100 Poales Herbaceous perennial Angiosperm TCF  
## 101 Poales Herbaceous perennial Angiosperm MON  
## 102 Poales Herbaceous perennial Angiosperm TCF  
## 103 Poales Herbaceous perennial Angiosperm DES  
## 104 Poales Epiphyte Angiosperm TSC  
## 105 Asparagales Herbaceous perennial Angiosperm TBM  
## 106 Asparagales Herbaceous perennial Angiosperm TCF  
## 107 Asparagales Herbaceous perennial Angiosperm TCF  
## 108 Asparagales Herbaceous perennial Angiosperm TCF  
## 109 Asparagales Herbaceous perennial Angiosperm TBM  
## 110 Liliales Herbaceous perennial Angiosperm TBM  
## 111 Liliales Herbaceous perennial Angiosperm TBM  
## 112 Liliales Herbaceous perennial Angiosperm TBM  
## 113 Liliales Herbaceous perennial Angiosperm TBM  
## 114 Liliales Herbaceous perennial Angiosperm TBM  
## 115 Liliales Herbaceous perennial Angiosperm TBM  
## 116 Liliales Herbaceous perennial Angiosperm TBM  
## 117 Liliales Herbaceous perennial Angiosperm TBM  
## 118 Liliales Herbaceous perennial Angiosperm TBM  
## 119 Liliales Herbaceous perennial Angiosperm TGS  
## 120 Piperales Herbaceous perennial Angiosperm TBM  
## 121 Pinales Tree Gymnosperm TBM  
## Binomial.y  
## 1 Euphorbia\_fontqueriana  
## 2 Hypericum\_cumulicola  
## 3 Agrimonia\_eupatoria  
## 4 Purshia\_subintegra  
## 5 Cucurbita\_pepo  
## 6 Castanea\_dentata  
## 7 Castanea\_dentata  
## 8 Castanea\_dentata  
## 9 Castanea\_dentata  
## 10 Castanea\_dentata  
## 11 Astragalus\_scaphoides  
## 12 Astragalus\_alopecurus  
## 13 Astragalus\_tremolsianus  
## 14 Dorycnium\_spectabile  
## 15 Anthyllis\_vulneraria  
## 16 Lupinus\_tidestromii  
## 17 Lupinus\_tidestromii  
## 18 Lupinus\_lepidus  
## 19 Carapa\_guianensis  
## 20 Acer\_saccharum  
## 21 Alliaria\_petiolata  
## 22 Alliaria\_petiolata  
## 23 Alliaria\_petiolata  
## 24 Alliaria\_petiolata  
## 25 Alliaria\_petiolata  
## 26 Alliaria\_petiolata  
## 27 Sphaeralcea\_coccinea  
## 28 Helianthemum\_polygonoides  
## 29 Helianthemum\_teneriffae  
## 30 Erodium\_paularense  
## 31 Erodium\_paularense  
## 32 Oenothera\_deltoides  
## 33 Saxifraga\_tridactylites  
## 34 Plantago\_coronopus  
## 35 Plantago\_coronopus  
## 36 Plantago\_coronopus  
## 37 Dracocephalum\_austriacum  
## 38 Dracocephalum\_austriacum  
## 39 Ramonda\_myconi  
## 40 Ramonda\_myconi  
## 41 Myosotis\_ramosissima  
## 42 Gentiana\_pneumonanthe  
## 43 Hypochaeris\_radicata  
## 44 Echinacea\_angustifolia  
## 45 Echinacea\_angustifolia  
## 46 Echinacea\_angustifolia  
## 47 Ratibida\_columnifera  
## 48 Liatris\_scariosa  
## 49 Artemisia\_genipi  
## 50 Solidago\_mollis  
## 51 Cirsium\_palustre  
## 52 Cirsium\_dissectum  
## 53 Cirsium\_dissectum  
## 54 Cirsium\_dissectum  
## 55 Cirsium\_pitcheri  
## 56 Cirsium\_pitcheri  
## 57 Cirsium\_undulatum  
## 58 Jurinea\_fontqueri  
## 59 Centaurea\_jacea  
## 60 Centaurea\_jacea  
## 61 Cheirolophus\_metlesicsii  
## 62 Carum\_carvi  
## 63 Carum\_carvi  
## 64 Succisa\_pratensis  
## 65 Succisa\_pratensis  
## 66 Succisa\_pratensis  
## 67 Succisa\_pratensis  
## 68 Ardisia\_escallonioides  
## 69 Androsace\_elongata  
## 70 Primula\_farinosa  
## 71 Primula\_veris  
## 72 Primula\_elatior  
## 73 Primula\_vulgaris  
## 74 Primula\_vulgaris  
## 75 Primula\_vulgaris  
## 76 Sarracenia\_purpurea  
## 77 Paronychia\_jamesii  
## 78 Atriplex\_canescens  
## 79 Neobuxbaumia\_mezcalaensis  
## 80 Neobuxbaumia\_mezcalaensis  
## 81 Neobuxbaumia\_macrocephala  
## 82 Mammillaria\_huitzilopochtli  
## 83 Mammillaria\_huitzilopochtli  
## 84 Mammillaria\_solisioides  
## 85 Ariocarpus\_fissuratus  
## 86 Ariocarpus\_fissuratus  
## 87 Escobaria\_robbinsorum  
## 88 Rumex\_rupestris  
## 89 Armeria\_caespitosa  
## 90 Limonium\_erectum  
## 91 Ranunculus\_peltatus  
## 92 Actaea\_spicata  
## 93 Actaea\_spicata  
## 94 Dicentra\_canadensis  
## 95 Dicentra\_canadensis  
## 96 Dicentra\_canadensis  
## 97 Chamaedorea\_elegans  
## 98 Chamaedorea\_radicalis  
## 99 Borassus\_aethiopum  
## 100 Poa\_alpina  
## 101 Zea\_diploperennis  
## 102 Danthonia\_sericea  
## 103 Hilaria\_mutica  
## 104 Catopsis\_compacta  
## 105 Orchis\_purpurea  
## 106 Cypripedium\_fasciculatum  
## 107 Cypripedium\_fasciculatum  
## 108 Cypripedium\_fasciculatum  
## 109 Allium\_tricoccum  
## 110 Trillium\_grandiflorum  
## 111 Trillium\_grandiflorum  
## 112 Trillium\_grandiflorum  
## 113 Trillium\_grandiflorum  
## 114 Trillium\_grandiflorum  
## 115 Trillium\_grandiflorum  
## 116 Trillium\_grandiflorum  
## 117 Trillium\_grandiflorum  
## 118 Trillium\_grandiflorum  
## 119 Calochortus\_lyallii  
## 120 Asarum\_canadense  
## 121 Pinus\_strobus

## 10.1 Ranking buffering

Rank more and less buffered populations. Again sum of stochastic elasticity within respect to variance is used.

#-----------------------------------------------------------------------------------  
# RANKING BUFFERING  
#-----------------------------------------------------------------------------------  
ToRank<-final\_data%>%  
mutate(Cumulative\_SigElas=abs(Cumulative\_SigElas))%>%  
group\_by(Kingdom)%>%  
select(ID,Cumulative\_SigElas,SpeciesAccepted,AngioGymno,Class)%>%  
 mutate(rank = rank(Cumulative\_SigElas, ties.method = "random"))  
  
ToRank<-ToRank%>%  
group\_by(Kingdom)%>%  
mutate(min=min(Cumulative\_SigElas),  
 max=max(Cumulative\_SigElas))%>%  
filter(rank==min(rank)|rank==max(rank))%>%  
select(-c(min,max))%>%  
left\_join(.,Metadata%>%select(ID, CommonName,Family)%>%distinct(),by="ID")%>%  
select(2,3,7,4,5,6,8,9)  
  
ToRank%>%  
left\_join(.,ElasSigVR\_full,by="ID")%>%mutate\_if(is.numeric,round,3)%>%filter(Kingdom=="Plantae")

## # A tibble: 2 × 21  
## # Groups: Kingdom [1]  
## Kingdom ID Cumulative\_SigElas rank SpeciesAccepted AngioGymno Class  
## <chr> <chr> <dbl> <dbl> <chr> <chr> <chr>  
## 1 Plantae Rmnd.445\_12… 0 1 Ramonda myconi Angiosperm Magn…  
## 2 Plantae Rtbd.129\_12… 2.01 121 Ratibida colum… Angiosperm Magn…  
## # ℹ 14 more variables: CommonName <chr>, Family <chr>, Mean\_Reproduction <dbl>,  
## # Mean\_Growth <dbl>, Mean\_Shrinking <dbl>, Mean\_Clonality <dbl>,  
## # Mean\_Survival <dbl>, Mean\_Cumulative <dbl>, SD\_Reproduction <dbl>,  
## # SD\_Growth <dbl>, SD\_Shrinking <dbl>, SD\_Clonality <dbl>, SD\_Survival <dbl>,  
## # SD\_Cumulative <dbl>

### Plot

temp<-Stochslambs<-NULL  
for(i in 1:length(unique(final\_data$ID))){  
temp<-filter(  
 Metadata,ID==unique(final\_data$ID)[i])$mat%>%  
 matA()%>%  
 stoch.growth.rate(.,maxt = 200,verbose = FALSE)  
Stochslambs$approx[[i]]<-temp$approx  
Stochslambs$sim[[i]]<-temp$sim  
Stochslambs$CIlow[[i]]<-temp$sim.CI[[1]]  
Stochslambs$CIhigh[[i]]<-temp$sim.CI[[2]]  
#add verbose   
 if (i == 1 || i%%40 == 0) {  
 message("Calculating mean Matrices",   
 i)  
 }  
rm(temp)  
}  
  
Stochslambs\_df<-data.frame(  
 unique(final\_data$ID),  
 lapply(Stochslambs,cbind))%>%  
 as\_tibble()%>% unnest()%>%  
 mutate\_if(is.numeric,exp)%>%  
 rename(., ID = unique.final\_data.ID.)

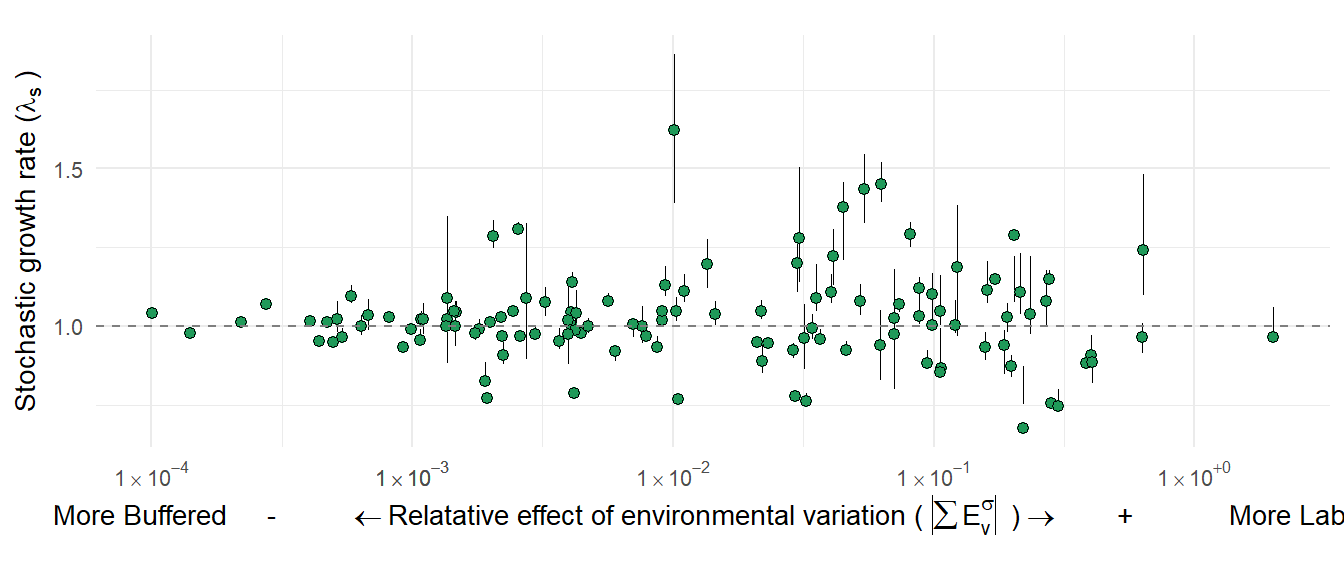
An accessory function is necessary to better represent very small numbers.

scientific\_10 <- function(x) {  
 parse(text=gsub("e", " %\*% 10^", scales::scientific\_format()(x)))  
}

Plot

# Figure S1  
final\_data%>%  
 select(ID:Cumulative\_SigElas,Buffmx:MatRep,OrganismType,Kingdom,lambda)%>%  
 pivot\_longer(!c(ID,MatRep:lambda))%>%  
 mutate(values=ifelse(value==0,rnorm(1,1e-7,1e-7),value))%>%  
 left\_join(.,Stochslambs\_df,by='ID')%>%  
 filter(name=="Cumulative\_SigElas" & Kingdom=="Plantae")%>%  
 #filter(!(value>quantile(value,.95)))%>%  
 #filter(!(value<quantile(value,.025)))%>%  
 ggplot(.,aes(y=approx,x=abs(value)))+  
# geom\_point(aes(size=sqrt(MatRep),fill=Kingdom),shape=21)  
#geom\_point(aes(size=sqrt(MatRep),fill=Kingdom),shape=21)+  
geom\_pointrange(aes(ymin=CIlow,ymax=CIhigh),shape=21,fill="#1f9a59",size=.9)+  
geom\_hline(yintercept=1,linetype=2,color="grey50",size=.9)+  
scale\_x\_continuous(trans ='log',  
breaks=c(0,0.000001,0.0001,0.001,0.001,0.01,0.1,1),  
label = scientific\_10)+  
#annotation\_logticks() +   
#xlab(expression("(More Buffered) - " %<-% " "~Sigma~"E"^"s"^~mu~" " %->% " + (More Labile)")) +  
xlab(bquote("More Buffered - "   
 %<-% "Relatative effect of environmental variation ("~ abs(sum(E[v]^sigma))~" )" %->%   
 " + More Labile"))+  
ylab(bquote("Stochastic growth rate ("~lambda[s]~")"))+  
#facet\_grid(.~name,scales="free")+  
#theme(legend.position="top")+  
theme\_minimal(base\_size=21)+  
theme(aspect.ratio=6/18)

## Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.  
## ℹ Please use `linewidth` instead.  
## This warning is displayed once every 8 hours.  
## Call `lifecycle::last\_lifecycle\_warnings()` to see where this warning was  
## generated.



#ggsave(file="Figures/Buffering continuum.svg")

## 10.3. Proportional contribution

Quantify proportional contribution of each vital rate to . We used percentage RelContrib\*100 to improve readability.

RelContrib<-final\_data%>%as\_tibble()%>%  
select(ID,Reproduction\_SigElas:Survival\_SigElas)%>%  
mutate\_if(is.numeric,abs)%>% # Make sure valures are in their absolute form. (This is likely to be removed in next version because it is already done in the final dataset but confirm before remove this line)  
mutate(NewCumulative=rowSums(across(where(is.numeric))))%>%  
#mutate\_if(is.numeric,round,4)%>%glimpse()  
pivot\_longer(!c(ID,NewCumulative))%>%  
mutate(RelativeProp=(value/NewCumulative))%>%  
left\_join(.,MetadataClean%>%select(-lambda)%>%distinct(),by="ID")  
  
RelContrib%>%mutate\_if(is.numeric,round,5)%>%filter(Kingdom=="Plantae")

## # A tibble: 605 × 14  
## ID NewCumulative name value RelativeProp SpeciesAccepted Kingdom Phylum  
## <chr> <dbl> <chr> <dbl> <dbl> <chr> <chr> <chr>   
## 1 Ephr… 0.00266 Repr… 0.00037 0.141 Euphorbia font… Plantae Magno…  
## 2 Ephr… 0.00266 Grow… 0.00076 0.285 Euphorbia font… Plantae Magno…  
## 3 Ephr… 0.00266 Shri… 0.00003 0.0123 Euphorbia font… Plantae Magno…  
## 4 Ephr… 0.00266 Clon… 0 0 Euphorbia font… Plantae Magno…  
## 5 Ephr… 0.00266 Surv… 0.00149 0.562 Euphorbia font… Plantae Magno…  
## 6 Hypr… 0.191 Repr… 0.0647 0.339 Hypericum cumu… Plantae Magno…  
## 7 Hypr… 0.191 Grow… 0.00419 0.0220 Hypericum cumu… Plantae Magno…  
## 8 Hypr… 0.191 Shri… 0.00199 0.0104 Hypericum cumu… Plantae Magno…  
## 9 Hypr… 0.191 Clon… 0 0 Hypericum cumu… Plantae Magno…  
## 10 Hypr… 0.191 Surv… 0.120 0.629 Hypericum cumu… Plantae Magno…  
## # ℹ 595 more rows  
## # ℹ 6 more variables: Class <chr>, Order <chr>, OrganismType <chr>,  
## # AngioGymno <chr>, Ecoregion <chr>, Binomial <chr>

### 10.3.1 Kingdoms

RelContrib\_df<-RelContrib%>%  
group\_by(name,Kingdom)%>%  
summarise(Relativemean=mean(RelativeProp), #Relative contribution (mean for each kingdom)  
 SD=sd(RelativeProp),  
 n=n())  
  
RelContrib\_df%>%  
 mutate(Relativemean=Relativemean\*100,  
 SD=SD\*100)%>%mutate\_if(is.numeric,round,3)

## # A tibble: 5 × 5  
## # Groups: name [5]  
## name Kingdom Relativemean SD n  
## <chr> <chr> <dbl> <dbl> <dbl>  
## 1 Clonality\_SigElas Plantae 4.82 18.6 121  
## 2 Growth\_SigElas Plantae 21.1 21.0 121  
## 3 Reproduction\_SigElas Plantae 18.1 27.1 121  
## 4 Shrinking\_SigElas Plantae 5.67 10.1 121  
## 5 Survival\_SigElas Plantae 50.3 27.6 121

#### By Organism types

#Relative contribution by organismType  
RelContrib\_orgType<-RelContrib%>%  
 mutate(Taxa=ifelse(Kingdom=="Plantae", OrganismType,Phylum))%>%  
 group\_by(Kingdom,name,Taxa)%>%  
 summarise(Relativemean=mean(RelativeProp),  
 n=n(),  
 SD=sd(RelativeProp))  
  
RelContrib\_orgType%>%  
 mutate(Relativemean=(Relativemean\*100),  
 SD=SD\*100)%>%mutate\_if(is.numeric,round,3)%>%filter(Kingdom=="Plantae")%>%ungroup()%>%select(-Kingdom)

## # A tibble: 35 × 5  
## name Taxa Relativemean n SD  
## <chr> <chr> <dbl> <dbl> <dbl>  
## 1 Clonality\_SigElas Annual 0 4 0   
## 2 Clonality\_SigElas Epiphyte 0 1 NA   
## 3 Clonality\_SigElas Herbaceous perennial 6.3 92 21.1   
## 4 Clonality\_SigElas Palm 1.05 3 1.83   
## 5 Clonality\_SigElas Shrub 0 3 0   
## 6 Clonality\_SigElas Succulent 0 10 0   
## 7 Clonality\_SigElas Tree 0 8 0   
## 8 Growth\_SigElas Annual 0.041 4 0.081  
## 9 Growth\_SigElas Epiphyte 1.77 1 NA   
## 10 Growth\_SigElas Herbaceous perennial 20.7 92 22.1   
## # ℹ 25 more rows

### 10.3.3. Plots

Plots need editing on proper software.

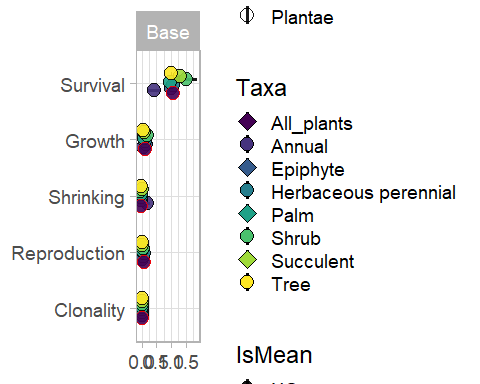
taxaLev<-c("Chordata","Arthropoda","Cnidaria",  
 "Annual","Herbaceous perennial","Succulent",  
 "Epiphyte","Shrub","Tree","Palm")  
  
traitLev<-c("Cumulative","Survival","Reproduction","Growth","Shrinking","Clonality")  
  
plotbuff\_data<-final\_data%>%  
mutate(Taxa=ifelse(Kingdom=="Plantae", OrganismType,Phylum))%>%  
select(c(Reproduction\_SigElas:Survival\_Base),MatRep,Kingdom,Taxa)%>%  
pivot\_longer(!c(Kingdom,MatRep,Taxa),names\_to="Variable",values\_to="Value")%>%  
group\_by(Kingdom,Taxa,Variable)%>%  
summarise(Mean=mean(Value),  
 SD=sd(Value),  
 Populations=n(),  
 MatRep=sum(MatRep),  
 SE=SD/sqrt(Populations),  
 CI=1.96\*(SD/sqrt(Populations)))%>%  
separate(Variable, c("Variable", "Form"))%>%  
mutate(Taxa = factor(Taxa , levels = taxaLev))%>%  
mutate(Variable = factor(Variable, levels = traitLev))  
  
#plotbuff\_data

#### Edited figure for plants

#### Plot Elasticities

Plot shows stochastic elasticities of each vital rate (A) and its relative effect on , it means

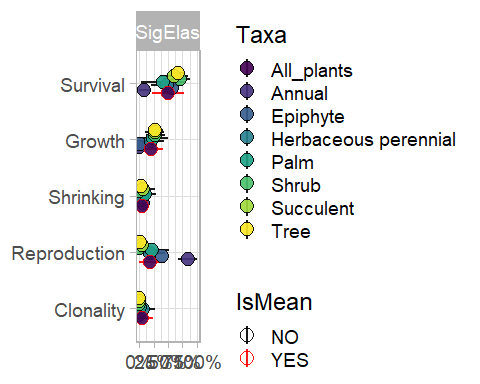
plotbuff<-rbind(  
 plotbuff\_data%>%mutate(IsMean="NO"),  
 final\_data%>%  
 select(c(Reproduction\_SigElas:Survival\_Base),MatRep,Kingdom)%>%  
 pivot\_longer(!c(Kingdom,MatRep),names\_to="Variable",values\_to="Value")%>%  
 group\_by(Kingdom,Variable)%>%  
 summarise(Mean=mean(Value),  
 SD=sd(Value),  
 Populations=n(),  
 MatRep=sum(MatRep),  
 SE=SD/sqrt(Populations),  
 CI=1.96\*(SD/sqrt(Populations)))%>%  
 separate(Variable, c("Variable", "Form"))%>%  
 mutate(Taxa =ifelse(Kingdom=="Animalia", "All\_animals","All\_plants"))%>%  
 mutate(IsMean="YES")  
)%>%  
 mutate(Taxa=fct\_relevel(Taxa, "All\_plants", "All\_animals"))%>%  
 # filter(Form=="Base")%>%  
 mutate(Variable=factor(Variable, levels = c("Cumulative","Clonality", "Reproduction", "Shrinking", "Growth","Survival")))%>%  
 ggplot(.,aes(x=Variable,y=Mean,group=Taxa))+  
 geom\_pointrange(position=position\_dodge(0.4),  
 aes(ymin = Mean-SE, ymax = Mean+SE,  
 fill=Taxa,shape=Kingdom,color=IsMean),linewidth = 1.3,size= 1.1,alpha=.9)+  
 ylab(NULL)+xlab(NULL)+  
 scale\_shape\_manual(values=c(21,23))+  
 scale\_fill\_viridis\_d()+  
 scale\_color\_manual(values=c("black","red"))+  
 #scale\_color\_viridis\_d()+  
 #guides(fill = guide\_legend(override.aes=list(shape=c(23,21))))+  
 guides(  
 alpha= "none",  
 fill = guide\_legend(override.aes=list(shape=c(23,21),alpha=1)))+  
 theme\_light(base\_size=18)+  
 facet\_grid(.~Form,scales="free")+  
 coord\_flip()  
  
plotbuff\_base<-plotbuff\_sigElas<-plotbuff  
  
plotbuff\_base$data<-plotbuff$data%>%  
 filter(Form=="Base")  
  
plotbuff\_base



#### Plot proportional contribution

Proportional contribution of each to

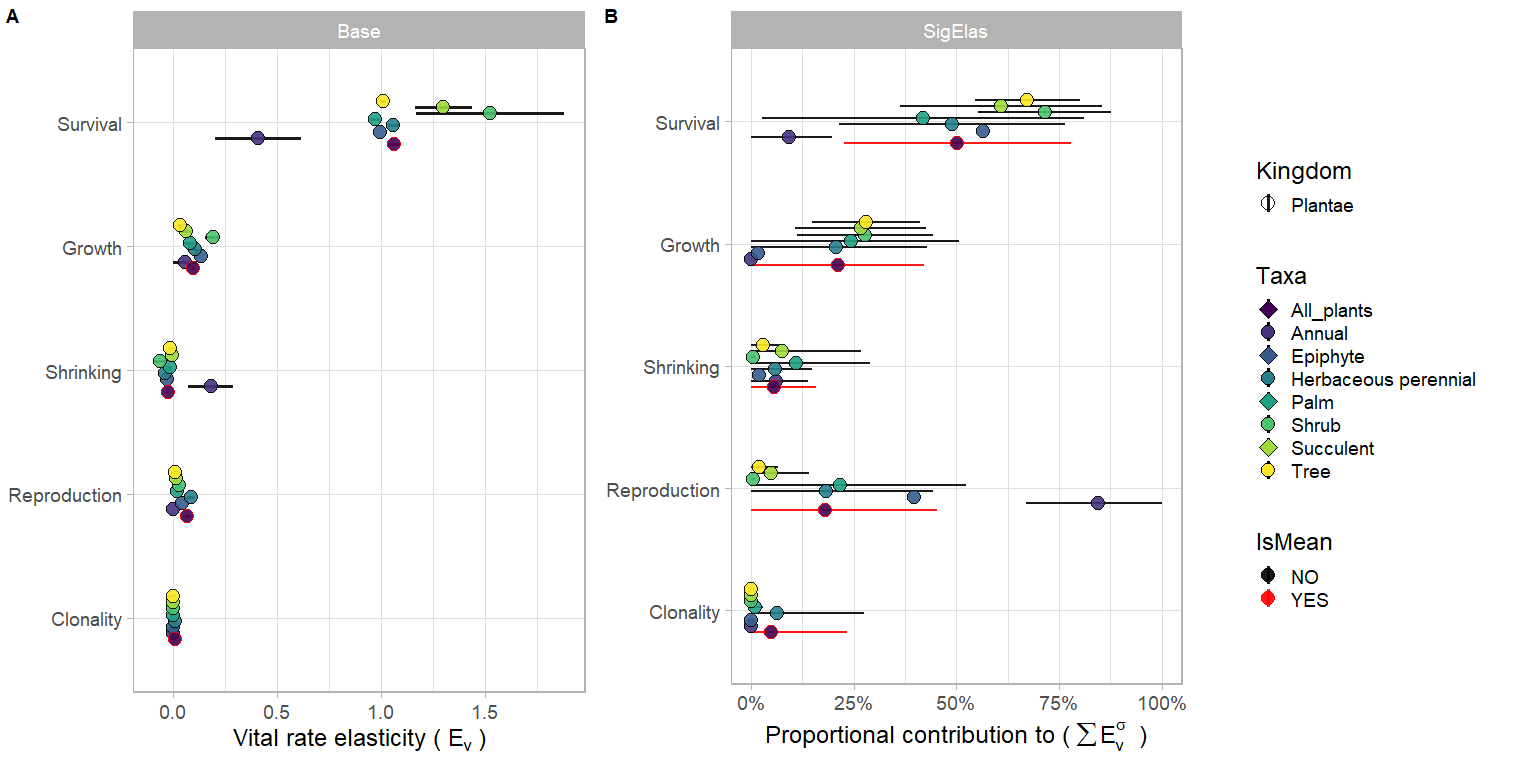
RelContrib\_plot<-rbind(  
 RelContrib\_orgType%>%mutate(IsMean="NO"),  
 RelContrib\_df%>%mutate(Taxa =ifelse(Kingdom=="Animalia", "All\_animals","All\_plants"))%>%  
 mutate(IsMean="YES"))%>%  
filter(Kingdom=="Plantae")%>%  
 mutate(name = str\_remove(name, "\_SigElas"))%>%  
 mutate(name=factor(name, levels = c("Cumulative","Clonality", "Reproduction", "Shrinking", "Growth","Survival")))%>%  
 mutate(Taxa=fct\_relevel(Taxa, "All\_plants", "All\_animals"))%>%  
 mutate(Form="SigElas")%>%  
 # filter(Kingdom=="Plantae")%>%  
 ggplot(.,aes(x=name,y=Relativemean))+  
 geom\_pointrange(position=position\_dodge(0.4),  
 aes(ymin = pmax(Relativemean-SD, 0), ymax = pmin(Relativemean+SD, 1),  
 fill=Taxa,group=Taxa,color=IsMean),shape=21,linewidth = 1,size= 1.1,alpha=.9)+  
 ylab(NULL)+xlab(NULL)+  
 scale\_shape\_manual(values=c(23,21))+  
 scale\_color\_manual(values=c("black","red"))+  
 scale\_y\_continuous(labels = scales::percent\_format())+  
 scale\_fill\_viridis\_d()+  
 #scale\_color\_viridis\_d()+  
 #guides(fill = guide\_legend(override.aes=list(shape=c(23,21))))+  
 # guides(  
 # alpha= "none",  
 # fill = guide\_legend(  
 # override.aes=list(shape=rep(c(23, 21),   
 # length.out=nlevels(factor(RelContrib$OrganismType))), alpha=1)))+  
 theme\_light(base\_size=18)+  
 facet\_grid(~Form,scales="free")+  
 coord\_flip()  
  
RelContrib\_plot



#### Raw figure

Provide the raw figure for posterior editing in proper software

cowplot::plot\_grid(  
 rel\_widths=c(.7,.2),nrow=1,  
 cowplot::plot\_grid(  
 plotbuff\_base+theme(legend.position="none")+ylab(expression(paste("Vital rate elasticity ( ",E[v]," )"))),  
 RelContrib\_plot+theme(legend.position="none")+ylab(bquote("Proportional contribution to ("~ sum(E[v]^sigma)~" )")),  
 ncol=2,labels="AUTO"),  
 cowplot::get\_legend(plotbuff\_base)  
 )



# ggsave(file="Figures/Relative contribution.svg", width=16, height=8)

# 11. MCMCglmm results and tidy

Use Data/MCMCglmm\_output.rds to check estimates and hypotheses testing

## 11.1 Loading GLMM outputs

MCMCglmm\_output<-readRDS("Data/MCMCglmm\_output.rds")  
  
lapply(MCMCglmm\_output,names)

## $Simple\_models  
## [1] "Plants"  
##   
## $Phylogenetic\_models  
## [1] "Plants"

# Phylogenetic models  
MCMCglmm\_phylo\_plants<-MCMCglmm\_output$Phylogenetic\_models[[1]]  
  
# Non-Phylogenetic (simple) models  
MCMCglmm\_simple\_plants<-MCMCglmm\_output$Simple\_models[[1]]  
  
rm(MCMCglmm\_output)

## 11.2. Data Harmonization

## 11.2.1 As summary

Use this for data summary along the text

Phylo\_models\_plants<-lapply(MCMCglmm\_phylo\_plants,function(inner\_list) summary(inner\_list))  
  
Simple\_models\_plants<-lapply(MCMCglmm\_simple\_plants,function(inner\_list) summary(inner\_list))  
  
  
Phylo\_models\_plants\_coefs<-lapply(Phylo\_models\_plants,function(inner\_list) inner\_list[[5]])  
Simple\_models\_plants\_coefs<-lapply(Simple\_models\_plants,function(inner\_list) inner\_list[[5]])  
  
Phylo\_models\_plants\_coefs<-lapply(Phylo\_models\_plants\_coefs,as.data.frame)  
Simple\_models\_plants\_coefs<-lapply(Simple\_models\_plants\_coefs,as.data.frame)  
  
  
Phylo\_models\_df\_plants<-lapply(Phylo\_models\_plants\_coefs,rownames\_to\_column, var = "Statistics")%>%  
 Map(cbind, Trait = names(.),Taxa="Plants", Model="Phylo", .)%>%do.call(rbind,.)  
  
Simple\_models\_df\_plants<-lapply(Simple\_models\_plants\_coefs,rownames\_to\_column, var = "Statistics")%>%  
 Map(cbind, Trait = names(.),Taxa="Plants", Model="Simple", .)%>%do.call(rbind,.)  
  
  
GLMMs\_df<-rbind(Phylo\_models\_df\_plants,  
 Simple\_models\_df\_plants)  
  
  
colnames(GLMMs\_df)<-c("Trait","Taxa","Model","Statistics","post.mean","low95","high95","eff.samp","pMCMC")  
  
  
#--------------------------------------------------------------------  
# ----- SUMMARY SINTHESIS -----   
#--------------------------------------------------------------------  
  
GLMMs\_df\_summary<-GLMMs\_df%>%  
 mutate(sig=ifelse(pMCMC<=0.05,"Sig","Non-Sig"))%>%  
 filter(Statistics!="(Intercept)")

### Plants

# PLANTs x Cumulative only  
GLMMs\_df\_summary%>%  
 filter(Taxa=="Plants" & Trait == "Cumulative\_SigElas")%>%  
 group\_by(Trait)

## # A tibble: 12 × 10  
## # Groups: Trait [1]  
## Trait Taxa Model Statistics post.mean low95 high95 eff.samp pMCMC  
## <chr> <chr> <chr> <chr> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 Cumulati… Plan… Phylo LHPC.1 -0.0105 -0.0203 -1.90e-4 9900. 0.0382   
## 2 Cumulati… Plan… Phylo LHPC.2 -0.00516 -0.0219 1.13e-2 9900. 0.541   
## 3 Cumulati… Plan… Phylo ClimPC.1 0.0167 -0.0163 5.12e-2 9900. 0.326   
## 4 Cumulati… Plan… Phylo ClimPC.2 0.0364 0.00950 5.95e-2 9900. 0.00566  
## 5 Cumulati… Plan… Phylo LHPC.1:LH… 0.00596 -0.00267 1.52e-2 9900. 0.182   
## 6 Cumulati… Plan… Phylo ClimPC.1:… 0.0130 -0.00540 3.18e-2 9900. 0.170   
## 7 Cumulati… Plan… Simp… LHPC.1 -0.0179 -0.0398 3.35e-3 10217. 0.107   
## 8 Cumulati… Plan… Simp… LHPC.2 -0.0262 -0.0637 1.42e-2 9900. 0.188   
## 9 Cumulati… Plan… Simp… ClimPC.1 0.0414 0.0107 7.19e-2 9900. 0.00970  
## 10 Cumulati… Plan… Simp… ClimPC.2 0.0204 -0.0154 5.53e-2 9900. 0.253   
## 11 Cumulati… Plan… Simp… LHPC.1:LH… 0.0228 0.00254 4.36e-2 10229. 0.0253   
## 12 Cumulati… Plan… Simp… ClimPC.1:… 0.0404 0.0171 6.47e-2 9900. 0.00121  
## # ℹ 1 more variable: sig <chr>

# By vital rates - Plants & Animals  
GLMMs\_df\_summary%>%  
 filter(Taxa=="Plants" & !c(Trait %in% c("Cumulative\_SigElas","Buffmx")))%>%  
 group\_by(Trait)%>%group\_split()

## <list\_of<  
## tbl\_df<  
## Trait : character  
## Taxa : character  
## Model : character  
## Statistics: character  
## post.mean : double  
## low95 : double  
## high95 : double  
## eff.samp : double  
## pMCMC : double  
## sig : character  
## >  
## >[5]>  
## [[1]]  
## # A tibble: 12 × 10  
## Trait Taxa Model Statistics post.mean low95 high95 eff.samp pMCMC sig   
## <chr> <chr> <chr> <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <chr>  
## 1 Clona… Plan… Phylo LHPC.1 -0.00263 -0.00871 0.00338 10581. 0.393 Non-…  
## 2 Clona… Plan… Phylo LHPC.2 -0.00101 -0.0110 0.00946 9605. 0.853 Non-…  
## 3 Clona… Plan… Phylo ClimPC.1 0.00152 -0.0103 0.0127 9900. 0.794 Non-…  
## 4 Clona… Plan… Phylo ClimPC.2 -0.00396 -0.0153 0.00831 9900. 0.509 Non-…  
## 5 Clona… Plan… Phylo LHPC.1:LH… 0.00123 -0.00421 0.00662 9900 0.655 Non-…  
## 6 Clona… Plan… Phylo ClimPC.1:… -0.00170 -0.00930 0.00572 8527. 0.656 Non-…  
## 7 Clona… Plan… Simp… LHPC.1 -0.000547 -0.00740 0.00607 9900 0.875 Non-…  
## 8 Clona… Plan… Simp… LHPC.2 -0.00591 -0.0175 0.00682 9900. 0.337 Non-…  
## 9 Clona… Plan… Simp… ClimPC.1 0.00179 -0.00740 0.0116 9900. 0.704 Non-…  
## 10 Clona… Plan… Simp… ClimPC.2 -0.00281 -0.0135 0.00890 10882. 0.629 Non-…  
## 11 Clona… Plan… Simp… LHPC.1:LH… 0.000515 -0.00595 0.00681 9900 0.868 Non-…  
## 12 Clona… Plan… Simp… ClimPC.1:… -0.00193 -0.00923 0.00569 9900. 0.619 Non-…  
##   
## [[2]]  
## # A tibble: 12 × 10  
## Trait Taxa Model Statistics post.mean low95 high95 eff.samp pMCMC  
## <chr> <chr> <chr> <chr> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 Growth\_S… Plan… Phylo LHPC.1 2.18e-5 -2.99e-3 2.83e-3 10460. 9.80e-1  
## 2 Growth\_S… Plan… Phylo LHPC.2 -1.14e-3 -6.29e-3 3.79e-3 9900. 6.60e-1  
## 3 Growth\_S… Plan… Phylo ClimPC.1 -8.23e-4 -5.56e-3 4.03e-3 9900. 7.41e-1  
## 4 Growth\_S… Plan… Phylo ClimPC.2 5.96e-3 7.10e-4 1.13e-2 9900. 2.79e-2  
## 5 Growth\_S… Plan… Phylo LHPC.1:LH… -9.03e-6 -2.55e-3 2.60e-3 10512. 9.85e-1  
## 6 Growth\_S… Plan… Phylo ClimPC.1:… -3.48e-3 -6.81e-3 -1.62e-4 9900. 4.28e-2  
## 7 Growth\_S… Plan… Simp… LHPC.1 -2.10e-4 -1.62e-3 1.10e-3 9900. 7.66e-1  
## 8 Growth\_S… Plan… Simp… LHPC.2 -1.64e-3 -3.97e-3 1.01e-3 9900. 1.91e-1  
## 9 Growth\_S… Plan… Simp… ClimPC.1 -4.49e-4 -2.39e-3 1.39e-3 9900. 6.36e-1  
## 10 Growth\_S… Plan… Simp… ClimPC.2 4.79e-3 2.60e-3 7.09e-3 9900. 1.01e-4  
## 11 Growth\_S… Plan… Simp… LHPC.1:LH… -2.11e-4 -1.39e-3 1.11e-3 9900. 7.41e-1  
## 12 Growth\_S… Plan… Simp… ClimPC.1:… -2.78e-3 -4.27e-3 -1.31e-3 9900. 4.04e-4  
## # ℹ 1 more variable: sig <chr>  
##   
## [[3]]  
## # A tibble: 12 × 10  
## Trait Taxa Model Statistics post.mean low95 high95 eff.samp pMCMC  
## <chr> <chr> <chr> <chr> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 Reproduct… Plan… Phylo LHPC.1 -0.00348 -1.09e-2 0.00413 9900. 0.350   
## 2 Reproduct… Plan… Phylo LHPC.2 -0.00360 -1.62e-2 0.00875 9900. 0.580   
## 3 Reproduct… Plan… Phylo ClimPC.1 0.00857 -1.20e-2 0.0297 9900. 0.415   
## 4 Reproduct… Plan… Phylo ClimPC.2 0.00166 -1.59e-2 0.0190 10617. 0.857   
## 5 Reproduct… Plan… Phylo LHPC.1:LH… 0.00425 -2.51e-3 0.0112 9900. 0.217   
## 6 Reproduct… Plan… Phylo ClimPC.1:… 0.0107 -1.69e-3 0.0226 9900. 0.0828   
## 7 Reproduct… Plan… Simp… LHPC.1 -0.000644 -1.21e-2 0.0111 10031. 0.912   
## 8 Reproduct… Plan… Simp… LHPC.2 -0.00214 -2.32e-2 0.0188 9594. 0.837   
## 9 Reproduct… Plan… Simp… ClimPC.1 0.0192 3.33e-3 0.0352 9900. 0.0222   
## 10 Reproduct… Plan… Simp… ClimPC.2 -0.00236 -2.07e-2 0.0173 9607. 0.801   
## 11 Reproduct… Plan… Simp… LHPC.1:LH… 0.0103 5.24e-6 0.0214 9186. 0.0610   
## 12 Reproduct… Plan… Simp… ClimPC.1:… 0.0168 3.86e-3 0.0290 9900. 0.00990  
## # ℹ 1 more variable: sig <chr>  
##   
## [[4]]  
## # A tibble: 12 × 10  
## Trait Taxa Model Statistics post.mean low95 high95 eff.samp pMCMC sig   
## <chr> <chr> <chr> <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <chr>  
## 1 Shrin… Plan… Phylo LHPC.1 7.20e-5 -2.63e-3 0.00297 9900. 0.958 Non-…  
## 2 Shrin… Plan… Phylo LHPC.2 -7.43e-5 -5.04e-3 0.00463 9900. 0.977 Non-…  
## 3 Shrin… Plan… Phylo ClimPC.1 7.47e-4 -4.09e-3 0.00528 8491. 0.738 Non-…  
## 4 Shrin… Plan… Phylo ClimPC.2 -1.87e-4 -5.34e-3 0.00477 9900 0.949 Non-…  
## 5 Shrin… Plan… Phylo LHPC.1:LH… 2.92e-4 -2.18e-3 0.00289 9900. 0.819 Non-…  
## 6 Shrin… Plan… Phylo ClimPC.1:… -6.99e-5 -3.39e-3 0.00316 9580. 0.966 Non-…  
## 7 Shrin… Plan… Simp… LHPC.1 2.35e-4 -9.85e-4 0.00149 9900. 0.707 Non-…  
## 8 Shrin… Plan… Simp… LHPC.2 1.28e-4 -2.15e-3 0.00239 9900. 0.913 Non-…  
## 9 Shrin… Plan… Simp… ClimPC.1 5.21e-4 -1.25e-3 0.00221 9900. 0.546 Non-…  
## 10 Shrin… Plan… Simp… ClimPC.2 -3.34e-4 -2.31e-3 0.00178 9900. 0.745 Non-…  
## 11 Shrin… Plan… Simp… LHPC.1:LH… 3.15e-4 -8.41e-4 0.00150 9900. 0.595 Non-…  
## 12 Shrin… Plan… Simp… ClimPC.1:… 1.12e-4 -1.28e-3 0.00145 9900. 0.871 Non-…  
##   
## [[5]]  
## # A tibble: 12 × 10  
## Trait Taxa Model Statistics post.mean low95 high95 eff.samp pMCMC  
## <chr> <chr> <chr> <chr> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 Survival… Plan… Phylo LHPC.1 -0.0145 -2.92e-2 -1.25e-4 9900 0.0511   
## 2 Survival… Plan… Phylo LHPC.2 -0.0176 -4.30e-2 8.64e-3 9900. 0.180   
## 3 Survival… Plan… Phylo ClimPC.1 0.0246 2.76e-3 4.62e-2 9900. 0.0277   
## 4 Survival… Plan… Phylo ClimPC.2 0.0181 -6.87e-3 4.17e-2 9900. 0.141   
## 5 Survival… Plan… Phylo LHPC.1:LH… 0.0135 9.09e-4 2.74e-2 9900. 0.0465   
## 6 Survival… Plan… Phylo ClimPC.1:… 0.0269 1.14e-2 4.33e-2 9900. 0.00101  
## 7 Survival… Plan… Simp… LHPC.1 -0.0132 -2.65e-2 6.27e-4 9347. 0.0606   
## 8 Survival… Plan… Simp… LHPC.2 -0.0178 -4.23e-2 6.98e-3 9900. 0.165   
## 9 Survival… Plan… Simp… ClimPC.1 0.0249 5.83e-3 4.37e-2 9900 0.0101   
## 10 Survival… Plan… Simp… ClimPC.2 0.0171 -5.00e-3 3.87e-2 9596. 0.131   
## 11 Survival… Plan… Simp… LHPC.1:LH… 0.0136 1.99e-4 2.59e-2 9900. 0.0370   
## 12 Survival… Plan… Simp… ClimPC.1:… 0.0284 1.34e-2 4.27e-2 9900. 0.00101  
## # ℹ 1 more variable: sig <chr>

## 11.2.2 Posterior distribution

Better for figures.

Phylo\_posterior\_plants<-lapply(MCMCglmm\_phylo\_plants,function(inner\_list) data.frame(inner\_list$Sol,Taxa="Plants",Model="Phylo"))  
  
Simple\_posterior\_plants<-lapply(MCMCglmm\_simple\_plants,function(inner\_list) data.frame(inner\_list$Sol,Taxa="Plants",Model="Simple"))  
  
Posterior\_data<-rbind(  
 do.call(rbind,Phylo\_posterior\_plants),  
 do.call(rbind,Simple\_posterior\_plants))%>%  
 rownames\_to\_column(., var = "VAR")%>%  
 separate(VAR,c("Trait"))%>%  
 pivot\_longer(!c(Trait,Taxa,Model),values\_to="Values",names\_to="Variables")%>%  
 mutate(Variables=ifelse(Variables=="LHPC.1.LHPC.2","LHPC.1:LHPC.2",Variables))%>%  
 mutate(Variables=ifelse(Variables=="ClimPC.1.ClimPC.2","ClimPC.1:ClimPC.2",Variables))%>%  
 as\_tibble()%>%  
 filter(Variables!="X.Intercept.")

## Warning: Expected 1 pieces. Additional pieces discarded in 138600 rows [1, 2, 3, 4, 5,  
## 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, ...].

Posterior\_data<-left\_join(Posterior\_data,  
 GLMMs\_df%>%separate(Trait,"Trait"),  
 by=c("Trait","Taxa","Model","Variables"="Statistics"))%>%  
 mutate(sig=ifelse(pMCMC<=0.05,"Sig","Non-Sig"))

## Warning: Expected 1 pieces. Additional pieces discarded in 84 rows [1, 2, 3, 4, 5, 6, 7,  
## 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, ...].

Posterior\_data%>%as\_tibble()

## # A tibble: 831,600 × 11  
## Trait Taxa Model Variables Values post.mean low95 high95 eff.samp  
## <chr> <chr> <chr> <chr> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 Reproduct… Plan… Phylo LHPC.1 0.00187 -0.00348 -0.0109 0.00413 9900.  
## 2 Reproduct… Plan… Phylo LHPC.2 -0.0103 -0.00360 -0.0162 0.00875 9900.  
## 3 Reproduct… Plan… Phylo ClimPC.1 0.00409 0.00857 -0.0120 0.0297 9900.  
## 4 Reproduct… Plan… Phylo ClimPC.2 -0.0136 0.00166 -0.0159 0.0190 10617.  
## 5 Reproduct… Plan… Phylo LHPC.1:L… 0.00750 0.00425 -0.00251 0.0112 9900.  
## 6 Reproduct… Plan… Phylo ClimPC.1… 0.0157 0.0107 -0.00169 0.0226 9900.  
## 7 Reproduct… Plan… Phylo LHPC.1 -0.00181 -0.00348 -0.0109 0.00413 9900.  
## 8 Reproduct… Plan… Phylo LHPC.2 0.00298 -0.00360 -0.0162 0.00875 9900.  
## 9 Reproduct… Plan… Phylo ClimPC.1 0.0242 0.00857 -0.0120 0.0297 9900.  
## 10 Reproduct… Plan… Phylo ClimPC.2 -0.00762 0.00166 -0.0159 0.0190 10617.  
## # ℹ 831,590 more rows  
## # ℹ 2 more variables: pMCMC <dbl>, sig <chr>

## 11.3. GGPLOT Posterior distribution

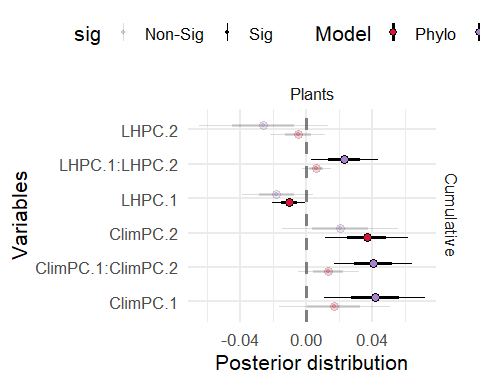
### Code

Code only

ggplot\_posteriors<-Posterior\_data%>%  
 filter(Trait!="Buffmx")%>%  
 mutate(Trait = factor(Trait , levels = c("Cumulative", "Survival","Growth","Shrinking", "Reproduction", "Clonality")))%>%  
 ggplot(.,aes(x=Variables,y=Values,group=Model))+  
 geom\_hline(yintercept=0,linetype=2,color="grey50",linewidth=1.4)+  
 stat\_pointinterval(position=position\_dodge(.5),.width = c(.66, .95),  
 aes(x = Variables,color=sig,shape=Model,fill=Model,alpha=sig))+  
 scale\_alpha\_manual(values=c(.2,1))+  
 scale\_fill\_manual(values=c("#da1438","#a783ce"))+  
 scale\_color\_manual(values=c("grey30","black"))+  
 scale\_shape\_manual(values=c(21,21))+  
 xlab("Variables")+ylab("Posterior distribution")+  
 ggh4x::facet\_grid2(Trait~Taxa,scales="free\_x",independent = "x")+  
 theme\_minimal(base\_size=16)+coord\_flip()+  
 theme(  
 #axis.text.x = element\_text(angle = 45, hjust=1),  
 legend.position="top")+  
 guides(shape = guide\_legend(override.aes = list(size = 5)))  
  
ggplot\_posteriors\_vr<-ggplot\_posteriors\_cumu<-ggplot\_posteriors  
  
ggplot\_posteriors\_cumu$data<-filter(ggplot\_posteriors$data,Taxa=="Plants" & Trait == "Cumulative")  
ggplot\_posteriors\_vr$data<-filter(ggplot\_posteriors$data,Taxa=="Plants" & Trait != "Cumulative")

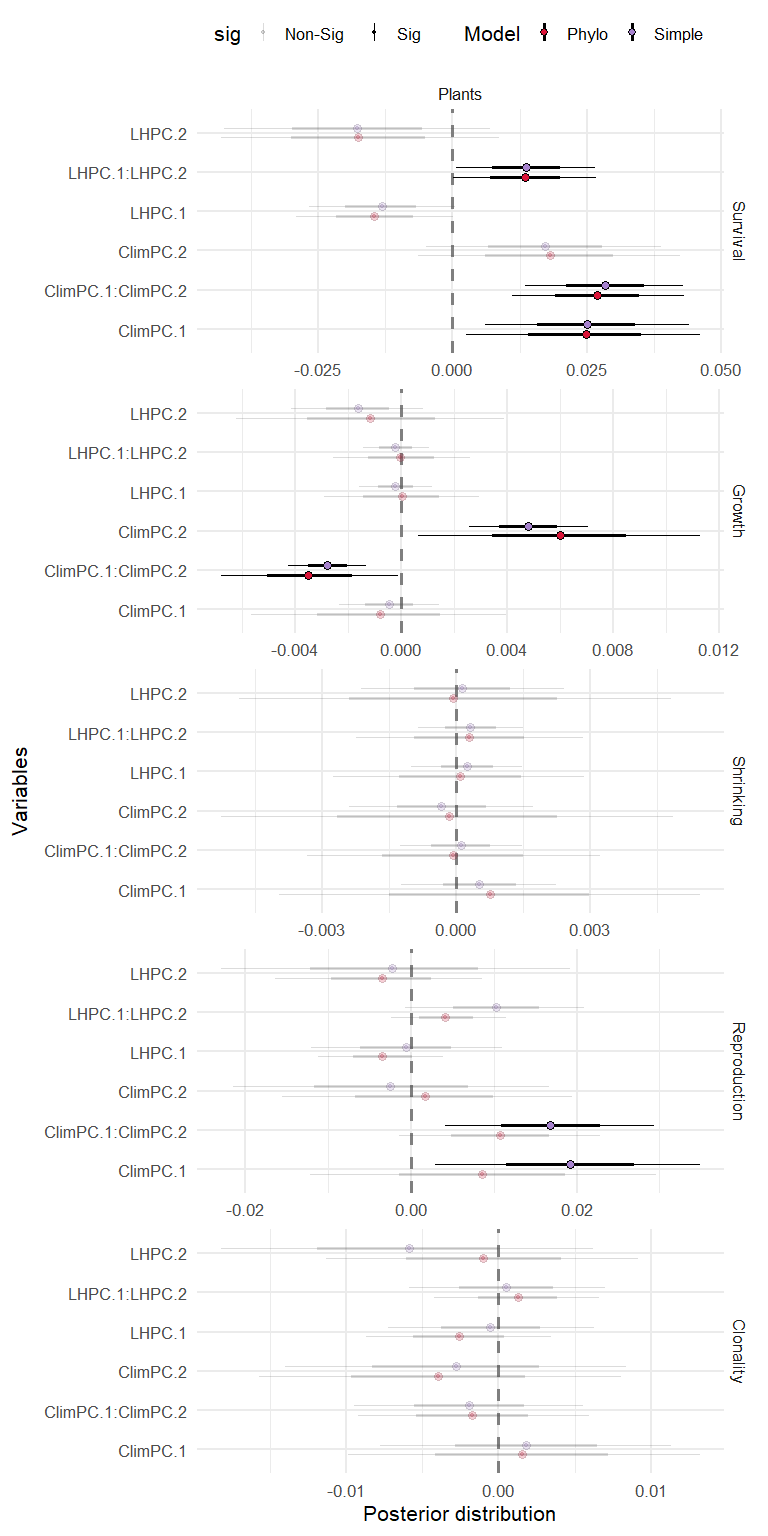
### Cumulative

# cumulative & Plants only  
ggplot\_posteriors\_cumu



### Vital rates

# cumulative vr & Plants only  
ggplot\_posteriors\_vr



# 12. Estimating Phylogenetic signal

## 11.1. Create an anxiliary function Creates the new anxilliary function my.fake.lamb.

This function was created based on Garamszegi (2014)

my.fake.lamb<-function(model){  
 out = model$VCV[,"phylo"]/  
 (model$VCV[,"phylo"]+  
 # model$VCV[,"species"]+  
 model$VCV[,"units"])  
 mean.Lambda=mean(out)  
 SE.lambda=(sd(out)/sqrt(length(out)))  
 return(out)  
}

## 12.2. Estimating phylogenetic signal for all models

Code below use my.fake.lamb to estimate phylogenetic signal for all models in a list.

package ggridges is necessary. Dependency for geom\_density\_ridges

#InterestingVars<-c("Survival","Growth","Shrinking","Reproduction","Clonality","Buffmx","Cumulative")  
traits<-c("Reproduction\_SigElas", "Growth\_SigElas", "Shrinking\_SigElas", "Clonality\_SigElas", "Survival\_SigElas",  
 "Cumulative\_SigElas","Buffmx")   
  
#lapply(MCMCglmm\_phylo\_animals,function(inner\_list) inner\_list$VCV)  
  
Phylo\_signal\_plants<-lapply(MCMCglmm\_phylo\_plants,function(inner\_list) as.data.frame(my.fake.lamb(inner\_list)))%>%  
 do.call(cbind,.)  
  
colnames(Phylo\_signal\_plants)<-str\_split\_i(traits, "\_", 1)  
  
Phylo\_signal\_df<-data.frame(Phylo\_signal\_plants,Taxa="Plants")%>%  
 pivot\_longer(!Taxa,names\_to="Trait",values\_to="Values")  
  
Phylo\_signal\_df%>%  
 group\_by(Taxa,Trait)%>%  
 summarise(Mean=mean(Values),  
 SD=sd(Values),  
 N=n(),  
 gaussianCI=1.96\*(SD/sqrt(N)),  
 lower95=quantile(Values,.025),  
 higher95=quantile(Values,.975))

## `summarise()` has grouped output by 'Taxa'. You can override using the  
## `.groups` argument.

## # A tibble: 7 × 8  
## # Groups: Taxa [1]  
## Taxa Trait Mean SD N gaussianCI lower95 higher95  
## <chr> <chr> <dbl> <dbl> <int> <dbl> <dbl> <dbl>  
## 1 Plants Buffmx 0.570 0.172 9900 0.00339 0.235 0.851  
## 2 Plants Clonality 0.816 0.0575 9900 0.00113 0.676 0.901  
## 3 Plants Cumulative 0.992 0.00287 9900 0.0000565 0.985 0.996  
## 4 Plants Growth 0.659 0.0554 9900 0.00109 0.546 0.762  
## 5 Plants Reproduction 0.968 0.0130 9900 0.000256 0.937 0.985  
## 6 Plants Shrinking 0.670 0.0529 9900 0.00104 0.561 0.768  
## 7 Plants Survival 0.252 0.100 9900 0.00198 0.107 0.490

## 12.3. Comparing phylogenetic signal

without significant correlation between phylogenetic signal and contribution to buffering capacity

# Summarise phylogenetic signal  
Phylo\_summary <- Phylo\_signal\_df %>%  
 filter(!(Trait %in% c("Cumulative","Buffmx")))%>%  
 group\_by(Taxa,Trait) %>%  
 summarise(  
 MEDIAN = median(Values),  
 SD = sd(Values),  
 SE = SD / sqrt(n()) )%>%  
 mutate(Trait=factor(Trait,levels = c("Survival", "Growth", "Shrinking", "Reproduction", "Clonality")))  
  
# Merge phylogenetic signal (summarized) with relative contribution  
phylo\_buffer\_df<-left\_join(  
Phylo\_summary%>%mutate(Kingdom=ifelse(Taxa=="Animals", "Animalia", "Plantae")),  
RelContrib\_df%>%mutate(name = str\_remove(name, "\_SigElas")),  
by=c("Trait" = "name", "Kingdom"),suffix = c(".phylo", ".buffer"))%>%  
 select(-Kingdom)  
  
cor.test(method="spearman",  
 filter(phylo\_buffer\_df,Taxa=="Plants")$MEDIAN,  
filter(phylo\_buffer\_df,Taxa=="Plants")$Relativemean  
)

Spearman's rank correlation rho

data: filter(phylo\_buffer\_df, Taxa == “Plants”)$MEDIAN and filter(phylo\_buffer\_df, Taxa == "Plants")$Relativemean S = 34, p-value = 0.2333 alternative hypothesis: true rho is not equal to 0 sample estimates: rho -0.7

Detailed values for plants

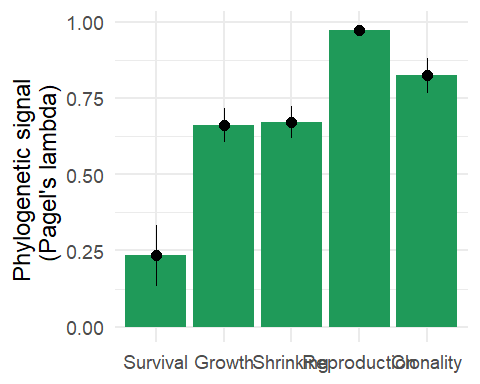
Phylo\_summary

## # A tibble: 5 × 5  
## # Groups: Taxa [1]  
## Taxa Trait MEDIAN SD SE  
## <chr> <fct> <dbl> <dbl> <dbl>  
## 1 Plants Clonality 0.824 0.0575 0.000577  
## 2 Plants Growth 0.661 0.0554 0.000557  
## 3 Plants Reproduction 0.971 0.0130 0.000131  
## 4 Plants Shrinking 0.671 0.0529 0.000532  
## 5 Plants Survival 0.234 0.100 0.00101

### Bar Plot

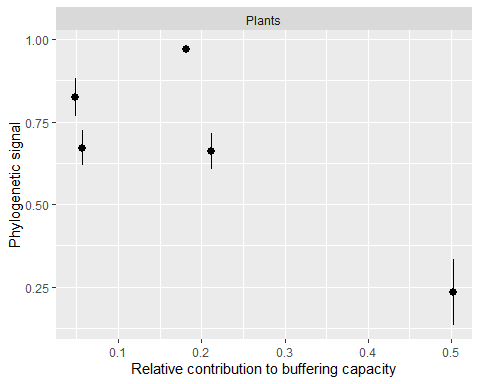
#### Plants

Phylo\_summary%>%  
ggplot(., aes(x = Trait, y = MEDIAN, fill = Taxa)) +  
 geom\_bar(stat = "identity", position = position\_dodge()) + # Barras com transparência leve  
 geom\_pointrange(aes(ymin = MEDIAN - SD, ymax=pmin(MEDIAN + SD, 1)),   
 position = position\_dodge(width = 0.9), color = "black", size = 0.8) +  
 scale\_fill\_manual(values=c("#1f9a59"))+  
 labs(x = NULL,  
 y = "Phylogenetic signal \n (Pagel's lambda)") +  
 theme\_minimal(base\_size=18)+  
 theme(legend.position="none",  
 panel.spacing = unit(2, "lines"))



### Phylo x buffer plot

phylo\_buffer\_df%>%  
 ggplot(data=.,aes(x=Relativemean,y=MEDIAN))+  
 geom\_point()+  
 geom\_pointrange(aes(ymin=MEDIAN-SD.phylo,ymax=MEDIAN+SD.phylo))+  
 facet\_grid(.~Taxa)+  
 labs(x="Relative contribution to buffering capacity",  
 y="Phylogenetic signal")



# References

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1. Remember that absolute sum of stochastic elasticity within respect to variance is extremaly important to the analyses because our question is about the demographic position, not what determine the contribution of these vital rates. If we use raw values we could answers other question but not their position about buffering capacity [↑](#footnote-ref-55)