#### Load Libraries for analysis

library(piecewiseSEM)

library(readxl)

library(nlme)

library(lsmeans)

#### ANALYSIS for pika holes

SOCHS\_data<-read\_excel("/PikaHS.xlsx")

#### combined grouped predictors

SOCHS\_data$composite\_score\_POC\_HPOC <- (SOCHS\_data$POC + SOCHS\_data$HPOC) / 2

SOCHS\_data$composite\_score\_AGB\_BGB <- (SOCHS\_data$AGB + SOCHS\_data$BGB) / 2

############ MODEL FIT

sem\_model\_HS <- psem(

+ lme(SWC ~ PD + BD, random = ~1 | Biomes, data = SOCHS\_data, method = "ML"),

+ lme(BD ~ PD, random = ~1 | Biomes, data = SOCHS\_data, method = "ML"),

+ lme(pH ~ PD, random = ~1 | Biomes, data = SOCHS\_data, method = "ML"),

+ lme(composite\_score\_POC\_HPOC ~ MBC + composite\_score\_AGB\_BGB + SWC + BD + pH + PD, random = ~1 | Biomes, data = SOCHS\_data, method = "ML"),

+ lme(composite\_score\_AGB\_BGB ~ SWC + BD + MBC + pH + PD, random = ~1 | Biomes, data = SOCHS\_data, method = "ML"),

+ lme(MBC ~ SWC + BD + pH + PD, random = ~1 | Biomes, data = SOCHS\_data, method = "ML"),

+ lme(MAOC ~ SWC + BD + composite\_score\_POC\_HPOC + composite\_score\_AGB\_BGB+MBC + pH + PD, random = ~1 | Biomes, data = SOCHS\_data, method = "ML"),

+ lme(SOC ~ SWC + BD + composite\_score\_POC\_HPOC + composite\_score\_AGB\_BGB + MBC + MAOC + pH + PD, random = ~1 | Biomes, data = SOCHS\_data, method = "ML"),

+ data = SOCHS\_data

+ )

summary(sem\_model\_HS)

#### Get coefficients, including categorical means

pmodel <- psem(lme(SWC ~ PD + BD, random = ~1 | Biomes, data = SOCHS \_data, method = "ML"))

(pmultigroup<-multigroup(pmodel,group="Biomes"))

pmodel <- psem(lme(composite\_score\_POC\_HPOC ~ MBC + composite\_score\_AGB\_BGB + SWC + BD + pH + PD, random = ~1 | Biomes, data = SOCHS \_data, method = "ML"))

(pmultigroup<-multigroup(pmodel,group="Biomes"))

pmodel <- psem(lme(composite\_score\_AGB\_BGB ~ SWC + BD + MBC + pH + PD, random = ~1 | Biomes, data = SOCHS \_data, method = "ML"))

(pmultigroup<-multigroup(pmodel,group="Biomes"))

pmodel <- psem(lme(MBC ~ SWC + BD + pH + PD, random = ~1 | Biomes, data = SOCHS \_data, method = "ML"))

(pmultigroup<-multigroup(pmodel,group="Biomes"))

pmodel <- psem(lme(MAOC ~ SWC + BD + composite\_score\_POC\_HPOC +composite\_score\_AGB\_BGB + MBC + pH + PD, random = ~1 | Biomes, data = SOCHS \_data, method = "ML"))

(pmultigroup<-multigroup(pmodel,group="Biomes"))

pmodel <- psem(lme(SOC ~ SWC + BD + composite\_score\_POC\_HPOC + composite\_score\_AGB\_BGB + MBC + MAOC + pH + PD, random = ~1 | Biomes, data = SOCHS \_data, method = "ML"))

(pmultigroup<-multigroup(pmodel,group="Biomes"))

#### ANALYSIS for pika tunnels

SOCHS\_data<-read\_excel("/PikaTS.xlsx")

#### combined grouped predictors

SOCTS\_data$composite\_score\_POC\_HPOC <- (SOCTS\_data$POC + SOCTS \_data$HPOC) / 2

SOCTS\_data$composite\_score\_AGB\_BGB <- (SOCTS\_data$AGB + SOCTS \_data$BGB) / 2

############ MODEL FIT

sem\_model\_TS <- psem(

+ lme(SWC ~ PD + BD, random = ~1 | Biomes, data = SOCTS \_data, method = "ML"),

+ lme(BD ~ PD, random = ~1 | Biomes, data = SOCTS \_data, method = "ML"),

+ lme(pH ~ PD, random = ~1 | Biomes, data = SOCTS \_data, method = "ML"),

+ lme(composite\_score\_POC\_HPOC ~ MBC + composite\_score\_AGB\_BGB + SWC + BD + pH + PD, random = ~1 | Biomes, data = SOCTS \_data, method = "ML"),

+ lme(composite\_score\_AGB\_BGB ~ SWC + BD + MBC + pH + PD, random = ~1 | Biomes, data = SOCTS \_data, method = "ML"),

+ lme(MBC ~ SWC + BD + pH + PD, random = ~1 | Biomes, data = SOCTS \_data, method = "ML"),

+ lme(MAOC ~ SWC + BD + composite\_score\_POC\_HPOC + composite\_score\_AGB\_BGB+MBC + pH + PD, random = ~1 | Biomes, data = SOCTS \_data, method = "ML"),

+ lme(SOC ~ SWC + BD + composite\_score\_POC\_HPOC + composite\_score\_AGB\_BGB + MBC + MAOC + pH + PD, random = ~1 | Biomes, data = SOCTS \_data, method = "ML"),

+ data = SOCTS \_data

+ )

summary(sem\_model\_TS)

#### Get coefficients, including categorical means

pmodel <- psem(lme(SWC ~ PD + BD, random = ~1 | Biomes, data = SOCTS\_data, method = "ML"))

(pmultigroup<-multigroup(pmodel,group="Biomes"))

pmodel <- psem(lme(composite\_score\_POC\_HPOC ~ MBC + composite\_score\_AGB\_BGB + SWC + BD + pH + PD, random = ~1 | Biomes, data = SOCTS\_data, method = "ML"))

(pmultigroup<-multigroup(pmodel,group="Biomes"))

pmodel <- psem(lme(composite\_score\_AGB\_BGB ~ SWC + BD + MBC + pH + PD, random = ~1 | Biomes, data = SOCTS\_data, method = "ML"))

(pmultigroup<-multigroup(pmodel,group="Biomes"))

pmodel <- psem(lme(MBC ~ SWC + BD + pH + PD, random = ~1 | Biomes, data = SOCTS\_data, method = "ML"))

(pmultigroup<-multigroup(pmodel,group="Biomes"))

pmodel <- psem(lme(MAOC ~ SWC + BD + composite\_score\_POC\_HPOC +composite\_score\_AGB\_BGB + MBC + pH + PD, random = ~1 | Biomes, data = SOCTS\_data, method = "ML"))

(pmultigroup<-multigroup(pmodel,group="Biomes"))

pmodel <- psem(lme(SOC ~ SWC + BD + composite\_score\_POC\_HPOC + composite\_score\_AGB\_BGB + MBC + MAOC + pH + PD, random = ~1 | Biomes, data = SOCTS\_data, method = "ML"))

(pmultigroup<-multigroup(pmodel,group="Biomes"))