BAM-CASFRI forest structure estimation

Andrew Crosby

15 March, 2018

This document describes the process for deriving forest compostition and structure variables for the BAM-CASFRI points from the most up-to-date CASFRI data.

We first separated the data that did not have crown closure estimates. This included all of the non-forested layer (NFL) records and a large number of the North American Breeding Bird Survey (BBS) and provincial breeding bird atlas (BBA) sites. We then separted out the records from the remaining data that did not have at least one tree species defined. This included all of the polygons designated as non-productive forest (NP), scrub coniferous (SC), scrub deciduous (SD), treed muskeg (TM), and treed ???? (TR).

# Seperate out the data that does not have crown closure records.   
no\_clos <- bam\_casfri[which(bam\_casfri$lyr\_crown\_closure\_upper < 0 | is.na(bam\_casfri$lyr\_crown\_closure\_upper)), ]  
  
# Subset the data to only include rows with crown closure data  
nc <- which(bam\_casfri$lyr\_crown\_closure\_upper < 0 | is.na(bam\_casfri$lyr\_crown\_closure\_upper))  
bam\_casfri\_close <- bam\_casfri[-nc, ]  
  
# Separate from the remaining records those that do not have at least 1 defined species. This includes all of the polygons designated as NP, SC, SD, TM, and TR  
ns <- which(is.na(bam\_casfri\_close$species\_1) | bam\_casfri\_close$species\_1 == "WNBP HEGR" | bam\_casfri\_close$species\_1 == "Uncl spp." | bam\_casfri\_close$species\_1 == "XXXX ERRC" | bam\_casfri\_close$species\_1 == "XXXX MISS" | bam\_casfri\_close$species\_1 == "XXXX UNDF")  
  
bam\_casfri\_data <- bam\_casfri\_close[-ns, ]   
levels(droplevels(bam\_casfri\_data$productive\_for)) # The only remaining sites are either null, PF, or PP for 'productive\_for'

## [1] "-1111" "PF" "PP"

rownames(bam\_casfri\_data) <- 1:nrow(bam\_casfri\_data)

Next we created a table that included the stand structure data and the stand origin. Specifically, we calculated the mean of the upper and lower estimates of crown closure, canopy height, and stand origin. For records that had only a single estimate (either upper or lower), we used the single estimate as the mean.

# Create the file with the desired variables form all the points  
lyr\_totals<-data.frame(cas\_id=bam\_casfri\_data$cas\_id, crown\_closure=rep(NA, nrow(bam\_casfri\_data)), canopy\_height=rep(NA, nrow(bam\_casfri\_data)),   
 pct\_con=rep(NA, nrow(bam\_casfri\_data)), pct\_pinus=rep(NA, nrow(bam\_casfri\_data)), stand\_origin=rep(NA, nrow(bam\_casfri\_data)),   
 photo\_year=bam\_casfri\_data$photo\_year, pin\_dom=rep(NA, nrow(bam\_casfri\_data)))  
tree\_lookup <- read.csv("tree\_lookup.csv", header = TRUE)  
tree\_lookup$cas\_code <- as.factor(trimws(tree\_lookup$cas\_code))  
  
lyr\_totals[, "crown\_closure"]<-as.numeric(rowMeans(cbind(bam\_casfri\_data$lyr\_crown\_closure\_upper, bam\_casfri\_data$lyr\_crown\_closure\_lower)))  
  
# Derive the canopy hieght estimates  
for(i in 1:nrow(lyr\_totals)){  
 if(bam\_casfri\_data$lyr\_height\_upper[i] < 0 & bam\_casfri\_data$lyr\_height\_lower[i] < 0){  
 lyr\_totals[i, "canopy\_height"] <- NA  
 }else if(bam\_casfri\_data$lyr\_height\_upper[i] < 0 | bam\_casfri\_data$lyr\_height\_lower[i] < 0){  
 lyr\_totals[i, "canopy\_height"] <- as.numeric(max(bam\_casfri\_data$lyr\_height\_upper[i], bam\_casfri\_data$lyr\_height\_lower[i]))  
 }else{  
 lyr\_totals[i, "canopy\_height"] <- as.numeric(mean(bam\_casfri\_data$lyr\_height\_upper[i], bam\_casfri\_data$lyr\_height\_lower[i]))  
 }  
}  
  
lyr\_totals[, "canopy\_height"]<-as.numeric(lyr\_totals$canopy\_height)  
  
# Derive the stand origin estimates  
for(i in 1:nrow(lyr\_totals)){  
 if(bam\_casfri\_data$origin\_upper[i] < 0 & bam\_casfri\_data$origin\_lower[i] < 0){  
 lyr\_totals[i, "stand\_origin"] <- NA  
 }else if(bam\_casfri\_data$origin\_upper[i] < 0 | bam\_casfri\_data$origin\_lower[i] < 0){  
 lyr\_totals[i, "stand\_origin"] <- as.numeric(max(bam\_casfri\_data$origin\_upper[i], bam\_casfri\_data$origin\_lower[i]))  
 }else{  
 lyr\_totals[i, "stand\_origin"] <- as.numeric(mean(bam\_casfri\_data$origin\_upper[i], bam\_casfri\_data$origin\_lower[i]))  
 }  
}

Finally, we looped over all of the species data at each row to calculate percent conifer, percent in *Pinus spp.*, presence of *Pinus spp.* in the overstory as a 1 or 0, and whether or not pines were dominant (i.e. if species\_1 was *Pinus*). We also omitted rows that did not have information on canopy height.

specnum<-paste0("species\_", 1:10)  
specper<-paste0("species\_per\_", 1:10)  
  
  
  
for(i in 1:nrow(lyr\_totals)){  
 c <- 0  
 p <- 0  
 for(j in 1:length(specnum)){  
 d <- tree\_lookup[which(tree\_lookup$cas\_code==paste(bam\_casfri\_data[i, specnum[j]])), ]$conifer  
 e <- d\*bam\_casfri\_data[i, specper[j]]  
 c <- c + e  
   
 f <- tree\_lookup[which(tree\_lookup$cas\_code==paste(bam\_casfri\_data[i, specnum[j]])), ]$pinus  
 g <- f\*bam\_casfri\_data[i, specper[j]]  
 p <- p + g  
 }  
 lyr\_totals[i, "pct\_con"] <- c  
 lyr\_totals[i, "pct\_pinus"] <- p  
 lyr\_totals[i, "pin\_dom"] <- tree\_lookup[which(tree\_lookup$cas\_code==paste(bam\_casfri\_data[i, "species\_1"])), ]$pinus  
 lyr\_totals$spec1[i] <- as.character(bam\_casfri\_data[i, "species\_1"])  
}  
  
# Create an indicator for presence of pines  
lyr\_totals$pinus <- lyr\_totals$pct\_pinus  
lyr\_totals$pinus[lyr\_totals$pinus > 0] <- 1  
  
head(lyr\_totals)

## cas\_id crown\_closure  
## 1 AB\_0016-xxxxxxxxxCANFOR-xT083R09M6-0000001693-0000129 60.5  
## 2 AB\_0016-xxxxxxxxxCANFOR-xT083R09M6-0000001553-0000095 85.5  
## 3 AB\_0016-xxxxxxxxxCANFOR-xT083R09M6-0000001553-0000095 85.5  
## 4 AB\_0016-xxxxxxxxxCANFOR-xT083R09M6-0000001553-0000095 85.5  
## 5 AB\_0016-xxxxxxxxxCANFOR-xT083R09M6-0000001693-0000129 60.5  
## 6 AB\_0016-xxxxxxxxxCANFOR-xT083R09M6-0000001693-0000129 60.5  
## canopy\_height pct\_con pct\_pinus stand\_origin photo\_year pin\_dom  
## 1 14.5 0 0 1950 1994 0  
## 2 14.5 0 0 1950 1994 0  
## 3 14.5 0 0 1950 1994 0  
## 4 14.5 0 0 1950 1994 0  
## 5 14.5 0 0 1950 1994 0  
## 6 14.5 0 0 1950 1994 0  
## spec1 pinus  
## 1 Popu trem 0  
## 2 Popu trem 0  
## 3 Popu trem 0  
## 4 Popu trem 0  
## 5 Popu trem 0  
## 6 Popu trem 0

# Omit the rows that don't have information on canopy height  
lyr\_totals <- lyr\_totals[-which(is.na(lyr\_totals$canopy\_height)), ]

We were left with 51,581 points that did not show eveidence of disturbance between the photo year and the survey year, and had sufficient information to estimate the desired predictor variables.