####Models####

library(lme4)

library(MuMIn)

library(MASS)

library(pscl)

library(car)

library(boot)

library(multcomp)

library(AICcmodavg)

library(vegan)

y=cbind(SIGN2, REV2-SIGN2)

summary(y)

M0=glm(y~1, data=datos, family = binomial, na.action=na.omit)

summary(M0)

AIC(M0)

add1.test <-add1(M0,scope=y~1+zona+quemaentierrabasura2+basuradomestica2+hojasfrutascaidas2+servic\_index+calle\_pav+cemento2+aguadered2+pozosartesianos2+cloaca2+pozociego2+alumbrado2+tierraanegada2+recolecciondebasura2+energiaelectrica2+cisternas2+perros\_pres+gallinas\_pres+tierra\_d+cesped\_d+arbustos\_d+arboles\_d+distancia\_agua\_km+I(distancia\_agua\_km^2)+arboles\_25+I(arboles\_25^2)+arboles\_50+I(arboles\_50^2)+arboles\_100+I(arboles\_100^2)+arboles\_250+I(arboles\_250^2)+herbaceas\_25+I(herbaceas\_25^2)+herbaceas\_50+I(herbaceas\_50^2)+herbaceas\_100+I(herbaceas\_100^2)+herbaceas\_250+I(herbaceas\_250^2)+suelo\_25+I(suelo\_25^2)+suelo\_50+suelo\_100+suelo\_250+I(suelo\_50^2)+I(suelo\_100^2)+I(suelo\_250^2)+urbano\_25+I(urbano\_25^2)+urbano\_50+I(urbano\_50^2)+urbano\_100+I(urbano\_100^2)+urbano\_250+I(urbano\_250^2)+cultivos\_100+I(cultivos\_100^2)+cultivos\_250+I(cultivos\_250^2)+shannon25+I(shannon25^2)+shannon50+I(shannon50^2)+shannon100+I(shannon100^2)+shannon250+I(shannon250^2)+diver\_cob\_25+I(diver\_cob\_25^2)+diver\_cob\_50+I(diver\_cob\_50^2)+diver\_cob\_100+I(diver\_cob\_100^2)+diver\_cob\_250+I(diver\_cob\_250^2)+ndvi\_25+I(ndvi\_25^2)+ndvi\_50+I(ndvi\_50^2)+ndvi\_100+I(ndvi\_100^2)+ndvi\_250+I(ndvi\_250^2)+ndwi\_25+I(ndwi\_25^2)+ndwi\_50+I(ndwi\_50^2)+ndwi\_100+I(ndwi\_100^2)+ndwi\_250+I(ndwi\_250^2), test="Chisq", x=NULL, k=2, trace=T)

M1=glm(y ~1+ shannon100, family = binomial,data = datos, na.action = na.omit)

summary(M1)

add1.test <-add1(M1,scope=y~1+zona+quemaentierrabasura2+basuradomestica2+hojasfrutascaidas2+servic\_index+calle\_pav+cemento2+aguadered2+pozosartesianos2+cloaca2+pozociego2+alumbrado2+tierraanegada2+recolecciondebasura2+energiaelectrica2+cisternas2+perros\_pres+gallinas\_pres+tierra\_d+cesped\_d+arbustos\_d+arboles\_d+distancia\_agua\_km+I(distancia\_agua\_km^2)+arboles\_25+I(arboles\_25^2)+arboles\_50+I(arboles\_50^2)+arboles\_100+I(arboles\_100^2)+arboles\_250+I(arboles\_250^2)+herbaceas\_25+I(herbaceas\_25^2)+herbaceas\_50+I(herbaceas\_50^2)+herbaceas\_100+I(herbaceas\_100^2)+herbaceas\_250+I(herbaceas\_250^2)+suelo\_25+I(suelo\_25^2)+suelo\_50+suelo\_100+suelo\_250+I(suelo\_50^2)+I(suelo\_100^2)+I(suelo\_250^2)+urbano\_25+I(urbano\_25^2)+urbano\_50+I(urbano\_50^2)+urbano\_100+I(urbano\_100^2)+urbano\_250+I(urbano\_250^2)+cultivos\_100+I(cultivos\_100^2)+cultivos\_250+I(cultivos\_250^2)+shannon25+I(shannon25^2)+shannon50+I(shannon50^2)+shannon100+I(shannon100^2)+shannon250+I(shannon250^2)+diver\_cob\_25+I(diver\_cob\_25^2)+diver\_cob\_50+I(diver\_cob\_50^2)+diver\_cob\_100+I(diver\_cob\_100^2)+diver\_cob\_250+I(diver\_cob\_250^2)+ndvi\_25+I(ndvi\_25^2)+ndvi\_50+I(ndvi\_50^2)+ndvi\_100+I(ndvi\_100^2)+ndvi\_250+I(ndvi\_250^2)+ndwi\_25+I(ndwi\_25^2)+ndwi\_50+I(ndwi\_50^2)+ndwi\_100+I(ndwi\_100^2)+ndwi\_250+I(ndwi\_250^2), test="Chisq", x=NULL, k=2, trace=T)

add1.test[order(add1.test$"Pr(>Chi)"),]

M1 <- update(M1, .~.+zona)

vif(M1)

anova(M1, test="Chisq")

summary(M1)

M1 <- update(M1, .~.+urbano\_100+ I(urbano\_100^2))

vif(M1)

anova(M1, test="Chisq")

summary(M1)

M1 <- update(M1, .~.+arboles\_250)

vif(M1)

anova(M1, test="Chisq")

summary(M1)

M1 <- update(M1, .~.+ suelo\_25 + I(suelo\_25^2))

vif(M1)

anova(M1, test="Chisq")

summary(M1)

M1.1 <- update(M1, .~.+ arboles\_d)

vif(M1)

anova(M1, test)

M1.1=glm( y ~1+ shannon100 + zona + urbano\_100 + I(urbano\_100^2) + arboles\_250 + suelo\_25 + I(suelo\_25^2)+arboles\_d, family = binomial,data = datos, na.action = na.omit)

summary(M1.1)

#pruebo rama distancia al agua en km

M0=glm(y~1, data=datos, family = binomial, na.action=na.omit)

summary(M0)

AIC(M0)

add1.test <-add1(M2,scope=y~1+zona+quemaentierrabasura2+basuradomestica2+hojasfrutascaidas2+servic\_index+calle\_pav+cemento2+aguadered2+pozosartesianos2+cloaca2+pozociego2+alumbrado2+tierraanegada2+recolecciondebasura2+energiaelectrica2+cisternas2+perros\_pres+gallinas\_pres+tierra\_d+cesped\_d+arbustos\_d+arboles\_d+distancia\_agua\_km+I(distancia\_agua\_km^2)+arboles\_25+I(arboles\_25^2)+arboles\_50+I(arboles\_50^2)+arboles\_100+I(arboles\_100^2)+arboles\_250+I(arboles\_250^2)+herbaceas\_25+I(herbaceas\_25^2)+herbaceas\_50+I(herbaceas\_50^2)+herbaceas\_100+I(herbaceas\_100^2)+herbaceas\_250+I(herbaceas\_250^2)+suelo\_25+I(suelo\_25^2)+suelo\_50+suelo\_100+suelo\_250+I(suelo\_50^2)+I(suelo\_100^2)+I(suelo\_250^2)+urbano\_25+I(urbano\_25^2)+urbano\_50+I(urbano\_50^2)+urbano\_100+I(urbano\_100^2)+urbano\_250+I(urbano\_250^2)+cultivos\_100+I(cultivos\_100^2)+cultivos\_250+I(cultivos\_250^2)+shannon25+I(shannon25^2)+shannon50+I(shannon50^2)+shannon100+I(shannon100^2)+shannon250+I(shannon250^2)+diver\_cob\_25+I(diver\_cob\_25^2)+diver\_cob\_50+I(diver\_cob\_50^2)+diver\_cob\_100+I(diver\_cob\_100^2)+diver\_cob\_250+I(diver\_cob\_250^2)+ndvi\_25+I(ndvi\_25^2)+ndvi\_50+I(ndvi\_50^2)+ndvi\_100+I(ndvi\_100^2)+ndvi\_250+I(ndvi\_250^2)+ndwi\_25+I(ndwi\_25^2)+ndwi\_50+I(ndwi\_50^2)+ndwi\_100+I(ndwi\_100^2)+ndwi\_250+I(ndwi\_250^2), test="Chisq", x=NULL, k=2, trace=T)

add1.test[order(add1.test$"Pr(>Chi)"),] #AIC Pr(>Chi)

M2=glm (y ~1+ distancia\_agua\_km, family = binomial, data = datos,

 na.action = na.omit)

summary(M2)

M2 <- update(M2, .~.+shannon100)

vif(M2)

anova(M2, test="Chisq")

M2 <- update(M2, .~.+arboles\_250)

vif(M2)

anova(M2, test="Chisq")

M2 <- update(M2, .~.+ urbano\_100 + I(urbano\_100^2))

summary(M2)

vif(M2)

anova(M2, test="Chisq")

M2.1=glm (y ~1+ distancia\_agua\_km + shannon100 + arboles\_250 +

 urbano\_100 + I(urbano\_100^2), family = binomial, data = datos,

 na.action = na.omit)

summary(M2.1)

modlist=list(M0,M1.1,M2)

modnames=c("M0","M1.1","M2")

aictab(modlist, modnames =modnames)

M1.1=glm( y ~1+ shannon100 + zona + urbano\_100 + I(urbano\_100^2) + arboles\_250 + suelo\_25 + I(suelo\_25^2)+arboles\_d, family = binomial,data = datos, na.action = na.omit)

summary(M1.1)

(((M1.1$null.deviance-M1.1$deviance)/M1.1$null.deviance)\*100)

contr\_zona<-glht(M1.1, linfct = mcp(zona="Tukey"))

summary(contr\_zona)

library(ggplot2)

windows()

plot(contr\_zona)

####Predichos####

datos$zona1 <- factor(datos$zona, labels=c("Rural","Peri urban", "Urban"))

datos$arboles\_d1 <- factor(datos$arboles\_d, labels=c("Without trees","With trees"))

library(ggplot2)

library(ggeffects)

pred.shannon<-ggpredict(M1.1, terms = "shannon100 [all]")

pred.urbano<-ggpredict(M1.1, terms = "urbano\_100 [all]")

pred.arboles<-ggpredict(M1.1, terms = "arboles\_250 [all]")

pred.suelo<-ggpredict(M1.1, terms = "suelo\_25 [all]")

pred.zona<-ggpredict(M1.1, terms = "zona1")

pred.presarbol<-ggpredict(M1.1, terms = "arboles\_d1")

#numericas#

shannon <- plot(pred.shannon)+ theme\_bw()+labs(x="Shannon index at 100 m", y="Infestation index")+

 theme(plot.title=element\_blank(), legend.position = c(0.1,0.9),

 axis.title=element\_text(size=rel(2)),axis.text= element\_text(size = rel(2)))+scale\_y\_continuous(limits = c(0,1))+ ggtitle("A") +

 theme(

 axis.title.x = element\_text(colour="black", size=20),

 axis.text.x = element\_text(colour="black", size=20),

 axis.title.y = element\_text(colour="black", size=20, angle = 90),

 axis.text.y = element\_text(colour="black", size=20))

arb\_cob <- plot(pred.arboles)+ theme\_bw()+labs(x="Trees cover at 250 m", y="")+

 theme(plot.title=element\_blank(), legend.position = c(0.1,0.9),

 axis.title=element\_text(size=rel(2)),axis.text= element\_text(size = rel(2)))+scale\_y\_continuous(limits = c(0,1)) + ggtitle("B") +

 theme(

 axis.title.x = element\_text(colour="black", size=20),

 axis.text.x = element\_text(colour="black", size=20),

 axis.title.y = element\_text(colour="black", size=20, angle = 90),

 axis.text.y = element\_text(colour="black", size=20))

imper\_sourface <- plot(pred.urbano)+ theme\_bw()+labs(x="Impervious surfaces at 100 m", y="")+

 theme(plot.title=element\_blank(), legend.position = c(0.1,0.9),

 axis.title=element\_text(size=rel(2)),axis.text= element\_text(size = rel(2)))+scale\_y\_continuous(limits = c(0,1))+ ggtitle("C") +

 theme(

 axis.title.x = element\_text(colour="black", size=20),

 axis.text.x = element\_text(colour="black", size=20),

 axis.title.y = element\_text(colour="black", size=20, angle = 90),

 axis.text.y = element\_text(colour="black", size=20))

suel <- plot(pred.suelo)+ theme\_bw()+labs(x="Bare soil cover at 25 m", y="")+

 theme(plot.title=element\_blank(), legend.position = c(0.1,0.9),

 axis.title=element\_text(size=rel(2)),axis.text= element\_text(size = rel(2)))+scale\_y\_continuous(limits = c(0,1))+ ggtitle("D") +

 theme(

 axis.title.x = element\_text(colour="black", size=20),

 axis.text.x = element\_text(colour="black", size=20),

 axis.title.y = element\_text(colour="black", size=20, angle = 90),

 axis.text.y = element\_text(colour="black", size=20))

zone <- plot(pred.zona)+ theme\_bw()+labs(x="Landscape", y="")+

 theme(plot.title=element\_blank(), legend.position = c(0.1,0.9),

 axis.title=element\_text(size=rel(2)),axis.text= element\_text(size = rel(2)))+scale\_y\_continuous(limits = c(0,1))+ ggtitle("D") +

 theme(

 axis.title.x = element\_text(colour="black", size=20),

 axis.text.x = element\_text(colour="black", size=20),

 axis.title.y = element\_text(colour="black", size=20, angle = 90),

 axis.text.y = element\_text(colour="black", size=20))

arb\_pres\_aus <- plot(pred.presarbol)+ theme\_bw()+labs(x="Tree presence", y="")+

 theme(plot.title=element\_blank(), legend.position = c(0.1,0.9),

 axis.title=element\_text(size=rel(2)),axis.text= element\_text(size = rel(2)))+scale\_y\_continuous(limits = c(0,1))+ ggtitle("D") +

 theme(

 axis.title.x = element\_text(colour="black", size=20),

 axis.text.x = element\_text(colour="black", size=20),

 axis.title.y = element\_text(colour="black", size=20, angle = 90),

 axis.text.y = element\_text(colour="black", size=20))

require(cowplot)

windows()

par(mfrow = c(3,2), mar = c(2,2,2,2))

plot\_grid(suel,imper\_sourface, shannon, arb\_cob , zone, arb\_pres\_aus, nrow=3)

###Variance Partition####

M1.1=glm( y ~1+ shannon100 + zona + urbano\_100 + I(urbano\_100^2) + arboles\_250 + suelo\_25 + I(suelo\_25^2)+arboles\_d, family = binomial,data = datos, na.action = na.omit)#Mejor modelo selecto!

library(variancePartition)

calcVarPart(M1.1)

M1=glmer(y~estacion+ (1|Codigo\_sitio), data=datos, family = binomial, na.action=na.omit)

summary(M1)

AIC(M1)#222.7759

library(emmeans)

Tukey <- emmeans(M1, pairwise~estacion, adjust = "tukey")

summary(Tukey)

residuos<-resid(M1)

predichos<-predict(M1)

qqnorm(residuos)

qqline(residuos)

shapiro.test(residuos)