Curtis Analysis

library(tidyverse)

## ── Attaching packages ─────────────────────────────────────── tidyverse 1.3.1 ──

## ✔ ggplot2 3.3.5 ✔ purrr 0.3.4  
## ✔ tibble 3.1.6 ✔ dplyr 1.0.8  
## ✔ tidyr 1.2.0 ✔ stringr 1.4.0  
## ✔ readr 2.1.2 ✔ forcats 0.5.1

## ── Conflicts ────────────────────────────────────────── tidyverse\_conflicts() ──  
## ✖ dplyr::filter() masks stats::filter()  
## ✖ dplyr::lag() masks stats::lag()

library(lubridate)

##   
## Attaching package: 'lubridate'

## The following objects are masked from 'package:base':  
##   
## date, intersect, setdiff, union

`%!in%` <- Negate(`%in%`)  
  
## Reading in 2021 vegetation data  
veg\_2021 <- as\_tibble(read.csv(  
 "/Users/isaacbailey/Library/CloudStorage/OneDrive-UW-Madison/Research/Curtis\_Prairie\_DA/Curtis\_Analysis/Final\_2021\_Curtis\_Sample\_04062022.csv", header = TRUE))  
names(veg\_2021)[1] <- "Plot"  
  
# Reclassifying total cover into single integer  
veg\_2021$Total\_Cover <- replace(veg\_2021$Total\_Cover, veg\_2021$Total\_Cover == "\"1-25\"", 12.5)  
veg\_2021$Total\_Cover <- replace(veg\_2021$Total\_Cover, veg\_2021$Total\_Cover == "\"26-50\"", 37.5)  
veg\_2021$Total\_Cover <- replace(veg\_2021$Total\_Cover, veg\_2021$Total\_Cover == "\"51-75\"", 62.5)  
veg\_2021$Total\_Cover <- replace(veg\_2021$Total\_Cover, veg\_2021$Total\_Cover == "\"76-95\"", 85.5)  
veg\_2021$Total\_Cover <- replace(veg\_2021$Total\_Cover, veg\_2021$Total\_Cover == "\"96-100\"", 98)  
veg\_2021$Total\_Cover <- as.numeric(veg\_2021$Total\_Cover)  
  
# Reclassifying species cover into single integer  
veg\_2021$Sp\_Cover <- replace(veg\_2021$Sp\_Cover, veg\_2021$Sp\_Cover == "\"<1\"", 0.5)  
veg\_2021$Sp\_Cover <- replace(veg\_2021$Sp\_Cover, veg\_2021$Sp\_Cover == "\"1-5\"", 2.5)  
veg\_2021$Sp\_Cover <- replace(veg\_2021$Sp\_Cover, veg\_2021$Sp\_Cover == "\"6-25\"", 15.5)  
veg\_2021$Sp\_Cover <- replace(veg\_2021$Sp\_Cover, veg\_2021$Sp\_Cover == "\"26-50\"", 38)  
veg\_2021$Sp\_Cover <- replace(veg\_2021$Sp\_Cover, veg\_2021$Sp\_Cover == "\"51-75\"", 63)  
veg\_2021$Sp\_Cover <- replace(veg\_2021$Sp\_Cover, veg\_2021$Sp\_Cover == "\"76-95\"", 85.5)  
veg\_2021$Sp\_Cover <- replace(veg\_2021$Sp\_Cover, veg\_2021$Sp\_Cover == "\"96-100\"", 98)  
veg\_2021$Sp\_Cover <- as.numeric(veg\_2021$Sp\_Cover)

## Warning: NAs introduced by coercion

# Reclassifying dates  
veg\_2021$Date <- mdy(veg\_2021$Date)  
  
# Clean out canopy cover  
veg\_2021 %>% filter(!is.na(Canopy\_Cover)) %>% filter(is.na(Sp\_Cover)) -> just\_canopy  
veg\_2021 %>% anti\_join(just\_canopy) -> veg\_2021

## Joining, by = c("Plot", "Total\_Cover", "Scientific\_name", "Species\_name",  
## "Sp\_Cover", "Flower", "Fruit", "Seedling\_Only", "Canopy\_Cover",  
## "Intercept\_Rank", "Collected", "Unkn\_No..MCG001.", "Comments", "Date",  
## "Botanist", "Assistant", "Clean.up.Notes")

## Reading in 2002 data  
veg\_snyder <- as\_tibble(read.csv("/Users/isaacbailey/Library/CloudStorage/OneDrive-UW-Madison/Research/Curtis\_Prairie\_DA/Curtis\_Analysis/IB\_and\_MC\_Combo\_11\_10\_21 - 2002\_Data.csv", header = TRUE))  
  
# Reading in environmental data  
cross\_walk <- as\_tibble(read.csv("/Users/isaacbailey/Library/CloudStorage/OneDrive-UW-Madison/Research/Curtis\_Prairie\_DA/Curtis\_Analysis/Snyder\_crosswalk.csv", header = TRUE))  
  
# creating snyder dataframe  
ds <- data.frame(veg\_snyder)  
ds <- merge(ds, cross\_walk, by = "X2021\_Plot")  
  
# creating 2021 dataframe  
dmci <- data.frame(veg\_2021$Plot, veg\_2021$Scientific\_name)  
dmci <- merge(dmci, cross\_walk, by.x = "veg\_2021.Plot", by.y = "X2021\_Plot")  
  
# Creating dataframe without rare species  
  
nr\_dmci <- veg\_2021  
richness\_by\_spec <- nr\_dmci %>% group\_by(Scientific\_name) %>% tally()  
nr\_spec <- filter(richness\_by\_spec, n > 10)  
nr\_dmci <- filter(nr\_dmci, Scientific\_name %in% nr\_spec$Scientific\_name)

=======================================================================

# For ecological analyses  
library(vegan)

## Loading required package: permute

## Loading required package: lattice

## This is vegan 2.6-2

# Spatial data processing  
library(sp)  
library(sf)

## Linking to GEOS 3.9.1, GDAL 3.4.0, PROJ 8.1.1; sf\_use\_s2() is TRUE

# For the geostats  
library(automap)  
library(gstat)  
  
# For mapping  
library(patchwork)  
library(viridis)

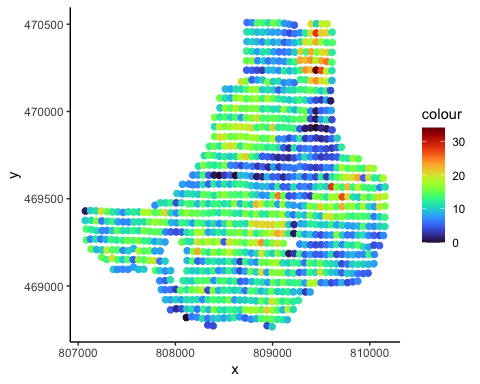
## Loading required package: viridisLite

# Setting up dataframes  
  
spat\_df <- as.tibble(cbind(dmci$veg\_2021.Plot, dmci$Easting, dmci$Northing, dmci$NumSpec))

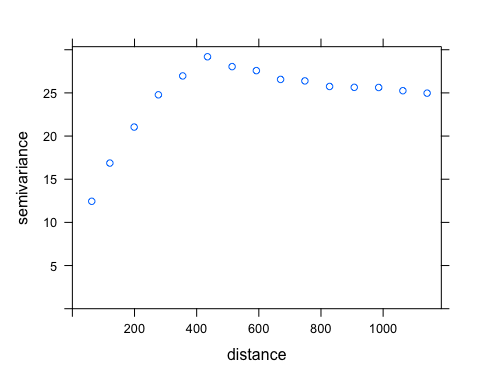
## Warning: `as.tibble()` was deprecated in tibble 2.0.0.  
## Please use `as\_tibble()` instead.  
## The signature and semantics have changed, see `?as\_tibble`.  
## This warning is displayed once every 8 hours.  
## Call `lifecycle::last\_lifecycle\_warnings()` to see where this warning was generated.

## Warning: The `x` argument of `as\_tibble.matrix()` must have unique column names if `.name\_repair` is omitted as of tibble 2.0.0.  
## Using compatibility `.name\_repair`.  
## This warning is displayed once every 8 hours.  
## Call `lifecycle::last\_lifecycle\_warnings()` to see where this warning was generated.

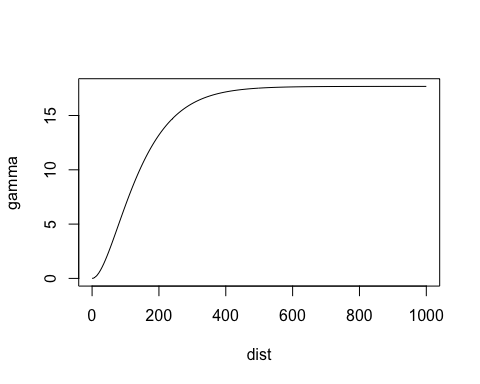
spat\_df <- aggregate(cbind(V2, V3, V4) ~ V1, data = spat\_df, FUN = mean)  
  
ggplot(data = spat\_df, aes\_(x = spat\_df$V2, y = spat\_df$V3, color = spat\_df$V4)) +  
 geom\_point(size = 2) +  
 scale\_color\_viridis(option = "H") +  
 theme\_classic()



spat\_sf <- st\_as\_sf(spat\_df, coords = c("V2", "V3"), crs = 3069) %>%  
 cbind(st\_coordinates(.))  
  
spat\_v <- variogram(  
 V4 ~ 1,  
 as(spat\_sf, "Spatial")  
)  
  
plot(spat\_v)



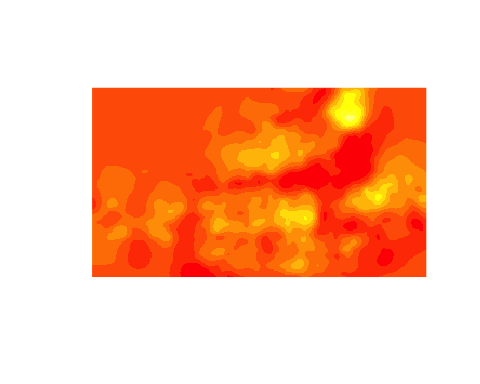
spat\_v.fit <- fit.variogram(spat\_v, vgm(c("Exp", "Mat", "Sph")), fit.kappa = TRUE, fit.method = 7)  
plot(variogramLine(vgm(17.68, "Mat", 72.11875, kappa = 1.6), 1000), type = "l")



grd\_1\_sf <- spat\_sf %>%  
 st\_bbox() %>%  
 st\_as\_sfc() %>%  
 st\_make\_grid(  
 cellsize = c(10, 10),  
 what = "centers"  
 ) %>%  
 st\_as\_sf() %>%  
 cbind(., st\_coordinates(.))  
  
grd\_1\_sp <- as(grd\_1\_sf, "Spatial")  
gridded(grd\_1\_sp) <- TRUE  
grd\_1\_sp <- as(grd\_1\_sp, "SpatialPixels")  
  
SK\_rich <- krige(  
 V4 ~ 1,  
 as(spat\_sf, "Spatial"),  
 grd\_1\_sp,  
 model = spat\_v.fit  
)

## [using ordinary kriging]

image(SK\_rich)



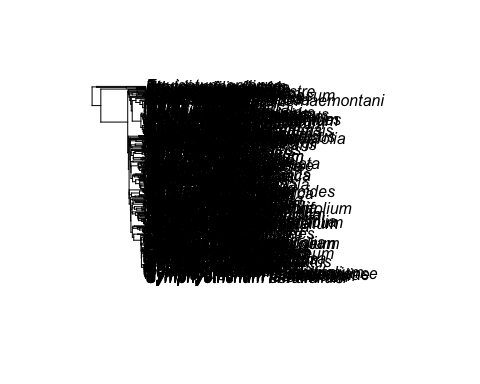
library(betapart)  
  
dmci %>% filter(veg\_2021.Plot != 905) -> spat\_dmci  
veg\_snyder %>% filter(X2021\_Plot != 1004) -> spat\_snyder  
  
dmci\_plot <- as.factor(spat\_dmci$veg\_2021.Plot)  
dmci\_spec <- as.factor(spat\_dmci$veg\_2021.Scientific\_name)  
  
snyder\_plot <- as.factor(spat\_snyder$X2021\_Plot)  
snyder\_spec <- as.factor(spat\_snyder$X2021\_Taxon)  
  
dmci\_mat <- table(dmci\_plot, dmci\_spec)  
dmci\_mat[dmci\_mat > 1] <- 1  
  
snyder\_mat <- table(snyder\_plot, snyder\_spec)  
snyder\_mat[snyder\_mat > 1] <- 1  
  
comb\_spec <- unique(append(dmci\_spec, snyder\_spec))  
  
subset(comb\_spec, comb\_spec %!in% dmci\_spec) -> ni\_dmci  
addon\_dmci <- matrix(0,length(unique(dmci\_plot)),length(ni\_dmci))  
colnames(addon\_dmci) <- (ni\_dmci)  
row.names(addon\_dmci) <- unique(dmci\_plot)  
  
dmci\_mat <- cbind(dmci\_mat, addon\_dmci)  
  
  
  
  
subset(comb\_spec, comb\_spec %!in% snyder\_spec) -> ni\_snyder  
addon\_snyder <- matrix(0,length(unique(snyder\_plot)),length(ni\_snyder))  
colnames(addon\_snyder) <- (ni\_snyder)  
row.names(addon\_snyder) <- unique(snyder\_plot)  
  
snyder\_mat <- cbind(snyder\_mat, addon\_snyder)  
  
dmci\_mat <- dmci\_mat[,order(colnames(dmci\_mat))]  
snyder\_mat <- snyder\_mat[,order(colnames(snyder\_mat))]  
  
  
beta\_dmci\_mat <- betapart.core(dmci\_mat)  
beta\_snyder\_mat <- betapart.core(snyder\_mat)  
  
jaccard <- beta.temp(beta\_dmci\_mat,beta\_snyder\_mat, "jaccard")

=================================================================================================================== This chunk trims a phylogenetic tree for the species in our sample from the tree of Wisconsin flora from Spalink, Daniel et al. (2019). Not listed in the tree are the edge lengths for each branch. These are stored, but not graphically represented. As it stands now, this tree excludes individuals not identified to species,and some This will be used to calculate PD, NTI, and NRI later in the document.

library(ape)  
  
#sort into distinct species  
keep\_species <- distinct(veg\_2021, Scientific\_name)  
  
#reformat of species list for tree pruning  
keep\_species$Scientific\_name <- as.character(keep\_species$Scientific\_name)  
keep <- gsub(" ", "\_", keep\_species$Scientific\_name)  
  
#reading in large phylogenetic tree  
bigtree <- read.tree("/Users/isaacbailey/Library/CloudStorage/OneDrive-UW-Madison/Research/Curtis\_Prairie\_DA/GC.ultrametric\_genera\_constrained.tre")  
  
#finding taxa to remove  
setdiff(bigtree$tip.label, keep) -> remove\_taxa  
  
#tree pruning  
pruned.tree <- drop.tip(bigtree, remove\_taxa)  
  
#List species in tree  
pruned.tree$tip.label

## [1] "Symphyotrichum\_firmum" "Symphyotrichum\_cordifolium"   
## [3] "Symphyotrichum\_lateriflorum" "Symphyotrichum\_lanceolatum"   
## [5] "Symphyotrichum\_laeve" "Symphyotrichum\_novae-angliae"   
## [7] "Symphyotrichum\_pilosum" "Symphyotrichum\_ericoides"   
## [9] "Symphyotrichum\_oolentangiense" "Symphyotrichum\_oblongifolium"   
## [11] "Symphyotrichum\_praealtum" "Euthamia\_graminifolia"   
## [13] "Solidago\_riddellii" "Solidago\_juncea"   
## [15] "Solidago\_ulmifolia" "Solidago\_nemoralis"   
## [17] "Solidago\_rigida" "Solidago\_speciosa"   
## [19] "Solidago\_canadensis" "Solidago\_gigantea"   
## [21] "Erigeron\_pulchellus" "Erigeron\_annuus"   
## [23] "Erigeron\_strigosus" "Erigeron\_philadelphicus"   
## [25] "Doellingeria\_umbellata" "Achillea\_millefolium"   
## [27] "Artemisia\_ludoviciana" "Helianthus\_hirsutus"   
## [29] "Helianthus\_maximiliani" "Helianthus\_grosseserratus"   
## [31] "Helianthus\_strumosus" "Helianthus\_pauciflorus"   
## [33] "Ambrosia\_artemisiifolia" "Ambrosia\_trifida"   
## [35] "Parthenium\_integrifolium" "Echinacea\_pallida"   
## [37] "Echinacea\_purpurea" "Heliopsis\_helianthoides"   
## [39] "Ratibida\_pinnata" "Rudbeckia\_subtomentosa"   
## [41] "Rudbeckia\_triloba" "Rudbeckia\_hirta"   
## [43] "Rudbeckia\_laciniata" "Silphium\_laciniatum"   
## [45] "Silphium\_integrifolium" "Silphium\_terebinthinaceum"   
## [47] "Eupatorium\_altissimum" "Eupatorium\_perfoliatum"   
## [49] "Eutrochium\_maculatum" "Liatris\_spicata"   
## [51] "Liatris\_ligulistylis" "Liatris\_pycnostachya"   
## [53] "Liatris\_aspera" "Ageratina\_altissima"   
## [55] "Brickellia\_eupatorioides" "Helenium\_autumnale"   
## [57] "Bidens\_frondosa" "Bidens\_cernua"   
## [59] "Coreopsis\_palmata" "Packera\_paupercula"   
## [61] "Packera\_aurea" "Hasteola\_suaveolens"   
## [63] "Erechtites\_hieraciifolius" "Arnoglossum\_plantagineum"   
## [65] "Arnoglossum\_atriplicifolium" "Antennaria\_neglecta"   
## [67] "Antennaria\_plantaginifolia" "Sonchus\_oleraceus"   
## [69] "Sonchus\_arvensis" "Taraxacum\_officinale"   
## [71] "Lactuca\_canadensis" "Lactuca\_biennis"   
## [73] "Lactuca\_serriola" "Lactuca\_ludoviciana"   
## [75] "Hieracium\_longipilum" "Pilosella\_aurantiaca"   
## [77] "Vernonia\_fasciculata" "Cirsium\_discolor"   
## [79] "Cirsium\_muticum" "Cirsium\_vulgare"   
## [81] "Cirsium\_arvense" "Arctium\_minus"   
## [83] "Campanula\_aparinoides" "Lobelia\_spicata"   
## [85] "Taenidia\_integerrima" "Zizia\_aptera"   
## [87] "Zizia\_aurea" "Pastinaca\_sativa"   
## [89] "Angelica\_atropurpurea" "Osmorhiza\_longistylis"   
## [91] "Daucus\_carota" "Torilis\_japonica"   
## [93] "Cicuta\_maculata" "Sanicula\_marilandica"   
## [95] "Eryngium\_yuccifolium" "Hydrocotyle\_americana"   
## [97] "Lonicera\_morrowii" "Dipsacus\_fullonum"   
## [99] "Viburnum\_opulus" "Monarda\_fistulosa"   
## [101] "Pycnanthemum\_tenuifolium" "Blephilia\_ciliata"   
## [103] "Pycnanthemum\_virginianum" "Mentha\_canadensis"   
## [105] "Glechoma\_hederacea" "Agastache\_scrophulariifolia"   
## [107] "Prunella\_vulgaris" "Lycopus\_americanus"   
## [109] "Lycopus\_uniflorus" "Teucrium\_canadense"   
## [111] "Scutellaria\_parvula" "Pedicularis\_canadensis"   
## [113] "Phryma\_leptostachya" "Verbena\_hastata"   
## [115] "Verbena\_stricta" "Verbena\_urticifolia"   
## [117] "Verbascum\_thapsus" "Scrophularia\_marilandica"   
## [119] "Veronicastrum\_virginicum" "Plantago\_rugelii"   
## [121] "Plantago\_major" "Linaria\_vulgaris"   
## [123] "Penstemon\_digitalis" "Fraxinus\_pennsylvanica"   
## [125] "Hackelia\_virginiana" "Asclepias\_syriaca"   
## [127] "Asclepias\_tuberosa" "Asclepias\_incarnata"   
## [129] "Apocynum\_cannabinum" "Apocynum\_androsaemifolium"   
## [131] "Gentianella\_quinquefolia" "Gentiana\_alba"   
## [133] "Gentiana\_andrewsii" "Galium\_boreale"   
## [135] "Galium\_triflorum" "Galium\_asprellum"   
## [137] "Solanum\_carolinense" "Solanum\_dulcamara"   
## [139] "Solanum\_ptychanthum" "Physalis\_heterophylla"   
## [141] "Physalis\_virginiana" "Cuscuta\_cephalanthi"   
## [143] "Cuscuta\_gronovii" "Calystegia\_sepium"   
## [145] "Convolvulus\_arvensis" "Lysimachia\_lanceolata"   
## [147] "Phlox\_pilosa" "Phlox\_glaberrima"   
## [149] "Impatiens\_capensis" "Cornus\_amomum"   
## [151] "Cornus\_racemosa" "Cornus\_sericea"   
## [153] "Chenopodium\_album" "Silene\_stellata"   
## [155] "Cerastium\_fontanum" "Rumex\_crispus"   
## [157] "Polygonum\_aviculare" "Persicaria\_pensylvanica"   
## [159] "Persicaria\_hydropiper" "Persicaria\_maculosa"   
## [161] "Persicaria\_punctata" "Persicaria\_hydropiperoides"   
## [163] "Persicaria\_amphibia" "Persicaria\_sagittata"   
## [165] "Persicaria\_virginiana" "Comandra\_umbellata"   
## [167] "Potentilla\_intermedia" "Potentilla\_simplex"   
## [169] "Fragaria\_virginiana" "Rosa\_setigera"   
## [171] "Rosa\_blanda" "Rosa\_carolina"   
## [173] "Rosa\_arkansana" "Rosa\_rubiginosa"   
## [175] "Agrimonia\_gryposepala" "Geum\_canadense"   
## [177] "Geum\_aleppicum" "Geum\_triflorum"   
## [179] "Rubus\_allegheniensis" "Rubus\_flagellaris"   
## [181] "Rubus\_idaeus" "Rubus\_occidentalis"   
## [183] "Crataegus\_crus-galli" "Malus\_ioensis"   
## [185] "Prunus\_americana" "Prunus\_serotina"   
## [187] "Spiraea\_alba" "Pilea\_fontana"   
## [189] "Urtica\_dioica" "Laportea\_canadensis"   
## [191] "Parietaria\_pensylvanica" "Boehmeria\_cylindrica"   
## [193] "Ulmus\_americana" "Rhamnus\_cathartica"   
## [195] "Frangula\_alnus" "Ceanothus\_americanus"   
## [197] "Vicia\_sativa" "Vicia\_americana"   
## [199] "Vicia\_villosa" "Trifolium\_pratense"   
## [201] "Trifolium\_hybridum" "Trifolium\_repens"   
## [203] "Trifolium\_campestre" "Medicago\_lupulina"   
## [205] "Melilotus\_albus" "Melilotus\_officinalis"   
## [207] "Lotus\_corniculatus" "Robinia\_pseudoacacia"   
## [209] "Baptisia\_bracteata" "Baptisia\_alba"   
## [211] "Lespedeza\_capitata" "Desmodium\_illinoense"   
## [213] "Desmodium\_canadense" "Amphicarpaea\_bracteata"   
## [215] "Dalea\_candida" "Dalea\_purpurea"   
## [217] "Amorpha\_canescens" "Juglans\_nigra"   
## [219] "Quercus\_rubra" "Quercus\_macrocarpa"   
## [221] "Quercus\_alba" "Euphorbia\_maculata"   
## [223] "Euphorbia\_corollata" "Euphorbia\_esula"   
## [225] "Hypericum\_majus" "Hypericum\_kalmianum"   
## [227] "Hypericum\_perforatum" "Salix\_discolor"   
## [229] "Salix\_interior" "Salix\_myricoides"   
## [231] "Salix\_humilis" "Salix\_eriocephala"   
## [233] "Salix\_petiolaris" "Salix\_bebbiana"   
## [235] "Populus\_tremuloides" "Populus\_deltoides"   
## [237] "Viola\_sagittata" "Viola\_pedatifida"   
## [239] "Euonymus\_europaeus" "Celastrus\_orbiculatus"   
## [241] "Oxalis\_stricta" "Oxalis\_dillenii"   
## [243] "Barbarea\_vulgaris" "Rorippa\_palustris"   
## [245] "Alliaria\_petiolata" "Napaea\_dioica"   
## [247] "Hibiscus\_trionum" "Acer\_rubrum"   
## [249] "Acer\_negundo" "Rhus\_glabra"   
## [251] "Rhus\_typhina" "Toxicodendron\_radicans"   
## [253] "Toxicodendron\_rydbergii" "Oenothera\_biennis"   
## [255] "Oenothera\_perennis" "Oenothera\_gaura"   
## [257] "Epilobium\_coloratum" "Epilobium\_leptophyllum"   
## [259] "Lythrum\_alatum" "Geranium\_maculatum"   
## [261] "Parthenocissus\_quinquefolia" "Micranthes\_pensylvanica"   
## [263] "Penthorum\_sedoides" "Ranunculus\_pensylvanicus"   
## [265] "Anemone\_virginiana" "Anemone\_cylindrica"   
## [267] "Thalictrum\_dasycarpum" "Thalictrum\_dioicum"   
## [269] "Poa\_compressa" "Poa\_palustris"   
## [271] "Poa\_pratensis" "Phleum\_pratense"   
## [273] "Elymus\_hystrix" "Agrostis\_gigantea"   
## [275] "Agrostis\_stolonifera" "Calamagrostis\_canadensis"   
## [277] "Sphenopholis\_intermedia" "Avena\_sativa"   
## [279] "Phalaris\_arundinacea" "Elymus\_canadensis"   
## [281] "Elymus\_repens" "Elymus\_virginicus"   
## [283] "Elymus\_villosus" "Bromus\_inermis"   
## [285] "Bromus\_kalmii" "Glyceria\_striata"   
## [287] "Setaria\_faberi" "Setaria\_viridis"   
## [289] "Setaria\_pumila" "Panicum\_capillare"   
## [291] "Panicum\_dichotomiflorum" "Panicum\_virgatum"   
## [293] "Eriochloa\_villosa" "Echinochloa\_crus-galli"   
## [295] "Dichanthelium\_boreale" "Dichanthelium\_oligosanthes"   
## [297] "Dichanthelium\_acuminatum" "Dichanthelium\_dichotomum"   
## [299] "Dichanthelium\_leibergii" "Digitaria\_cognata"   
## [301] "Digitaria\_ischaemum" "Schizachyrium\_scoparium"   
## [303] "Sorghastrum\_nutans" "Muhlenbergia\_mexicana"   
## [305] "Bouteloua\_curtipendula" "Sporobolus\_michauxianus"   
## [307] "Sporobolus\_heterolepis" "Sporobolus\_cryptandrus"   
## [309] "Leersia\_oryzoides" "Carex\_hystericina"   
## [311] "Carex\_pellita" "Carex\_stricta"   
## [313] "Carex\_meadii" "Carex\_brevior"   
## [315] "Carex\_buxbaumii" "Carex\_stipata"   
## [317] "Carex\_gravida" "Carex\_cephalophora"   
## [319] "Carex\_vulpinoidea" "Carex\_annectens"   
## [321] "Carex\_rosea" "Carex\_radiata"   
## [323] "Carex\_sartwellii" "Carex\_tribuloides"   
## [325] "Carex\_bebbii" "Carex\_normalis"   
## [327] "Carex\_bicknellii" "Carex\_blanda"   
## [329] "Carex\_molesta" "Carex\_tenera"   
## [331] "Scirpus\_atrovirens" "Schoenoplectus\_tabernaemontani"  
## [333] "Eleocharis\_erythropoda" "Eleocharis\_compressa"   
## [335] "Juncus\_dudleyi" "Juncus\_tenuis"   
## [337] "Juncus\_interior" "Typha\_latifolia"   
## [339] "Typha\_angustifolia" "Tradescantia\_ohiensis"   
## [341] "Allium\_canadense" "Allium\_cernuum"   
## [343] "Maianthemum\_racemosum" "Polygonatum\_biflorum"   
## [345] "Convallaria\_majalis" "Asparagus\_officinalis"   
## [347] "Sisyrinchium\_campestre" "Hypoxis\_hirsuta"   
## [349] "Lilium\_michiganense" "Smilax\_herbacea"   
## [351] "Smilax\_ecirrhata" "Alisma\_subcordatum"   
## [353] "Lemna\_minor" "Pinus\_resinosa"   
## [355] "Thelypteris\_palustris" "Athyrium\_filix-femina"   
## [357] "Onoclea\_sensibilis" "Pteridium\_aquilinum"   
## [359] "Equisetum\_arvense"

#writing out tree  
write.tree(pruned.tree, file = '/Users/isaacbailey/Library/CloudStorage/OneDrive-UW-Madison/Research/Curtis\_Prairie\_DA/Curtis\_Analysis/curtis.tre')  
  
#plot tree  
plot.phylo(pruned.tree, align.tip.label = TRUE)



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