Results early trial - group richness

Jesse Wood

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## R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

Setup

library("unmarked")

## Warning: package 'unmarked' was built under R version 3.3.2

## Loading required package: reshape

## Warning: package 'reshape' was built under R version 3.3.2

## Loading required package: lattice

## Warning: package 'lattice' was built under R version 3.3.3

## Loading required package: Rcpp

## Warning: package 'Rcpp' was built under R version 3.3.2

setwd("C:/Users/woodj/Documents/GRAD SCHOOL - CLEMSON/Project-Specific/R work/USDA-songbirds/USDA-songbirds")

# PC Data Only -

all counts (1-4) analyzed using pcount() function in unmarked

# Nesting guilds, 4 #

Cavity-nesters (n=16)

# covariates: tree height, age, BA, big trees, snags, open space #burns based on Greenberg paper!  
  
cavity.abund<- csvToUMF("Nesting\_cavity\_pcount.csv", long = FALSE, type = "unmarkedFramePCount")  
obsCovs(cavity.abund)= scale (obsCovs(cavity.abund))  
sc <- siteCovs(cavity.abund)  
sc[,c(5:74)] <- scale(sc[, c(5:74)])  
siteCovs(cavity.abund) <- sc  
  
#detection covariates first  
det.null.cavity <- pcount(~1 ~1, cavity.abund, mixture="P", K=50)  
det.weather.cavity <- pcount(~ Wind + Sky ~1, cavity.abund, mixture="P", K=50)  
det.global.cavity <- pcount(~ Jdate + Wind + Sky + Noise +Time ~1, cavity.abund, mixture="P", K=50)  
det.sound.cavity <- pcount(~ Noise + Wind ~1, cavity.abund, mixture="P", K=50)  
det.date.cavity <- pcount(~ Jdate ~1, cavity.abund, mixture="P", K=50)  
det.detect.cavity <- pcount(~ Jdate + Noise + Time ~1, cavity.abund, mixture="P", K=50)  
det.notdate.cavity <-pcount(~ Wind + Sky + Noise ~1, cavity.abund, mixture="P", K=50)  
det.time.cavity <-pcount(~ Time ~1, cavity.abund, mixture="P",K=50)  
det.timing.cavity <-pcount(~ Time + Jdate ~1, cavity.abund, mixture="P", K=50)  
  
fmsDC <- fitList(det.null.cavity, det.weather.cavity, det.global.cavity,  
 det.sound.cavity, det.date.cavity, det.detect.cavity, det.notdate.cavity,  
 det.time.cavity, det.timing.cavity)

## Warning in fitList(det.null.cavity, det.weather.cavity,  
## det.global.cavity, : Your list was unnamed, so model names were added as  
## object names

msDC.cavity <- modSel(fmsDC)  
msDC.cavity

## nPars AIC delta AICwt cumltvWt  
## det.weather.cavity 4 727.18 0.00 0.196 0.20  
## det.time.cavity 3 727.48 0.29 0.169 0.36  
## det.date.cavity 3 727.89 0.70 0.138 0.50  
## det.timing.cavity 4 727.89 0.71 0.137 0.64  
## det.global.cavity 7 728.30 1.11 0.112 0.75  
## det.null.cavity 2 728.86 1.68 0.085 0.84  
## det.notdate.cavity 5 728.88 1.70 0.084 0.92  
## det.detect.cavity 5 729.44 2.25 0.063 0.98  
## det.sound.cavity 4 732.08 4.89 0.017 1.00

#msDC.cavity@Full  
#summary: weather, time, date, timing, global, null, notdate all under 2.0  
  
det.weather.cavity

##   
## Call:  
## pcount(formula = ~Wind + Sky ~ 1, data = cavity.abund, K = 50,   
## mixture = "P")  
##   
## Abundance:  
## Estimate SE z P(>|z|)  
## 3.1 0.395 7.85 4.02e-15  
##   
## Detection:  
## Estimate SE z P(>|z|)  
## (Intercept) -1.030963 0.5365 -1.9215 0.0547  
## Wind -0.000817 0.0402 -0.0203 0.9838  
## Sky -0.096071 0.0423 -2.2687 0.0233  
##   
## AIC: 727.1848

confint(det.weather.cavity, type="state",method="normal")

## 0.025 0.975  
## lam(Int) 2.326423 3.873559

#write.table(msDC.cavity@Full, file="C:/Users/woodj/Documents/GRAD SCHOOL - CLEMSON/Project-Specific/R work/USDA-songbirds/USDA-songbirds/Nest\_cavity\_top\_models\_msDC.xls",sep="\t")  
  
  
##site covariates next  
#more appropriate detection covariates (Wind + Sky)  
null.cavity <- pcount(~ Wind + Sky ~1, cavity.abund, mixture="P", K=80)  
global.cavity <- pcount(~ Wind + Sky  
 ~ Treatment + Herbicide + BA + Nsnags +Ccover  
 + Ldepth + TreeHt + Age + TimeSinceB + TimeSinceT + Nthins + Nburns  
 + HW\_dens\_1050 + NP\_over\_20cm  
 + Rel\_HW2P\_canopy + PISoils + NSoilTypes  
 + Parea + ShapeIndex  
 , cavity.abund, mixture="P", K=80) #+ FPSiteIndex  
local.cavity <- pcount(~ Wind + Sky  
 ~ Ccover + TreeHt + Ldepth  
 , cavity.abund, mixture="P", K=80) #can only include BA OR CCover  
lh.cavity <- pcount(~ Wind + Sky  
 ~ Age + TreeHt + BA + NP\_over\_20cm + Nsnags + Rel\_HW2P\_canopy  
 , cavity.abund, mixture="P", K=80)  
#tree height, age, BA, big trees, snags, open space #burns based on Greenberg paper!  
landmetrics.cavity <- pcount (~ Wind + Sky  
 ~ Parea + ShapeIndex  
 , cavity.abund, mixture="P",K=80)  
landscape500.cavity <- pcount(~ Wind + Sky  
 ~ Evergreen500m + HighDev500m + Schrubs500m  
 , cavity.abund, mixture="P", K=80)  
landscape1.cavity <- pcount(~ Wind + Sky  
 ~ Evergreen1km + HighDev1km + Schrubs1km  
 , cavity.abund, mixture="P", K=80)  
landscape5.cavity <- pcount(~ Wind + Sky  
 ~ Evergreen5km + HighDev5km + Schrubs5km  
 , cavity.abund, mixture="P", K=80)  
landscape30.cavity <- pcount(~ Wind + Sky  
 ~ Evergreen30km + HighDev30km + Protected30km  
 , cavity.abund, mixture="P", K=80)  
treatment.cavity <- pcount(~ Wind + Sky  
 ~ Treatment + Nthins  
 , cavity.abund, mixture ="P", K=80)  
management.cavity <- pcount(~ Wind + Sky  
 ~ Treatment + BA + TimeSinceB + TimeSinceT + Herbicide  
 , cavity.abund, mixture="P", K=80)  
disturbance.cavity <- pcount(~ Wind + Sky  
 ~ TimeSinceB + TimeSinceT  
 , cavity.abund, mixture="P", K=80)  
siteprod.cavity <- pcount(~ Wind + Sky ~ PISoils + NSoilTypes  
 , cavity.abund, mixture="P", K=80) #FPSiteIndex  
greenberg.cavity <- pcount(~ Wind + Sky ~ BA + Nsnags + Nburns  
 , cavity.abund, mixture="P", K=80)  
  
fmsCN <- fitList(null.cavity, global.cavity, local.cavity, lh.cavity, landmetrics.cavity,  
 landscape500.cavity, landscape1.cavity, landscape5.cavity, landscape30.cavity,  
 treatment.cavity, management.cavity, disturbance.cavity,  
 siteprod.cavity, greenberg.cavity)

## Warning in fitList(null.cavity, global.cavity, local.cavity, lh.cavity, :  
## Your list was unnamed, so model names were added as object names

ms.cavity <- modSel(fmsCN)  
ms.cavity

## nPars AIC delta AICwt cumltvWt  
## null.cavity 4 727.18 0.00 3.3e-01 0.33  
## siteprod.cavity 6 728.59 1.41 1.6e-01 0.49  
## disturbance.cavity 6 729.59 2.40 9.9e-02 0.59  
## local.cavity 7 730.00 2.82 8.1e-02 0.67  
## lh.cavity 10 730.27 3.08 7.1e-02 0.74  
## landmetrics.cavity 6 730.27 3.09 7.0e-02 0.81  
## greenberg.cavity 7 730.53 3.35 6.2e-02 0.88  
## treatment.cavity 8 731.79 4.61 3.3e-02 0.91  
## landscape30.cavity 7 732.31 5.12 2.5e-02 0.93  
## landscape1.cavity 7 732.45 5.27 2.4e-02 0.96  
## landscape500.cavity 7 732.67 5.48 2.1e-02 0.98  
## landscape5.cavity 7 732.99 5.80 1.8e-02 1.00  
## management.cavity 11 736.54 9.36 3.1e-03 1.00  
## global.cavity 25 747.16 19.97 1.5e-05 1.00

#ms.cavity@Full  
  
#null is the best model... siteprod second best model under d2.0  
siteprod.cavity

##   
## Call:  
## pcount(formula = ~Wind + Sky ~ PISoils + NSoilTypes, data = cavity.abund,   
## K = 80, mixture = "P")  
##   
## Abundance:  
## Estimate SE z P(>|z|)  
## (Intercept) 3.1720 0.4513 7.028 2.10e-12  
## PISoils -0.0123 0.0401 -0.306 7.60e-01  
## NSoilTypes -0.0653 0.0408 -1.601 1.09e-01  
##   
## Detection:  
## Estimate SE z P(>|z|)  
## (Intercept) -1.12917 0.5980 -1.8883 0.0590  
## Wind -0.00227 0.0396 -0.0573 0.9543  
## Sky -0.08940 0.0425 -2.1047 0.0353  
##   
## AIC: 728.591

confint(siteprod.cavity, type="state",method="normal")

## 0.025 0.975  
## lam(Int) 2.2874131 4.05665646  
## lam(PISoils) -0.0909448 0.06637925  
## lam(NSoilTypes) -0.1453242 0.01465274

#write.table(ms.cavity@Full, file="C:/Users/woodj/Documents/GRAD SCHOOL - CLEMSON/Project-Specific/R work/USDA-songbirds/USDA-songbirds/Nest\_cavity\_top\_models\_ms.xls",sep="\t")

Cavity-nesters (n=16) Summary: P distribution DCs: weather, time, date, timing, global, null, notdate all under 2.0 Weather: Negative w/ wind and negative w/ sky SCs using weather model: Null best :/ Site productivity next best under 2.0

Tree-nesters (n=25)

#covariates: tree ht, age, density?, canopy? idk else Greenberg: shrubs stem density, maybe burns  
tree.abund<- csvToUMF("Nesting\_tree\_pcount.csv", long = FALSE, type = "unmarkedFramePCount")  
  
obsCovs(tree.abund)= scale (obsCovs(tree.abund))  
sc <- siteCovs(tree.abund)  
sc[,c(5:74)] <- scale(sc[, c(5:74)])  
siteCovs(tree.abund) <- sc  
  
#detection covariates first  
det.null.tree <- pcount(~1 ~1, tree.abund, mixture="P", K=50)  
det.weather.tree <- pcount(~ Wind + Sky ~1, tree.abund, mixture="P", K=50)  
det.global.tree <- pcount(~ Jdate + Wind + Sky + Noise +Time ~1, tree.abund, mixture="P", K=50)  
det.sound.tree <- pcount(~ Noise + Wind ~1, tree.abund, mixture="P", K=50)  
det.date.tree <- pcount(~ Jdate ~1, tree.abund, mixture="P", K=50)  
det.detect.tree <- pcount(~ Jdate + Noise + Time ~1, tree.abund, mixture="P", K=50)  
det.notdate.tree <-pcount(~ Wind + Sky + Noise ~1, tree.abund, mixture="P", K=50)  
det.time.tree <-pcount(~ Time ~1, tree.abund, mixture="P",K=50)  
det.timing.tree <-pcount(~ Time + Jdate ~1, tree.abund, mixture="P", K=50)  
  
fmsDC <- fitList(det.null.tree, det.weather.tree, det.global.tree,  
 det.sound.tree, det.date.tree, det.detect.tree, det.notdate.tree,  
 det.time.tree, det.timing.tree)

## Warning in fitList(det.null.tree, det.weather.tree, det.global.tree,  
## det.sound.tree, : Your list was unnamed, so model names were added as  
## object names

msDC.tree <- modSel(fmsDC)  
msDC.tree

## nPars AIC delta AICwt cumltvWt  
## det.null.tree 2 728.95 0.00 0.233 0.23  
## det.sound.tree 4 729.18 0.22 0.208 0.44  
## det.date.tree 3 729.74 0.78 0.157 0.60  
## det.weather.tree 4 730.77 1.81 0.094 0.69  
## det.time.tree 3 730.80 1.84 0.093 0.79  
## det.notdate.tree 5 731.15 2.20 0.078 0.86  
## det.detect.tree 5 731.52 2.57 0.065 0.93  
## det.timing.tree 4 731.73 2.78 0.058 0.99  
## det.global.tree 7 734.59 5.63 0.014 1.00

#msDC.tree@Full  
#summary: null, sound, date, weather, time under 2.0  
  
det.sound.tree

##   
## Call:  
## pcount(formula = ~Noise + Wind ~ 1, data = tree.abund, K = 50,   
## mixture = "P")  
##   
## Abundance:  
## Estimate SE z P(>|z|)  
## 3.23 0.511 6.32 2.54e-10  
##   
## Detection:  
## Estimate SE z P(>|z|)  
## (Intercept) -1.1750 0.6696 -1.75 0.0793  
## Noise -0.0559 0.0435 -1.28 0.1988  
## Wind -0.0535 0.0401 -1.33 0.1825  
##   
## AIC: 729.1793

confint(det.sound.tree, type="state",method="normal")

## 0.025 0.975  
## lam(Int) 2.231043 4.234826

#write.table(msDC.tree@Full, file="C:/Users/woodj/Documents/GRAD SCHOOL - CLEMSON/Project-Specific/R work/USDA-songbirds/USDA-songbirds/Nest\_tree\_top\_models\_msDC.xls",sep="\t")  
  
##site covariates next  
# ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  
#null detection covariates (best model, technically - NOT RUN YET)  
# ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~  
  
 #sound model was second best, run here:  
null.tree <- pcount(~ Wind + Noise ~1, tree.abund, mixture="P", K=80)  
global.tree <- pcount(~ Wind + Noise  
 ~ Treatment + Herbicide + BA +Ccover  
 + Ldepth + TreeHt + Age + TimeSinceB + TimeSinceT + Nthins  
 + HW\_dens\_1050 + NHW\_saplings  
 + Rel\_HW2P\_canopy + PISoils + NSoilTypes  
 + Parea + ShapeIndex  
 , tree.abund, mixture="P", K=80) #FPSiteIndex, middle row, snags  
local.tree <- pcount(~ Wind + Noise  
 ~ Ccover + TreeHt + Ldepth  
 , tree.abund, mixture="P", K=80) #can only include BA OR CCover  
lh.tree <- pcount(~ Wind + Noise  
 ~ Age + TreeHt + BA + NHW\_saplings + Rel\_HW2P\_canopy  
 , tree.abund, mixture="P", K=80)  
#covariates: tree ht, age, density?, canopy? idk else Greenberg: shrubs stem density, maybe burns  
landmetrics.tree <- pcount (~ Wind + Noise  
 ~ Parea + ShapeIndex  
 , tree.abund, mixture="P",K=80)  
landscape500.tree <- pcount(~ Wind + Noise  
 ~ Evergreen500m + HighDev500m + Schrubs500m + OpenDev500m  
 , tree.abund, mixture="P", K=80)  
landscape1.tree <- pcount(~ Wind + Noise  
 ~ Evergreen1km + HighDev1km + Schrubs1km + OpenDev1km  
 , tree.abund, mixture="P", K=80)  
landscape5.tree <- pcount(~ Wind + Noise  
 ~ Evergreen5km + HighDev5km + Schrubs5km  
 , tree.abund, mixture="P", K=80)  
landscape30.tree <- pcount(~ Wind + Noise  
 ~ Evergreen30km + HighDev30km + Protected30km  
 , tree.abund, mixture="P", K=80)  
treatment.tree <- pcount(~ Wind + Noise  
 ~ Treatment + Nthins  
 , tree.abund, mixture ="P", K=80)  
management.tree <- pcount(~ Wind + Noise  
 ~ Treatment + BA + TimeSinceB + TimeSinceT + Herbicide  
 , tree.abund, mixture="P", K=80)  
disturbance.tree <- pcount(~ Wind + Noise  
 ~ TimeSinceB + TimeSinceT  
 , tree.abund, mixture="P", K=80)  
siteprod.tree <- pcount(~ Wind + Noise ~ PISoils + NSoilTypes  
 , tree.abund, mixture="P", K=80) #FPSiteIndex  
greenberg.tree <- pcount(~ Wind + Noise ~ Ccover + NHW\_saplings + HW\_dens\_1050 + Nburns  
 , tree.abund, mixture="P", K=80)  
  
fmsTN <- fitList(null.tree, global.tree, local.tree, lh.tree, landmetrics.tree,  
 landscape500.tree, landscape1.tree, landscape5.tree, landscape30.tree,  
 treatment.tree, management.tree, disturbance.tree,  
 siteprod.tree, greenberg.tree)

## Warning in fitList(null.tree, global.tree, local.tree, lh.tree,  
## landmetrics.tree, : Your list was unnamed, so model names were added as  
## object names

ms.tree <- modSel(fmsTN)  
ms.tree

## nPars AIC delta AICwt cumltvWt  
## landmetrics.tree 6 726.54 0.00 4.7e-01 0.47  
## null.tree 4 729.18 2.64 1.3e-01 0.60  
## siteprod.tree 6 729.68 3.14 9.8e-02 0.70  
## landscape30.tree 7 729.84 3.30 9.1e-02 0.79  
## disturbance.tree 6 730.52 3.98 6.5e-02 0.85  
## local.tree 7 730.86 4.32 5.4e-02 0.91  
## lh.tree 9 732.24 5.70 2.7e-02 0.94  
## landscape5.tree 7 732.27 5.73 2.7e-02 0.96  
## landscape500.tree 8 733.57 7.03 1.4e-02 0.98  
## landscape1.tree 8 734.13 7.59 1.1e-02 0.99  
## management.tree 11 735.91 9.38 4.4e-03 0.99  
## treatment.tree 8 735.95 9.42 4.3e-03 1.00  
## greenberg.tree 8 736.06 9.52 4.1e-03 1.00  
## global.tree 23 747.79 21.25 1.1e-05 1.00

#ms.tree@Full  
  
#land metrics only top model!  
landmetrics.tree

##   
## Call:  
## pcount(formula = ~Wind + Noise ~ Parea + ShapeIndex, data = tree.abund,   
## K = 80, mixture = "P")  
##   
## Abundance:  
## Estimate SE z P(>|z|)  
## (Intercept) 3.8036 0.6456 5.89 3.83e-09  
## Parea 0.1015 0.0369 2.75 6.01e-03  
## ShapeIndex -0.0417 0.0390 -1.07 2.85e-01  
##   
## Detection:  
## Estimate SE z P(>|z|)  
## (Intercept) -1.8769 0.7446 -2.521 0.0117  
## Wind -0.0355 0.0369 -0.963 0.3356  
## Noise -0.0291 0.0392 -0.743 0.4577  
##   
## AIC: 726.5367

confint(landmetrics.tree, type="state",method="normal")

## 0.025 0.975  
## lam(Int) 2.53819756 5.06891899  
## lam(Parea) 0.02908628 0.17391643  
## lam(ShapeIndex) -0.11806578 0.03474101

#write.table(ms.tree@Full, file="C:/Users/woodj/Documents/GRAD SCHOOL - CLEMSON/Project-Specific/R work/USDA-songbirds/USDA-songbirds/Nest\_tree\_top\_models\_ms.xls",sep="\t")

Tree-nesters (n=25) Summary: P distribution DCs: null, sound, date, weather, time all models under 2.0 Sound: negative with noise and wind SCs using sound: Land Metrics (Area + Shape) only top model! Positive with Area *sig Negative with Shape Index but what does that mean?* non-sig

Shrub-nesters (n=16)

#covariates: midstory, HW saplings, BA, greenberg - Nburns, - tree density, + shrub stem density  
shrub.abund<- csvToUMF("Nesting\_shrub\_pcount.csv", long = FALSE, type = "unmarkedFramePCount")  
  
obsCovs(shrub.abund)= scale (obsCovs(shrub.abund))  
sc <- siteCovs(shrub.abund)  
sc[,c(5:74)] <- scale(sc[, c(5:74)])  
siteCovs(shrub.abund) <- sc  
  
det.null.shrub <- pcount(~1 ~1, shrub.abund, mixture="P", K=50)  
det.weather.shrub <- pcount(~ Wind + Sky ~1, shrub.abund, mixture="P", K=50)  
det.global.shrub <- pcount(~ Jdate + Wind + Sky + Noise +Time ~1, shrub.abund, mixture="P", K=50)  
det.sound.shrub <- pcount(~ Noise + Wind ~1, shrub.abund, mixture="P", K=50)  
det.date.shrub <- pcount(~ Jdate ~1, shrub.abund, mixture="P", K=50)  
det.detect.shrub <- pcount(~ Jdate + Noise + Time ~1, shrub.abund, mixture="P", K=50)  
det.notdate.shrub <-pcount(~ Wind + Sky + Noise ~1, shrub.abund, mixture="P", K=50)  
det.time.shrub <-pcount(~ Time ~1, shrub.abund, mixture="P",K=50)  
det.timing.shrub <-pcount(~ Time + Jdate ~1, shrub.abund, mixture="P", K=50)  
  
fmsDC <- fitList(det.null.shrub, det.weather.shrub, det.global.shrub,  
 det.sound.shrub, det.date.shrub, det.detect.shrub, det.notdate.shrub,  
 det.time.shrub, det.timing.shrub)

## Warning in fitList(det.null.shrub, det.weather.shrub, det.global.shrub, :  
## Your list was unnamed, so model names were added as object names

msDC.shrub <- modSel(fmsDC)  
msDC.shrub

## nPars AIC delta AICwt cumltvWt  
## det.detect.shrub 5 660.25 0.00 7.3e-01 0.73  
## det.global.shrub 7 663.35 3.10 1.5e-01 0.88  
## det.date.shrub 3 664.95 4.69 7.0e-02 0.95  
## det.timing.shrub 4 665.76 5.51 4.6e-02 1.00  
## det.sound.shrub 4 677.70 17.45 1.2e-04 1.00  
## det.null.shrub 2 679.27 19.02 5.4e-05 1.00  
## det.notdate.shrub 5 679.44 19.19 5.0e-05 1.00  
## det.time.shrub 3 681.24 20.99 2.0e-05 1.00  
## det.weather.shrub 4 682.17 21.91 1.3e-05 1.00

#msDC.shrub@Full  
#summary: detection is best model and only under 2.0  
  
det.detect.shrub

##   
## Call:  
## pcount(formula = ~Jdate + Noise + Time ~ 1, data = shrub.abund,   
## K = 50, mixture = "P")  
##   
## Abundance:  
## Estimate SE z P(>|z|)  
## 2.37 0.24 9.9 4.37e-23  
##   
## Detection:  
## Estimate SE z P(>|z|)  
## (Intercept) -0.418 0.3996 -1.05 0.295045  
## Jdate 0.256 0.0687 3.73 0.000192  
## Noise -0.178 0.0665 -2.68 0.007294  
## Time 0.101 0.0577 1.74 0.081573  
##   
## AIC: 660.2534

confint(det.detect.shrub, type="state",method="normal")

## 0.025 0.975  
## lam(Int) 1.900461 2.839289

#write.table(msDC.shrub@Full, file="C:/Users/woodj/Documents/GRAD SCHOOL - CLEMSON/Project-Specific/R work/USDA-songbirds/USDA-songbirds/Nest\_shrub\_top\_models\_msDC.xls",sep="\t")  
  
##site covariates next  
null.shrub <- pcount(~ Jdate + Noise + Time ~1, shrub.abund, mixture="P", K=80)  
global.shrub <- pcount(~ Jdate + Noise + Time   
 ~ Treatment + Herbicide + BA + Ccover  
 + Ldepth + TreeHt + Age + TimeSinceB + TimeSinceT + Nthins + Nburns  
 + HW\_dens\_1050 + FG\_shrub + NHW\_saplings  
 + PISoils + NSoilTypes  
 + Parea + ShapeIndex  
 , shrub.abund, mixture="P", K=80) #FPSiteIndex  
local.shrub <- pcount(~ Jdate + Noise + Time   
 ~ Ccover + TreeHt + Ldepth  
 , shrub.abund, mixture="P", K=80) #can only include BA OR CCover  
lh.shrub <- pcount(~ Jdate + Noise + Time   
 ~ BA + NHW\_saplings + FG\_shrub + HW\_dens\_1050  
 , shrub.abund, mixture="P", K=80)  
#covariates: midstory, HW saplings, BA, greenberg - Nburns, - tree density, + shrub stem density  
landmetrics.shrub <- pcount (~ Jdate + Noise + Time   
 ~ Parea + ShapeIndex  
 , shrub.abund, mixture="P",K=80)  
landscape500.shrub <- pcount(~ Jdate + Noise + Time   
 ~ Evergreen500m + HighDev500m + OpenDev500m+ + Schrubs500m + Ag500m  
 , shrub.abund, mixture="P", K=80)  
landscape1.shrub <- pcount(~ Jdate + Noise + Time   
 ~ Evergreen1km + HighDev1km + OpenDev1km + Schrubs1km + Ag1km  
 , shrub.abund, mixture="P", K=80)  
landscape5.shrub <- pcount(~ Jdate + Noise + Time   
 ~ OpenDev5km + Schrubs5km + Ag5km  
 , shrub.abund, mixture="P", K=80)  
# - can't use Evergreen&Ag,  
#+ can't use HighDev&OpenDev together  
landscape30.shrub <- pcount(~ Jdate + Noise + Time   
 ~ Schrubs30km + Evergreen30km + Protected30km  
 , shrub.abund, mixture="P", K=80)  
#- can't use Protected&Ag together,  
#- can't use Ag&HighDev together  
#- can't use Evergreen&Ag together  
#- can't use HighDev&OpenDev together  
#- can't use Schrubs&OpenDev together  
#+ can't use Grass&Ag together  
#+ can't use Ag&OpenDev together  
#+ can't use Water&Protected together  
#+ can't use Schrubs&HighDev together  
treatment.shrub <- pcount(~ Jdate + Noise + Time   
 ~ Treatment + Nthins  
 , shrub.abund, mixture ="P", K=80)  
management.shrub <- pcount(~ Jdate + Noise + Time   
 ~ Treatment + BA + TimeSinceB + TimeSinceT + Herbicide  
 , shrub.abund, mixture="P", K=80)  
disturbance.shrub <- pcount(~ Jdate + Noise + Time   
 ~ TimeSinceB + TimeSinceT  
 , shrub.abund, mixture="P", K=80)  
siteprod.shrub <- pcount(~ Jdate + Noise + Time ~ PISoils + NSoilTypes  
 , shrub.abund, mixture="P", K=80) #FPSiteIndex  
greenberg.shrub <- pcount(~ Jdate + Noise + Time ~ BA + HW\_dens\_1050 + Nburns  
 , shrub.abund, mixture="P", K=80)  
  
fmsSN <- fitList(null.shrub, global.shrub, local.shrub, lh.shrub, landmetrics.shrub,  
 landscape500.shrub, landscape1.shrub, landscape5.shrub, landscape30.shrub,  
 treatment.shrub, management.shrub, disturbance.shrub,  
 siteprod.shrub, greenberg.shrub)

## Warning in fitList(null.shrub, global.shrub, local.shrub, lh.shrub,  
## landmetrics.shrub, : Your list was unnamed, so model names were added as  
## object names

ms.shrub <- modSel(fmsSN)  
ms.shrub

## nPars AIC delta AICwt cumltvWt  
## greenberg.shrub 8 659.01 0.00 3.4e-01 0.34  
## lh.shrub 9 660.00 0.99 2.1e-01 0.55  
## null.shrub 5 660.25 1.24 1.8e-01 0.73  
## siteprod.shrub 7 662.67 3.66 5.5e-02 0.78  
## local.shrub 8 662.68 3.67 5.4e-02 0.84  
## disturbance.shrub 7 663.01 4.00 4.6e-02 0.88  
## landmetrics.shrub 7 663.90 4.89 2.9e-02 0.91  
## landscape5.shrub 8 663.92 4.91 2.9e-02 0.94  
## landscape30.shrub 8 664.17 5.16 2.6e-02 0.97  
## treatment.shrub 9 665.59 6.58 1.3e-02 0.98  
## landscape1.shrub 10 666.46 7.45 8.2e-03 0.99  
## management.shrub 12 666.68 7.67 7.3e-03 1.00  
## landscape500.shrub 10 667.71 8.70 4.4e-03 1.00  
## global.shrub 25 687.23 28.22 2.5e-07 1.00

#ms.shrub@Full  
#summary: greenberg model best, life history (similar) second, null is third best :/  
  
greenberg.shrub

##   
## Call:  
## pcount(formula = ~Jdate + Noise + Time ~ BA + HW\_dens\_1050 +   
## Nburns, data = shrub.abund, K = 80, mixture = "P")  
##   
## Abundance:  
## Estimate SE z P(>|z|)  
## (Intercept) 2.4551 0.3245 7.565 3.89e-14  
## BA -0.1083 0.0596 -1.818 6.91e-02  
## HW\_dens\_1050 0.0240 0.0591 0.406 6.85e-01  
## Nburns 0.0277 0.0560 0.495 6.21e-01  
##   
## Detection:  
## Estimate SE z P(>|z|)  
## (Intercept) -0.5747 0.5113 -1.12 0.261058  
## Jdate 0.2339 0.0703 3.33 0.000879  
## Noise -0.1462 0.0664 -2.20 0.027600  
## Time 0.0948 0.0565 1.68 0.093041  
##   
## AIC: 659.0096

confint(greenberg.shrub, type="state",method="normal")

## 0.025 0.975  
## lam(Int) 1.81894750 3.091155492  
## lam(BA) -0.22513779 0.008466626  
## lam(HW\_dens\_1050) -0.09185329 0.139776335  
## lam(Nburns) -0.08204739 0.137511039

lh.shrub

##   
## Call:  
## pcount(formula = ~Jdate + Noise + Time ~ BA + NHW\_saplings +   
## FG\_shrub + HW\_dens\_1050, data = shrub.abund, K = 80, mixture = "P")  
##   
## Abundance:  
## Estimate SE z P(>|z|)  
## (Intercept) 2.4860 0.3552 7.000 2.57e-12  
## BA -0.1098 0.0557 -1.972 4.86e-02  
## NHW\_saplings -0.0300 0.0529 -0.567 5.71e-01  
## FG\_shrub 0.0478 0.0539 0.887 3.75e-01  
## HW\_dens\_1050 0.0578 0.0612 0.943 3.45e-01  
##   
## Detection:  
## Estimate SE z P(>|z|)  
## (Intercept) -0.6237 0.5495 -1.14 0.25637  
## Jdate 0.2309 0.0705 3.28 0.00105  
## Noise -0.1442 0.0658 -2.19 0.02839  
## Time 0.0952 0.0561 1.70 0.08985  
##   
## AIC: 659.9996

confint(lh.shrub, type="state",method="normal")

## 0.025 0.975  
## lam(Int) 1.78990371 3.182104610  
## lam(BA) -0.21889244 -0.000680216  
## lam(NHW\_saplings) -0.13360126 0.073645581  
## lam(FG\_shrub) -0.05776097 0.153347515  
## lam(HW\_dens\_1050) -0.06226105 0.177828435

#write.table(ms.shrub@Full, file="C:/Users/woodj/Documents/GRAD SCHOOL - CLEMSON/Project-Specific/R work/USDA-songbirds/USDA-songbirds/Nest\_shrub\_top\_models\_ms.xls",sep="\t")

Shrub-nesters (n=16) Summary: P distribution DCs: detect best and only <2.0 + with Date and Time - with Noise SCs using Date+Noise+Time Best model is based on Greenberg et al paper in Southern Apps on this guild - with BA, + with hardwoods low height, - with #burns But none of these significantly so Second best model is similar, general life history - with BA, - with hardwood saplings, + with forbs/grasses midheight, + with hardwoods low height Only BA of the above is significant Null is third best model, and under 2.0 :/

Ground-nesters (n=10)

#covariates: forbes & grasses at 2 low heights, HW\_dens\_1050, leaf litter depth,  
# Greenberg: -Nburns, -TimeSinceB, leaf litter depth, - Nsnags  
  
ground.abund<- csvToUMF("Nesting\_ground\_pcount.csv", long = FALSE, type = "unmarkedFramePCount")  
  
obsCovs(ground.abund)= scale (obsCovs(ground.abund))  
sc <- siteCovs(ground.abund)  
sc[,c(5:74)] <- scale(sc[, c(5:74)])  
siteCovs(ground.abund) <- sc  
  
#detection covariates first  
det.null.ground <- pcount(~1 ~1, ground.abund, mixture="P", K=50)  
det.weather.ground <- pcount(~ Wind + Sky ~1, ground.abund, mixture="P", K=50)  
det.global.ground <- pcount(~ Jdate + Wind + Sky + Noise +Time ~1, ground.abund, mixture="P", K=50)  
det.sound.ground <- pcount(~ Noise + Wind ~1, ground.abund, mixture="P", K=50)  
det.date.ground <- pcount(~ Jdate ~1, ground.abund, mixture="P", K=50)  
det.detect.ground <- pcount(~ Jdate + Noise + Time ~1, ground.abund, mixture="P", K=50)  
det.notdate.ground <-pcount(~ Wind + Sky + Noise ~1, ground.abund, mixture="P", K=50)  
det.time.ground <-pcount(~ Time ~1, ground.abund, mixture="P",K=50)  
det.timing.ground <-pcount(~ Time + Jdate ~1, ground.abund, mixture="P", K=50)  
  
fmsDC <- fitList(det.null.ground, det.weather.ground, det.global.ground,  
 det.sound.ground, det.date.ground, det.detect.ground, det.notdate.ground,  
 det.time.ground, det.timing.ground)

## Warning in fitList(det.null.ground, det.weather.ground,  
## det.global.ground, : Your list was unnamed, so model names were added as  
## object names

msDC.ground <- modSel(fmsDC)  
msDC.ground

## nPars AIC delta AICwt cumltvWt  
## det.date.ground 3 556.32 0.00 0.4646 0.46  
## det.timing.ground 4 556.99 0.68 0.3313 0.80  
## det.detect.ground 5 558.82 2.50 0.1330 0.93  
## det.time.ground 3 561.86 5.54 0.0290 0.96  
## det.global.ground 7 562.45 6.13 0.0217 0.98  
## det.null.ground 2 563.58 7.26 0.0123 0.99  
## det.weather.ground 4 566.03 9.71 0.0036 1.00  
## det.sound.ground 4 566.46 10.14 0.0029 1.00  
## det.notdate.ground 5 567.91 11.59 0.0014 1.00

#msDC.ground@Full  
#summary: date and then timing (date+time) under 2.0  
  
det.date.ground

##   
## Call:  
## pcount(formula = ~Jdate ~ 1, data = ground.abund, K = 50, mixture = "P")  
##   
## Abundance:  
## Estimate SE z P(>|z|)  
## 1.88 0.256 7.37 1.64e-13  
##   
## Detection:  
## Estimate SE z P(>|z|)  
## (Intercept) -0.780 0.3735 -2.09 0.03674  
## Jdate 0.213 0.0745 2.85 0.00434  
##   
## AIC: 556.3178

confint(det.date.ground, type="state",method="normal")

## 0.025 0.975  
## lam(Int) 1.384002 2.385887

#write.table(msDC.ground@Full, file="C:/Users/woodj/Documents/GRAD SCHOOL - CLEMSON/Project-Specific/R work/USDA-songbirds/USDA-songbirds/Nest\_ground\_top\_models\_msDC.xls",sep="\t")  
  
##site covariates next  
null.ground <- pcount(~ Jdate ~1, ground.abund, mixture="P", K=80)  
global.ground <- pcount(~ Jdate  
 ~ Treatment + Herbicide + BA + Nsnags +Ccover  
 + Ldepth + TreeHt + TimeSinceB + TimeSinceT + Nthins + Nburns  
 + HW\_dens\_1050 + FG\_herb + FG\_shrub  
 + Rel\_HW2P\_canopy + PISoils + NSoilTypes  
 + Parea + ShapeIndex  
 , ground.abund, mixture="P", K=80) #FPSiteIndex  
local.ground <- pcount(~ Jdate  
 ~ Ccover + TreeHt + Ldepth  
 , ground.abund, mixture="P", K=80) #can only include BA OR CCover  
lh.ground <- pcount(~ Jdate  
 ~ FG\_herb + FG\_shrub + HW\_dens\_1050 + Ldepth + Rel\_HW2P\_canopy + BA  
 , ground.abund, mixture="P", K=80)  
landmetrics.ground <- pcount (~ Jdate  
 ~ Parea + ShapeIndex  
 , ground.abund, mixture="P",K=80)  
landscape500.ground <- pcount(~ Jdate  
 ~ Evergreen500m + HighDev500m + Schrubs500m + OpenDev500m  
 , ground.abund, mixture="P", K=80)  
landscape1.ground <- pcount(~ Jdate  
 ~ Evergreen1km + HighDev1km + Schrubs1km + OpenDev1km  
 , ground.abund, mixture="P", K=80)  
landscape5.ground <- pcount(~ Jdate  
 ~ Evergreen5km + HighDev5km + Schrubs5km  
 , ground.abund, mixture="P", K=80)  
landscape30.ground <- pcount(~ Jdate  
 ~ Evergreen30km + HighDev30km + Protected30km  
 , ground.abund, mixture="P", K=80)  
treatment.ground <- pcount(~ Jdate  
 ~ Treatment + Nthins  
 , ground.abund, mixture ="P", K=80)  
management.ground <- pcount(~ Jdate  
 ~ Treatment + BA + TimeSinceB + TimeSinceT + Herbicide  
 , ground.abund, mixture="P", K=80)  
disturbance.ground <- pcount(~ Jdate  
 ~ TimeSinceB + TimeSinceT  
 , ground.abund, mixture="P", K=80)  
siteprod.ground <- pcount(~ Jdate ~ PISoils + NSoilTypes  
 , ground.abund, mixture="P", K=80) #FPSiteIndex  
greenberg.ground <- pcount(~ Jdate ~ Ccover + Nsnags + Nburns + TimeSinceB + Ldepth  
 , ground.abund, mixture="P", K=80)  
  
fmsGN <- fitList(null.ground, global.ground, local.ground, lh.ground, landmetrics.ground,  
 landscape500.ground, landscape1.ground, landscape5.ground, landscape30.ground,  
 treatment.ground, management.ground, disturbance.ground,  
 siteprod.ground, greenberg.ground)

## Warning in fitList(null.ground, global.ground, local.ground, lh.ground, :  
## Your list was unnamed, so model names were added as object names

ms.ground <- modSel(fmsGN)  
ms.ground

## nPars AIC delta AICwt cumltvWt  
## local.ground 6 554.13 0.00 0.28044 0.28  
## landscape1.ground 7 555.02 0.89 0.17973 0.46  
## landmetrics.ground 5 555.10 0.97 0.17286 0.63  
## greenberg.ground 8 555.89 1.75 0.11661 0.75  
## null.ground 3 556.32 2.19 0.09397 0.84  
## disturbance.ground 5 558.45 4.32 0.03241 0.88  
## siteprod.ground 5 558.89 4.75 0.02603 0.90  
## landscape5.ground 6 558.98 4.85 0.02477 0.93  
## lh.ground 9 559.24 5.11 0.02178 0.95  
## landscape500.ground 7 559.30 5.16 0.02120 0.97  
## treatment.ground 7 559.52 5.39 0.01895 0.99  
## landscape30.ground 6 561.50 7.37 0.00705 1.00  
## management.ground 10 562.54 8.41 0.00418 1.00  
## global.ground 24 573.24 19.11 0.00002 1.00

#ms.ground@Full  
#summary: below 4 models all below 2.0  
  
local.ground

##   
## Call:  
## pcount(formula = ~Jdate ~ Ccover + TreeHt + Ldepth, data = ground.abund,   
## K = 80, mixture = "P")  
##   
## Abundance:  
## Estimate SE z P(>|z|)  
## (Intercept) 2.0160 0.3427 5.882 4.06e-09  
## Ccover -0.1608 0.0638 -2.519 1.18e-02  
## TreeHt 0.0164 0.0719 0.228 8.19e-01  
## Ldepth -0.0577 0.0725 -0.796 4.26e-01  
##   
## Detection:  
## Estimate SE z P(>|z|)  
## (Intercept) -0.994 0.4730 -2.10 0.03568  
## Jdate 0.195 0.0731 2.66 0.00774  
##   
## AIC: 554.1311

confint(local.ground, type="state",method="normal")

## 0.025 0.975  
## lam(Int) 1.3441931 2.68773327  
## lam(Ccover) -0.2858756 -0.03570587  
## lam(TreeHt) -0.1245795 0.15744215  
## lam(Ldepth) -0.1997464 0.08433214

landscape1.ground

##   
## Call:  
## pcount(formula = ~Jdate ~ Evergreen1km + HighDev1km + Schrubs1km +   
## OpenDev1km, data = ground.abund, K = 80, mixture = "P")  
##   
## Abundance:  
## Estimate SE z P(>|z|)  
## (Intercept) 2.0032 0.3504 5.717 1.08e-08  
## Evergreen1km 0.1641 0.0720 2.280 2.26e-02  
## HighDev1km -0.0331 0.0894 -0.371 7.11e-01  
## Schrubs1km 0.0155 0.0709 0.219 8.27e-01  
## OpenDev1km -0.0843 0.0758 -1.112 2.66e-01  
##   
## Detection:  
## Estimate SE z P(>|z|)  
## (Intercept) -0.987 0.4849 -2.03 0.0419  
## Jdate 0.183 0.0743 2.46 0.0139  
##   
## AIC: 555.0209

confint(landscape1.ground, type="state",method="normal")

## 0.025 0.975  
## lam(Int) 1.31644608 2.68994018  
## lam(Evergreen1km) 0.02304431 0.30517264  
## lam(HighDev1km) -0.20846267 0.14216383  
## lam(Schrubs1km) -0.12340112 0.15446449  
## lam(OpenDev1km) -0.23282584 0.06431449

landmetrics.ground

##   
## Call:  
## pcount(formula = ~Jdate ~ Parea + ShapeIndex, data = ground.abund,   
## K = 80, mixture = "P")  
##   
## Abundance:  
## Estimate SE z P(>|z|)  
## (Intercept) 1.9725 0.3053 6.460 1.04e-10  
## Parea 0.1257 0.0662 1.899 5.76e-02  
## ShapeIndex 0.0664 0.0720 0.923 3.56e-01  
##   
## Detection:  
## Estimate SE z P(>|z|)  
## (Intercept) -0.922 0.4292 -2.15 0.03171  
## Jdate 0.208 0.0732 2.83 0.00458  
##   
## AIC: 555.0988

confint(landmetrics.ground, type="state",method="normal")

## 0.025 0.975  
## lam(Int) 1.37406243 2.5709099  
## lam(Parea) -0.00406258 0.2554445  
## lam(ShapeIndex) -0.07466831 0.2075140

greenberg.ground

##   
## Call:  
## pcount(formula = ~Jdate ~ Ccover + Nsnags + Nburns + TimeSinceB +   
## Ldepth, data = ground.abund, K = 80, mixture = "P")  
##   
## Abundance:  
## Estimate SE z P(>|z|)  
## (Intercept) 2.07576 0.3836 5.4116 6.25e-08  
## Ccover -0.17132 0.0725 -2.3621 1.82e-02  
## Nsnags -0.06076 0.0740 -0.8206 4.12e-01  
## Nburns -0.00333 0.0857 -0.0388 9.69e-01  
## TimeSinceB 0.10888 0.0829 1.3133 1.89e-01  
## Ldepth -0.09468 0.0812 -1.1656 2.44e-01  
##   
## Detection:  
## Estimate SE z P(>|z|)  
## (Intercept) -1.079 0.5176 -2.08 0.03718  
## Jdate 0.196 0.0727 2.70 0.00703  
##   
## AIC: 555.8861

confint(greenberg.ground, type="state",method="normal")

## 0.025 0.975  
## lam(Int) 1.3239602 2.82755552  
## lam(Ccover) -0.3134652 -0.02916650  
## lam(Nsnags) -0.2058814 0.08436455  
## lam(Nburns) -0.1713115 0.16465864  
## lam(TimeSinceB) -0.0536072 0.27135883  
## lam(Ldepth) -0.2538852 0.06452059

#write.table(ms.ground@Full, file="C:/Users/woodj/Documents/GRAD SCHOOL - CLEMSON/Project-Specific/R work/USDA-songbirds/USDA-songbirds/Nest\_ground\_top\_models\_ms.xls",sep="\t")

Ground-nesters (n=10) Summary: P distribution DCs: Date is best, Date+Time second best + with date SCs using Date only: Local best Ccover only significant variable (-) TreeHt + and Ldepth - Landscape @ 1km Evergreen1km only significant one (+) HighDev -, Schrubs +, OpenDev - Land metrics None significant but Area + and Shape + Greenberg Ccover only significant (-) Nsnags -, Nburns -, TimeSinceB +, Ldepth -

# Behavior (foraging) guilds, 3 #

Bark foragers (n=9)

Bark foragers (n=9) Summary: P distribution DCs: Timing is best + with time, - with date SCs using Time+Date: Null is best, second best (landscape30km) is 2.39

Foliage gleaners (n=20)

Foliage gleaners (n=20) Summary: P distribution DCs: "not date" (Wind+Sky+Noise) is best Negative with all 3 . but only Wind significantly(?) But weather and sound also under 2.0 SCs using Wind+Sky+Noise Landscape @ 500m is best Only Ag @ 500m is significant (-) Evergreen, open development, scrubs/shrubs all negative Nothing else under 2.0 (Disturbance is closest but it is 4.0)

Ground foragers (n=27)

Ground foragers (n=27) Summary: P distribution DCs: date is best + with Date Date+Timing was second best, but 1.96 SCs using Date: Local stand model best significant variable: canopy cover (-) Tree height positive, litter depth negative but neither significant Nothing else under 2.0