Supplementary Data 1

R scripts used in Ozgo et al.

**A. Banding**

## Allemansgeest\_banding -----

Allemansgeest\_banding <- as.table(rbind(c(93,67,168,2), c(255,130,129,12), c(14,11,10,2)))

dimnames(Allemansgeest\_banding) <- list(Year = c("1942","1943", "2010"), Banding =c("Mid","Three","Five","Other"))

Allemansgeest\_banding

# 1942 -> 1943 -----

Allemansgeest\_banding\_Year1942.1943 <- rbind(Allemansgeest\_banding[1,],Allemansgeest\_banding[2,])

dimnames(Allemansgeest\_banding\_Year1942.1943) <- list(Year = c("1942","1943"), Banding =c("Mid","Three","Five","Other"))

Allemansgeest\_banding\_Year1942.1943

#### CHECK THIS NS

Allemansgeest\_banding\_Xsq\_Year1942.1943 <- chisq.test(Allemansgeest\_banding\_Year1942.1943[2,1:4], p = Allemansgeest\_banding\_Year1942.1943[1,1:4]/sum(Allemansgeest\_banding\_Year1942.1943[1,1:4]), correct = FALSE)

Allemansgeest\_banding\_Xsq\_Year1942.1943

fisher.test(Allemansgeest\_banding\_Year1942.1943) ##same

# 1942 -> 2010 -----

Allemansgeest\_banding\_Year1942.2010 <- rbind(Allemansgeest\_banding[1,],Allemansgeest\_banding[3,])

dimnames(Allemansgeest\_banding\_Year1942.2010) <- list(Year = c("1942","2010"), Banding =c("Mid","Three","Five","Other"))

Allemansgeest\_banding\_Year1942.2010

#### CHECK THIS NS

Allemansgeest\_banding\_Xsq\_Year1942.2010 <- chisq.test(Allemansgeest\_banding\_Year1942.2010[2,1:4], p = Allemansgeest\_banding\_Year1942.2010[1,1:4]/sum(Allemansgeest\_banding\_Year1942.2010[1,1:4]), correct = FALSE)

Allemansgeest\_banding\_Xsq\_Year1942.2010

fisher.test(Allemansgeest\_banding\_Year1942.2010) ##same

# 1943 -> 2010 -----

Allemansgeest\_banding\_Year1943.2010 <- rbind(Allemansgeest\_banding[2,],Allemansgeest\_banding[3,])

dimnames(Allemansgeest\_banding\_Year1943.2010) <- list(Year = c("1943","2010"), Banding =c("Mid","Three","Five","Other"))

Allemansgeest\_banding\_Year1943.2010

#### CHECK THIS NS

Allemansgeest\_banding\_Xsq\_Year1943.2010 <- chisq.test(Allemansgeest\_banding\_Year1943.2010[2,1:4], p = Allemansgeest\_banding\_Year1943.2010[1,1:4]/sum(Allemansgeest\_banding\_Year1943.2010[1,1:4]), correct = FALSE)

Allemansgeest\_banding\_Xsq\_Year1943.2010

fisher.test(Allemansgeest\_banding\_Year1943.2010) ##same

## Empe\_banding -----

##test2010 samples

Empe2010 <- as.table(rbind(c(1,36,22), c(1,41,14)))

dimnames(Empe2010) <- list(Year = c("2010o","2010s"), Banding =c("Mid","Three","Five"))

Empe2010

chisq.test(Empe2010)

Empe\_banding <- as.table(rbind(c(0,188,69,1), c(0,127,39,0), c(2,77,36,0)))

dimnames(Empe\_banding) <- list(Year = c("1915","1951","2010"), Banding =c("Mid","Three","Five","Other"))

Empe\_banding

# 1915 -> 1951 -----

Empe\_banding\_Year1915.1951 <- rbind(Empe\_banding[1,],Empe\_banding[2,])

dimnames(Empe\_banding\_Year1915.1951) <- list(Year = c("1915","1951"), Banding =c("Mid","Three","Five","Other"))

Empe\_banding\_Year1915.1951

#### CHECK THIS NS

Empe\_banding\_Xsq\_Year1915.1951 <- chisq.test(Empe\_banding\_Year1915.1951[2,2:4], p = Empe\_banding\_Year1915.1951[1,2:4]/sum(Empe\_banding\_Year1915.1951[1,2:4]), correct = FALSE)

Empe\_banding\_Xsq\_Year1915.1951

fisher.test(Empe\_banding\_Year1915.1951) ##same

Empe\_banding\_Xsq\_Year1915.1951\_exMO <- chisq.test(Empe\_banding\_Year1915.1951[2,2:3], p = Empe\_banding\_Year1915.1951[1,2:3]/sum(Empe\_banding\_Year1915.1951[1,2:3]), correct = FALSE)

Empe\_banding\_Xsq\_Year1915.1951\_exMO

fisher.test(Empe\_banding\_Year1915.1951) ##same

# 1915 -> 2010 -----

Empe\_banding\_Year1915.2010 <- rbind(Empe\_banding[1,],Empe\_banding[3,])

dimnames(Empe\_banding\_Year1915.2010) <- list(Year = c("1915","2010"), Banding =c("Mid","Three","Five","Other"))

Empe\_banding\_Year1915.2010

#### CHECK THIS NS

Empe\_banding\_Xsq\_Year1915.2010 <- chisq.test(Empe\_banding\_Year1915.2010[2,2:4], p = Empe\_banding\_Year1915.2010[1,2:4]/sum(Empe\_banding\_Year1915.2010[1,2:4]), correct = FALSE)

Empe\_banding\_Xsq\_Year1915.2010

Empe\_banding\_Xsq\_Year1915.2010\_exMO <- chisq.test(Empe\_banding\_Year1915.2010[2,2:3], p = Empe\_banding\_Year1915.2010[1,2:3]/sum(Empe\_banding\_Year1915.2010[1,2:3]), correct = FALSE)

Empe\_banding\_Xsq\_Year1915.2010\_exMO

fisher.test(Empe\_banding\_Year1915.2010) ##same

# 1951 -> 2010 -----

Empe\_banding\_Year1951.2010 <- rbind(Empe\_banding[2,],Empe\_banding[3,])

dimnames(Empe\_banding\_Year1951.2010) <- list(Year = c("1951","2010"), Banding =c("Mid","Three","Five","Other"))

Empe\_banding\_Year1951.2010

Empe\_banding\_Xsq\_Year1951.2010 <- chisq.test(Empe\_banding\_Year1951.2010[2,2:3], p = Empe\_banding\_Year1951.2010[1,2:3]/sum(Empe\_banding\_Year1951.2010[1,2:3]), correct = FALSE)

Empe\_banding\_Xsq\_Year1951.2010

fisher.test(Empe\_banding\_Year1951.2010) ##same barely p=0.049

## Lobith\_banding -----

Lobith\_banding <- as.table(rbind(c(0,38,116,8), c(1,25,121,13), c(3,115,408,31), c(0,10,28,13)))

dimnames(Lobith\_banding) <- list(Year = c("1960","1961","1962","2010"), Banding =c("Mid","Three","Five","Other"))

Lobith\_banding

# 1960, 1961, 1962 -----

Lobith\_banding\_Year1960.1961.1962 <- rbind(Lobith\_banding[1,],Lobith\_banding[2,],Lobith\_banding[3,])

dimnames(Lobith\_banding\_Year1960.1961.1962) <- list(Year = c("1960","1961","1962"), Banding =c("Mid","Three","Five","Other"))

Lobith\_banding\_Year1960.1961.1962

#### CHECK THIS NS

Lobith\_banding\_Xsq\_Year1960.1961.1962 <- chisq.test(Lobith\_banding\_Year1960.1961.1962[,1:4], correct = FALSE)

Lobith\_banding\_Xsq\_Year1960.1961.1962

fisher.test(Lobith\_banding\_Year1960.1961.1962) ##same

# 1960 -> 1961 -----

Lobith\_banding\_Year1960.1961 <- rbind(Lobith\_banding[1,],Lobith\_banding[2,])

dimnames(Lobith\_banding\_Year1960.1961) <- list(Year = c("1960","1961"), Banding =c("Mid","Three","Five","Other"))

Lobith\_banding\_Year1960.1961

#### CHECK THIS NS

Lobith\_banding\_Xsq\_Year1960.1961 <- chisq.test(Lobith\_banding\_Year1960.1961[2,2:4], p = Lobith\_banding\_Year1960.1961[1,2:4]/sum(Lobith\_banding\_Year1960.1961[1,2:4]), correct = FALSE)

Lobith\_banding\_Xsq\_Year1960.1961

fisher.test(Lobith\_banding\_Year1960.1961) ##DIFFERENT NS

fisher.test(Lobith\_banding\_Year1960.1961[,2:4]) ##DIFFERENT NS p=0.14 when "Mid" excluded

# 1960 -> 1962 -----

Lobith\_banding\_Year1960.1962 <- rbind(Lobith\_banding[1,],Lobith\_banding[3,])

dimnames(Lobith\_banding\_Year1960.1962) <- list(Year = c("1960","1962"), Banding =c("Mid","Three","Five","Other"))

Lobith\_banding\_Year1960.1962

Lobith\_banding\_Xsq\_Year1960.1962 <- chisq.test(Lobith\_banding\_Year1960.1962[2,2:4], p = Lobith\_banding\_Year1960.1962[1,2:4]/sum(Lobith\_banding\_Year1960.1962[1,2:4]), correct = FALSE)

Lobith\_banding\_Xsq\_Year1960.1962

fisher.test(Lobith\_banding\_Year1960.1962) ##same

# 1961 -> 1962 -----

Lobith\_banding\_Year1961.1962 <- rbind(Lobith\_banding[2,],Lobith\_banding[3,])

dimnames(Lobith\_banding\_Year1961.1962) <- list(Year = c("1961","1962"), Banding =c("Mid","Three","Five","Other"))

Lobith\_banding\_Year1961.1962

#### CHECK THIS NS

Lobith\_banding\_Xsq\_Year1961.1962 <- chisq.test(Lobith\_banding\_Year1961.1962[2,1:4], p = Lobith\_banding\_Year1961.1962[1,1:4]/sum(Lobith\_banding\_Year1961.1962[1,1:4]), correct = FALSE)

Lobith\_banding\_Xsq\_Year1961.1962

Lobith\_banding\_Xsq\_Year1961.1962\_exM <- chisq.test(Lobith\_banding\_Year1961.1962[2,2:4], p = Lobith\_banding\_Year1961.1962[1,2:4]/sum(Lobith\_banding\_Year1961.1962[1,2:4]), correct = FALSE)

Lobith\_banding\_Xsq\_Year1961.1962\_exM

fisher.test(Lobith\_banding\_Year1961.1962) ##DIFFERENT NS

fisher.test(Lobith\_banding\_Year1961.1962[,2:4]) ##different NS p=0.21 when "Mid" excluded

# 1960 -> 2010 -----

Lobith\_banding\_Year1960.2010 <- rbind(Lobith\_banding[1,],Lobith\_banding[4,])

dimnames(Lobith\_banding\_Year1960.2010) <- list(Year = c("1960","2010"), Banding =c("Mid","Three","Five","Other"))

Lobith\_banding\_Year1960.2010

#### CHECK THIS NS

Lobith\_banding\_Xsq\_Year1960.2010 <- chisq.test(Lobith\_banding\_Year1960.2010[2,2:4], p = Lobith\_banding\_Year1960.2010[1,2:4]/sum(Lobith\_banding\_Year1960.2010[1,2:4]), correct = FALSE)

Lobith\_banding\_Xsq\_Year1960.2010

fisher.test(Lobith\_banding\_Year1960.2010) ##same

# 1961 -> 2010 -----

Lobith\_banding\_Year1961.2010 <- rbind(Lobith\_banding[2,],Lobith\_banding[4,])

dimnames(Lobith\_banding\_Year1961.2010) <- list(Year = c("1961","2010"), Banding =c("Mid","Three","Five","Other"))

Lobith\_banding\_Year1961.2010

#### CHECK THIS NS

Lobith\_banding\_Xsq\_Year1961.2010 <- chisq.test(Lobith\_banding\_Year1961.2010[2,1:4], p = Lobith\_banding\_Year1961.2010[1,1:4]/sum(Lobith\_banding\_Year1961.2010[1,1:4]), correct = FALSE)

Lobith\_banding\_Xsq\_Year1961.2010

Lobith\_banding\_Xsq\_Year1961.2010\_exM <- chisq.test(Lobith\_banding\_Year1961.2010[2,2:4], p = Lobith\_banding\_Year1961.2010[1,2:4]/sum(Lobith\_banding\_Year1961.2010[1,2:4]), correct = FALSE)

Lobith\_banding\_Xsq\_Year1961.2010\_exM

fisher.test(Lobith\_banding\_Year1961.2010) ##same

# 1962 -> 2010 -----

Lobith\_banding\_Year1962.2010 <- rbind(Lobith\_banding[3,],Lobith\_banding[4,])

dimnames(Lobith\_banding\_Year1962.2010) <- list(Year = c("1962","2010"), Banding =c("Mid","Three","Five","Other"))

Lobith\_banding\_Year1962.2010

#### CHECK THIS NS

Lobith\_banding\_Xsq\_Year1962.2010 <- chisq.test(Lobith\_banding\_Year1962.2010[2,1:4], p = Lobith\_banding\_Year1962.2010[1,1:4]/sum(Lobith\_banding\_Year1962.2010[1,1:4]), correct = FALSE)

Lobith\_banding\_Xsq\_Year1962.2010

Lobith\_banding\_Xsq\_Year1962.2010\_exM <- chisq.test(Lobith\_banding\_Year1962.2010[2,2:4], p = Lobith\_banding\_Year1962.2010[1,2:4]/sum(Lobith\_banding\_Year1962.2010[1,2:4]), correct = FALSE)

Lobith\_banding\_Xsq\_Year1962.2010\_exM

fisher.test(Lobith\_banding\_Year1962.2010) ##same

#printing results

for (obj in objects(pattern = "Xsq")){

 print(obj)

 print(paste("statistic = ", round(get(obj)$statistic,3), ",", "d.f.=",(get(obj)$parameter), "p =", round(get(obj)$p.value,3)))

 print(round(get(obj)$stdres)\*(get(obj)$stdres),3)

 print(round(1-pchisq(((get(obj)$stdres)\*(get(obj)$stdres)),get(obj)$parameter),3))

 print(round(1-pchisq(((get(obj)$stdres)\*(get(obj)$stdres)),get(obj)$parameter),3) <= (0.05/(get(obj)$parameter+1)))

 print("--------------------")

}

for (obj in objects(pattern = "Xsq")){

 print(paste(obj,",","statistic = ", round(get(obj)$statistic,3), ",", "d.f.=",(get(obj)$parameter), ",","p =", round(get(obj)$p.value,3)))

}

###graphs

library(ggplot2)

library(plyr)

library(RColorBrewer)

Allemansgeest\_banding <- data.frame(Allemansgeest\_banding)

Abandprop <- ddply(Allemansgeest\_banding, "Year", transform, prop.freq=Freq/sum(Freq)\*100)

Abandprop <- ddply(Abandprop, "Year", transform, label\_y=cumsum(prop.freq))

Lobith\_banding <- data.frame(Lobith\_banding)

Lbandprop <- ddply(Lobith\_banding, "Year", transform, prop.freq=Freq/sum(Freq)\*100)

Lbandprop <- ddply(Lbandprop, "Year", transform, label\_y=cumsum(prop.freq))

Empe\_banding <- data.frame(Empe\_banding)

Ebandprop <- ddply(Empe\_banding, "Year", transform, prop.freq=Freq/sum(Freq)\*100)

Ebandprop <- ddply(Ebandprop, "Year", transform, label\_y=cumsum(prop.freq))

#numbers plot

ggplot(Allemansgeest\_colour, aes(x=Year, y=Freq,fill=Banding))+

 geom\_bar(stat="identity")

#proportion plot

ggplot(Abandprop, aes(x=Year, y=prop.freq,fill=Banding))+ geom\_bar(stat="identity")+theme\_bw()+theme(panel.grid.major = element\_blank(),panel.grid.minor = element\_blank())+

 scale\_fill\_manual(values=c("#fdd49e","#fc8d59" , "#b30000", "#bdbdbd")) + guides(fill=guide\_legend(reverse=TRUE))+

 ylab("Proportion (%)")+ scale\_y\_continuous(breaks=c(0,25,50,75,100))+

 ggtitle("Allemansgeest")+geom\_text(aes(y=label\_y,label=Freq), vjust=c(1.5, 1.5, 1.5,-0.1, 1.5, 1.5, 1.5,-0.1,1.5, 1.5, 1.5,-0.1), colour="black")+

 annotate("text", x=3, y=114, label="")+

#annotate("segment", x=2, xend=3, y=102, yend=102,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

annotate("segment", x=1, xend=2, y=105, yend=105,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

annotate("segment", x=1, xend=3, y=108, yend=108,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

annotate("text", x=1.5, y=106, label="\*\*\*", size=7)+

annotate("text", x=2, y=109, label="\*\*\*", size=7)

ggplot(Lbandprop, aes(x=Year, y=prop.freq,fill=Banding))+ geom\_bar(stat="identity")+theme\_bw()+theme(panel.grid.major = element\_blank(),panel.grid.minor = element\_blank())+

 scale\_fill\_manual(values=c("#fdd49e","#fc8d59" , "#b30000", "#bdbdbd"))+ guides(fill=guide\_legend(reverse=TRUE))+

 ylab("Proportion (%)")+ scale\_y\_continuous(breaks=c(0,25,50,75,100))+

 ggtitle("Lobith")+

 annotate("text", x=3, y=114, label="")+ geom\_text(aes(y=label\_y,label=Freq), vjust=c(1.5, 1.5, 1.5,1, 1.5, 1.5, 1.5,1, 1.5, 1.5, 1.5,1,1.5, 1.5, 1.5,1), colour="black")+

 annotate("segment", x=2, xend=3, y=104, yend=104,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("segment", x=1, xend=2, y=107, yend=107,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("segment", x=3, xend=4, y=106, yend=106,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("segment", x=1, xend=3, y=108, yend=108,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("segment", x=2, xend=4, y=111, yend=111,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("segment", x=1, xend=4, y=114, yend=114,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("text", x=1.5, y=108, label="\*", size=7)+

 annotate("text", x=2.5, y=115, label="\*\*\*", size=7)+

annotate("text", x=2.5, y=105, label="\*\*\*", size=7)+

 annotate("text", x=3, y=112, label="\*\*\*", size=7)+

 annotate("text", x=3.5, y=107, label="\*\*\*", size=7)

ggplot(Ebandprop, aes(x=Year, y=prop.freq,fill=Banding))+ geom\_bar(stat="identity")+theme\_bw()+theme(panel.grid.major = element\_blank(),panel.grid.minor = element\_blank())+

 scale\_fill\_manual(values=c("#fdd49e","#fc8d59" , "#b30000", "#bdbdbd"))+ guides(fill=guide\_legend(reverse=TRUE))+

 ylab("Proportion (%)")+scale\_y\_continuous(breaks=c(0,25,50,75,100))+

 ggtitle("Empe")+ geom\_text(aes(y=label\_y,label=Freq), vjust=c(.7, 1.5, 1.5,-0.1, .7, 1.5, 1.5,-0.1,.9, 1.5, 1.5,-.1), colour="black")+

 annotate("text", x=3, y=114, label="")+

 annotate("segment", x=2, xend=3, y=105, yend=105,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("segment", x=1, xend=2, y=107, yend=107,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("segment", x=1, xend=3, y=108, yend=108,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("text", x=1.5, y=108, label="\*\*\*", size=7)+

 annotate("text", x=2.5, y=106, label="\*", size=7)

**B. Colour**

## Allemansgeest\_colour -----

Allemansgeest\_colour <- as.table(rbind(c(270, 230, 0), c(404, 368, 0), c(48,29,0)))

dimnames(Allemansgeest\_colour) <- list(Year = c("1942","1943", "2010"), Colour = c("Yellow","Pink","Brown"))

Allemansgeest\_colour

# 1942 -> 1943 -----

Allemansgeest\_colour\_Year1942.1943 <- rbind(Allemansgeest\_colour[1,],Allemansgeest\_colour[2,])

dimnames(Allemansgeest\_colour\_Year1942.1943) <- list(Year = c("1942","1943"), colour = c("Yellow","Pink","Brown"))

Allemansgeest\_colour\_Year1942.1943

Allemansgeest\_colour\_Xsq\_Year1942.1943 <- chisq.test(Allemansgeest\_colour\_Year1942.1943[2,1:2], p = Allemansgeest\_colour\_Year1942.1943[1,1:2]/sum(Allemansgeest\_colour\_Year1942.1943[1,1:2]), correct = FALSE)

Allemansgeest\_colour\_Xsq\_Year1942.1943

fisher.test(Allemansgeest\_colour\_Year1942.1943) ##same

# 1942 -> 2010 -----

Allemansgeest\_colour\_Year1942.2010 <- rbind(Allemansgeest\_colour[1,],Allemansgeest\_colour[3,])

dimnames(Allemansgeest\_colour\_Year1942.2010) <- list(Year = c("1942","2010"), colour = c("Yellow","Pink","Brown"))

Allemansgeest\_colour\_Year1942.2010

Allemansgeest\_colour\_Xsq\_Year1942.2010 <- chisq.test(Allemansgeest\_colour\_Year1942.2010[2,1:2], p = Allemansgeest\_colour\_Year1942.2010[1,1:2]/sum(Allemansgeest\_colour\_Year1942.2010[1,1:2]), correct = FALSE)

Allemansgeest\_colour\_Xsq\_Year1942.2010

fisher.test(Allemansgeest\_colour\_Year1942.2010) ##same

# 1943 -> 2010 -----

Allemansgeest\_colour\_Year1943.2010 <- rbind(Allemansgeest\_colour[2,],Allemansgeest\_colour[3,])

dimnames(Allemansgeest\_colour\_Year1943.2010) <- list(Year = c("1943","2010"), colour = c("Yellow","Pink","Brown"))

Allemansgeest\_colour\_Year1943.2010

Allemansgeest\_colour\_Xsq\_Year1943.2010 <- chisq.test(Allemansgeest\_colour\_Year1943.2010[2,1:2], p = Allemansgeest\_colour\_Year1943.2010[1,1:2]/sum(Allemansgeest\_colour\_Year1943.2010[1,1:2]), correct = FALSE)

Allemansgeest\_colour\_Xsq\_Year1943.2010

fisher.test(Allemansgeest\_colour\_Year1943.2010) ##same

## Empe\_colour -----

##test2010 samples

Empe2010col <- as.table(rbind(c(73,19,2), c(72,23,0)))

dimnames(Empe2010col) <- list(Year = c("2010o","2010s"), banding = c("Y","P","B"))

Empe2010col

chisq.test(Empe2010col)

Empe\_colour <- as.table(rbind(c(350,104, 14), c(225,115, 0), c(145,42,2)))

dimnames(Empe\_colour) <- list(Year = c("1915","1951","2010"), Colour = c("Yellow","Pink","Brown"))

Empe\_colour

# 1915 -> 1951 -----

Empe\_colour\_Year1915.1951 <- rbind(Empe\_colour[1,],Empe\_colour[2,])

dimnames(Empe\_colour\_Year1915.1951) <- list(Year = c("1915","1951"), colour = c("Yellow","Pink","Brown"))

Empe\_colour\_Year1915.1951

Empe\_colour\_Xsq\_Year1915.1951 <- chisq.test(Empe\_colour\_Year1915.1951[2,1:3], p = Empe\_colour\_Year1915.1951[1,1:3]/sum(Empe\_colour\_Year1915.1951[1,1:3]), correct = FALSE)

Empe\_colour\_Xsq\_Year1915.1951

fisher.test(Empe\_colour\_Year1915.1951) ##same

# 1915 -> 2010 -----

Empe\_colour\_Year1915.2010 <- rbind(Empe\_colour[1,],Empe\_colour[3,])

dimnames(Empe\_colour\_Year1915.2010) <- list(Year = c("1915","2010"), colour = c("Yellow","Pink","Brown"))

Empe\_colour\_Year1915.2010

Empe\_colour\_Xsq\_Year1915.2010 <- chisq.test(Empe\_colour\_Year1915.2010[2,1:3], p = Empe\_colour\_Year1915.2010[1,1:3]/sum(Empe\_colour\_Year1915.2010[1,1:3]), correct = FALSE)

Empe\_colour\_Xsq\_Year1915.2010

fisher.test(Empe\_colour\_Year1915.2010) ##same

# 1951 -> 2010 -----

Empe\_colour\_Year1951.2010 <- rbind(Empe\_colour[2,],Empe\_colour[3,])

dimnames(Empe\_colour\_Year1951.2010) <- list(Year = c("1951","2010"), Colour = c("Yellow","Pink","Brown"))

Empe\_colour\_Year1951.2010

#### CHECK THIS

Empe\_colour\_Xsq\_Year1951.2010 <- chisq.test(Empe\_colour\_Year1951.2010[2,1:2], p = Empe\_colour\_Year1951.2010[1,1:2]/sum(Empe\_colour\_Year1951.2010[1,1:2]), correct = FALSE)

Empe\_colour\_Xsq\_Year1951.2010

fisher.test(Empe\_colour\_Year1951.2010) ##same

## Lobith\_colour -----

Lobith\_colour <- as.table(rbind(c(312,56, 0), c(314,84, 0), c(1384,273,2), c(109,20,2)))

dimnames(Lobith\_colour) <- list(Year = c("1960","1961","1962","2010"), Colour = c("Yellow","Pink","Brown"))

Lobith\_colour

# 1960 -> 1961 -----

Lobith\_colour\_Year1960.1961 <- rbind(Lobith\_colour[1,],Lobith\_colour[2,])

dimnames(Lobith\_colour\_Year1960.1961) <- list(Year = c("1960","1961"), colour = c("Yellow","Pink","Brown"))

Lobith\_colour\_Year1960.1961

Lobith\_colour\_Xsq\_Year1960.1961 <- chisq.test(Lobith\_colour\_Year1960.1961[2,1:2], p = Lobith\_colour\_Year1960.1961[1,1:2]/sum(Lobith\_colour\_Year1960.1961[1,1:2]), correct = FALSE)

Lobith\_colour\_Xsq\_Year1960.1961

fisher.test(Lobith\_colour\_Year1960.1961) ##same

# 1960 -> 1962 -----

Lobith\_colour\_Year1960.1962 <- rbind(Lobith\_colour[1,],Lobith\_colour[3,])

dimnames(Lobith\_colour\_Year1960.1962) <- list(Year = c("1960","1962"), colour = c("Yellow","Pink","Brown"))

Lobith\_colour\_Year1960.1962

#### CHECK THIS

Lobith\_colour\_Xsq\_Year1960.1962 <- chisq.test(Lobith\_colour\_Year1960.1962[2,1:2], p = Lobith\_colour\_Year1960.1962[1,1:2]/sum(Lobith\_colour\_Year1960.1962[1,1:2]), correct = FALSE)

Lobith\_colour\_Xsq\_Year1960.1962

fisher.test(Lobith\_colour\_Year1960.1962) ##same

# 1961 -> 1962 -----

Lobith\_colour\_Year1961.1962 <- rbind(Lobith\_colour[2,],Lobith\_colour[3,])

dimnames(Lobith\_colour\_Year1961.1962) <- list(Year = c("1961","1962"), colour = c("Yellow","Pink","Brown"))

Lobith\_colour\_Year1961.1962

#### CHECK THIS

Lobith\_colour\_Xsq\_Year1961.1962 <- chisq.test(Lobith\_colour\_Year1961.1962[2,1:2], p = Lobith\_colour\_Year1961.1962[1,1:2]/sum(Lobith\_colour\_Year1961.1962[1,1:2]), correct = FALSE)

Lobith\_colour\_Xsq\_Year1961.1962

fisher.test(Lobith\_colour\_Year1961.1962) ##DIFFERENT NS p=0.079

fisher.test(Lobith\_colour\_Year1961.1962[,1:2]) #same when brown excluded

# 1960 -> 2010 -----

Lobith\_colour\_Year1960.2010 <- rbind(Lobith\_colour[1,],Lobith\_colour[4,])

dimnames(Lobith\_colour\_Year1960.2010) <- list(Year = c("1960","2010"), colour = c("Yellow","Pink","Brown"))

Lobith\_colour\_Year1960.2010

#### CHECK THIS NS

Lobith\_colour\_Xsq\_Year1960.2010 <- chisq.test(Lobith\_colour\_Year1960.2010[2,1:2], p = Lobith\_colour\_Year1960.2010[1,1:2]/sum(Lobith\_colour\_Year1960.2010[1,1:2]), correct = FALSE)

Lobith\_colour\_Xsq\_Year1960.2010

fisher.test(Lobith\_colour\_Year1960.2010) ##same

# 1961 -> 2010 -----

Lobith\_colour\_Year1961.2010 <- rbind(Lobith\_colour[2,],Lobith\_colour[4,])

dimnames(Lobith\_colour\_Year1961.2010) <- list(Year = c("1961","2010"), colour = c("Yellow","Pink","Brown"))

Lobith\_colour\_Year1961.2010

#### CHECK THIS NS

Lobith\_colour\_Xsq\_Year1961.2010 <- chisq.test(Lobith\_colour\_Year1961.2010[2,1:2], p = Lobith\_colour\_Year1961.2010[1,1:2]/sum(Lobith\_colour\_Year1961.2010[1,1:2]), correct = FALSE)

Lobith\_colour\_Xsq\_Year1961.2010

fisher.test(Lobith\_colour\_Year1961.2010) ##DIFFERENT SIG

fisher.test(Lobith\_colour\_Year1961.2010[,1:2]) ##same NS when brown excluded

# 1962 -> 2010 -----

Lobith\_colour\_Year1962.2010 <- rbind(Lobith\_colour[3,],Lobith\_colour[4,])

dimnames(Lobith\_colour\_Year1962.2010) <- list(Year = c("1962","2010"), colour = c("Yellow","Pink","Brown"))

Lobith\_colour\_Year1962.2010

#### CHECK THIS NS

Lobith\_colour\_Xsq\_Year1962.2010 <- chisq.test(Lobith\_colour\_Year1962.2010[2,1:3], p = Lobith\_colour\_Year1962.2010[1,1:3]/sum(Lobith\_colour\_Year1962.2010[1,1:3]), correct = FALSE)

Lobith\_colour\_Xsq\_Year1962.2010

Lobith\_colour\_Xsq\_Year1962.2010\_exB <- chisq.test(Lobith\_colour\_Year1962.2010[2,1:2], p = Lobith\_colour\_Year1962.2010[1,1:2]/sum(Lobith\_colour\_Year1962.2010[1,1:2]), correct = FALSE)

Lobith\_colour\_Xsq\_Year1962.2010\_exB

fisher.test(Lobith\_colour\_Year1961.2010) #same

fisher.test(Lobith\_colour\_Year1961.2010[,1:2]) #same when brown excluded

for (obj in objects(pattern = "Xsq")){

 print(obj)

 print(paste("statistic = ", round(get(obj)$statistic,3), ",", "d.f.=",(get(obj)$parameter), "p =", round(get(obj)$p.value,3)))

 print(round(get(obj)$stdres)\*(get(obj)$stdres),3)

 print(round(1-pchisq(((get(obj)$stdres)\*(get(obj)$stdres)),get(obj)$parameter),3))

 print(round(1-pchisq(((get(obj)$stdres)\*(get(obj)$stdres)),get(obj)$parameter),3) <= (0.05/(get(obj)$parameter+1)))

 print("--------------------")

}

###graphs

library(ggplot2)

library(plyr)

Allemansgeest\_colour <- data.frame(Allemansgeest\_colour)

Acolprop <- ddply(Allemansgeest\_colour, "Year", transform, prop.freq=Freq/sum(Freq)\*100)

Acolprop <- ddply(Acolprop, "Year", transform, label\_y=cumsum(prop.freq))

Lobith\_colour <- data.frame(Lobith\_colour)

Lcolprop <- ddply(Lobith\_colour, "Year", transform, prop.freq=Freq/sum(Freq)\*100)

Lcolprop <- ddply(Lcolprop, "Year", transform, label\_y=cumsum(prop.freq))

Empe\_colour <- data.frame(Empe\_colour)

Ecolprop <- ddply(Empe\_colour, "Year", transform, prop.freq=Freq/sum(Freq)\*100)

Ecolprop <- ddply(Ecolprop, "Year", transform, label\_y=cumsum(prop.freq))

#numbers plot

ggplot(Allemansgeest\_colour, aes(x=Year, y=Freq,fill=colour))+

 geom\_bar(stat="identity")

#proportion plot

ggplot(Acolprop, aes(x=Year, y=prop.freq,fill=Colour))+ geom\_bar(stat="identity")+theme\_bw()+theme(panel.grid.major = element\_blank(),panel.grid.minor = element\_blank())+

 scale\_fill\_manual(values=c("goldenrod1", "indianred2", "brown4")) + guides(fill=guide\_legend(reverse=TRUE))+

 ylab("proportion (%)")+ scale\_y\_continuous(breaks=c(0,25,50,75,100))+

 ggtitle("Allemansgeest")+geom\_text(aes(y=label\_y,label=Freq), vjust=c(1.5, 1.5, 0,1.5, 1.5, 0,1.5, 1.5, 0), colour="black")+

annotate("text", x=3, y=114, label="")

#all NS

#annotate("segment", x=2, xend=3, y=102, yend=102,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

#annotate("segment", x=1, xend=2, y=105, yend=105,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 # annotate("segment", x=1, xend=3, y=108, yend=108,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("text", x=, y=106, label="\*", size=7)

ggplot(Lcolprop, aes(x=Year, y=prop.freq,fill=Colour))+ geom\_bar(stat="identity")+theme\_bw()+theme(panel.grid.major = element\_blank(),panel.grid.minor = element\_blank())+

 scale\_fill\_manual(values=c("goldenrod1", "indianred2", "brown4")) + guides(fill=guide\_legend(reverse=TRUE))+

 ylab("proportion (%)")+ scale\_y\_continuous(breaks=c(0,25,50,75,100))+

 ggtitle("Lobith")+

 annotate("text", x=3, y=114, label="")+ geom\_text(aes(y=label\_y,label=Freq), vjust=c(1.5, 1.5, 0, 1.5, 1.5, 0, 1.5,1.5, 0, 1.5, 1.5, 0), colour="black")+

 annotate("segment", x=2, xend=3, y=104, yend=104,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("segment", x=1, xend=2, y=107, yend=107,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("segment", x=3, xend=4, y=105, yend=105,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("segment", x=1, xend=3, y=108, yend=108,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("segment", x=2, xend=4, y=111, yend=111,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("segment", x=1, xend=4, y=114, yend=114,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("text", x=1.5, y=108, label="\*\*\*", size=7)+

annotate("text", x=2.5, y=105, label="\*\*\*", size=7)

ggplot(Ecolprop, aes(x=Year, y=prop.freq,fill=Colour))+ geom\_bar(stat="identity")+theme\_bw()+theme(panel.grid.major = element\_blank(),panel.grid.minor = element\_blank())+

 scale\_fill\_manual(values=c("goldenrod1", "indianred2", "brown4")) + guides(fill=guide\_legend(reverse=TRUE))+

 ylab("proportion (%)")+scale\_y\_continuous(breaks=c(0,25,50,75,100))+

 ggtitle("Empe")+ geom\_text(aes(y=label\_y,label=Freq), vjust=c(1.5,1.5,0, 1.5,1.5,0, 1.5, 1.5,0), colour="black")+

 annotate("text", x=3, y=114, label="")+

 annotate("segment", x=2, xend=3, y=104, yend=104,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("segment", x=1, xend=2, y=107, yend=107,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("segment", x=1, xend=3, y=108, yend=108,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("text", x=1.5, y=108, label="\*\*\*", size=7)+

annotate("text", x=2.5, y=105, label="\*\*\*", size=7)

**C. Yellow, effectively unbanded**

Allemansgeest\_YeU <- as.table(rbind(c(146,354), c(298,474), c(38,39)))

dimnames(Allemansgeest\_YeU) <- list(Year = c("1942","1943", "2010"), YeU = c("YeU","Other"))

Allemansgeest\_YeU

# 1942 -> 1943 -----

Allemansgeest\_YeU\_Year1942.1943 <- rbind(Allemansgeest\_YeU[1,],Allemansgeest\_YeU[2,])

dimnames(Allemansgeest\_YeU\_Year1942.1943) <- list(Year = c("1942","1943"), YeU = c("YeU","Other"))

Allemansgeest\_YeU\_Year1942.1943

Allemansgeest\_YeU\_Xsq\_Year1942.1943 <- chisq.test(Allemansgeest\_YeU\_Year1942.1943[2,1:2], p = Allemansgeest\_YeU\_Year1942.1943[1,1:2]/sum(Allemansgeest\_YeU\_Year1942.1943[1,1:2]), correct = FALSE)

Allemansgeest\_YeU\_Xsq\_Year1942.1943

fisher.test(Allemansgeest\_YeU\_Year1942.1943) ##same

# 1942 -> 2010 -----

Allemansgeest\_YeU\_Year1942.2010 <- rbind(Allemansgeest\_YeU[1,],Allemansgeest\_YeU[3,])

dimnames(Allemansgeest\_YeU\_Year1942.2010) <- list(Year = c("1942","2010"), YeU = c("YeU","Other"))

Allemansgeest\_YeU\_Year1942.2010

Allemansgeest\_YeU\_Xsq\_Year1942.2010 <- chisq.test(Allemansgeest\_YeU\_Year1942.2010[2,1:2], p = Allemansgeest\_YeU\_Year1942.2010[1,1:2]/sum(Allemansgeest\_YeU\_Year1942.2010[1,1:2]), correct = FALSE)

Allemansgeest\_YeU\_Xsq\_Year1942.2010

fisher.test(Allemansgeest\_YeU\_Year1942.2010) ##same

# 1943 -> 2010 -----

Allemansgeest\_YeU\_Year1943.2010 <- rbind(Allemansgeest\_YeU[2,],Allemansgeest\_YeU[3,])

dimnames(Allemansgeest\_YeU\_Year1943.2010) <- list(Year = c("1943","2010"), YeU = c("YeU","Other"))

Allemansgeest\_YeU\_Year1943.2010

Allemansgeest\_YeU\_Xsq\_Year1943.2010 <- chisq.test(Allemansgeest\_YeU\_Year1943.2010[2,1:2], p = Allemansgeest\_YeU\_Year1943.2010[1,1:2]/sum(Allemansgeest\_YeU\_Year1943.2010[1,1:2]), correct = FALSE)

Allemansgeest\_YeU\_Xsq\_Year1943.2010

fisher.test(Allemansgeest\_YeU\_Year1943.2010) ##DIFFERENT NS

## Empe\_YeU -----

Empe\_YeU <- as.table(rbind(c(303,165), c(198,142), c(115,74)))

dimnames(Empe\_YeU) <- list(Year = c("1915","1951","2010"), YeU = c("YeU","Other"))

Empe\_YeU

# 1915 -> 1951 -----

Empe\_YeU\_Year1915.1951 <- rbind(Empe\_YeU[1,],Empe\_YeU[2,])

dimnames(Empe\_YeU\_Year1915.1951) <- list(Year = c("1915","1951"), YeU = c("YeU","Other"))

Empe\_YeU\_Year1915.1951

Empe\_YeU\_Xsq\_Year1915.1951 <- chisq.test(Empe\_YeU\_Year1915.1951[2,1:2], p = Empe\_YeU\_Year1915.1951[1,1:2]/sum(Empe\_YeU\_Year1915.1951[1,1:2]), correct = FALSE)

Empe\_YeU\_Xsq\_Year1915.1951

fisher.test(Empe\_YeU\_Year1915.1951) ##DIFFERENT NS

# 1915 -> 2010 -----

Empe\_YeU\_Year1915.2010 <- rbind(Empe\_YeU[1,],Empe\_YeU[3,])

dimnames(Empe\_YeU\_Year1915.2010) <- list(Year = c("1915","2010"), YeU = c("YeU","Other"))

Empe\_YeU\_Year1915.2010

Empe\_YeU\_Xsq\_Year1915.2010 <- chisq.test(Empe\_YeU\_Year1915.2010[2,1:2], p = Empe\_YeU\_Year1915.2010[1,1:2]/sum(Empe\_YeU\_Year1915.2010[1,1:2]), correct = FALSE)

Empe\_YeU\_Xsq\_Year1915.2010

# 1951 -> 2010 -----

Empe\_YeU\_Year1951.2010 <- rbind(Empe\_YeU[2,],Empe\_YeU[3,])

dimnames(Empe\_YeU\_Year1951.2010) <- list(Year = c("1951","2010"), YeU = c("YeU","Other"))

Empe\_YeU\_Year1951.2010

Empe\_YeU\_Xsq\_Year1951.2010 <- chisq.test(Empe\_YeU\_Year1951.2010[2,1:2], p = Empe\_YeU\_Year1951.2010[1,1:2]/sum(Empe\_YeU\_Year1951.2010[1,1:2]), correct = FALSE)

Empe\_YeU\_Xsq\_Year1951.2010

## Lobith\_YeU -----

Lobith\_YeU <- as.table(rbind(c(199,169), c(191,207), c(1012,645), c(83,48)))

dimnames(Lobith\_YeU) <- list(Year = c("1960","1961","1962","2010"), YeU = c("YeU","Other"))

Lobith\_YeU

# 1960, 1961, 1962 -----

##"test of homogeneity"##

##"test of independence"##

Lobith\_YeU\_Year1960.1961.1962 <- rbind(Lobith\_YeU[1,],Lobith\_YeU[2,],Lobith\_YeU[3,])

dimnames(Lobith\_YeU\_Year1960.1961.1962) <- list(Year = c("1960","1961","1962"), YeU =c("YeU","Other"))

Lobith\_YeU\_Year1960.1961.1962

Lobith\_YeU\_Xsq\_Year1960.1961.1962 <- chisq.test(Lobith\_YeU\_Year1960.1961.1962[,1:2], correct = FALSE)

Lobith\_YeU\_Xsq\_Year1960.1961.1962

# 1960 -> 1961 -----

Lobith\_YeU\_Year1960.1961 <- rbind(Lobith\_YeU[1,],Lobith\_YeU[2,])

dimnames(Lobith\_YeU\_Year1960.1961) <- list(Year = c("1960","1961"), YeU = c("YeU","Other"))

Lobith\_YeU\_Year1960.1961

Lobith\_YeU\_Xsq\_Year1960.1961 <- chisq.test(Lobith\_YeU\_Year1960.1961[2,1:2], p = Lobith\_YeU\_Year1960.1961[1,1:2]/sum(Lobith\_YeU\_Year1960.1961[1,1:2]), correct = FALSE)

Lobith\_YeU\_Xsq\_Year1960.1961

# 1960 -> 1962 -----

Lobith\_YeU\_Year1960.1962 <- rbind(Lobith\_YeU[1,],Lobith\_YeU[3,])

dimnames(Lobith\_YeU\_Year1960.1962) <- list(Year = c("1960","1962"), YeU =c("YeU","Other"))

Lobith\_YeU\_Year1960.1962

Lobith\_YeU\_Xsq\_Year1960.1962 <- chisq.test(Lobith\_YeU\_Year1960.1962[2,1:2], p = Lobith\_YeU\_Year1960.1962[1,1:2]/sum(Lobith\_YeU\_Year1960.1962[1,1:2]), correct = FALSE)

Lobith\_YeU\_Xsq\_Year1960.1962

# 1961 -> 1962 -----

Lobith\_YeU\_Year1961.1962 <- rbind(Lobith\_YeU[2,],Lobith\_YeU[3,])

dimnames(Lobith\_YeU\_Year1961.1962) <- list(Year = c("1961","1962"), YeU =c("YeU","Other"))

Lobith\_YeU\_Year1961.1962

Lobith\_YeU\_Xsq\_Year1961.1962 <- chisq.test(Lobith\_YeU\_Year1961.1962[2,1:2], p = Lobith\_YeU\_Year1961.1962[1,1:2]/sum(Lobith\_YeU\_Year1961.1962[1,1:2]), correct = FALSE)

Lobith\_YeU\_Xsq\_Year1961.1962

# 1960 -> 2010 -----

Lobith\_YeU\_Year1960.2010 <- rbind(Lobith\_YeU[1,],Lobith\_YeU[4,])

dimnames(Lobith\_YeU\_Year1960.2010) <- list(Year = c("1960","2010"), YeU =c("YeU","Other"))

Lobith\_YeU\_Year1960.2010

Lobith\_YeU\_Xsq\_Year1960.2010 <- chisq.test(Lobith\_YeU\_Year1960.2010[2,1:2], p = Lobith\_YeU\_Year1960.2010[1,1:2]/sum(Lobith\_YeU\_Year1960.2010[1,1:2]), correct = FALSE)

Lobith\_YeU\_Xsq\_Year1960.2010

# 1961 -> 2010 -----

Lobith\_YeU\_Year1961.2010 <- rbind(Lobith\_YeU[2,],Lobith\_YeU[4,])

dimnames(Lobith\_YeU\_Year1961.2010) <- list(Year = c("1961","2010"), YeU =c("YeU","Other"))

Lobith\_YeU\_Year1961.2010

Lobith\_YeU\_Xsq\_Year1961.2010 <- chisq.test(Lobith\_YeU\_Year1961.2010[2,1:2], p = Lobith\_YeU\_Year1961.2010[1,1:2]/sum(Lobith\_YeU\_Year1961.2010[1,1:2]), correct = FALSE)

Lobith\_YeU\_Xsq\_Year1961.2010

# 1962 -> 2010 -----

Lobith\_YeU\_Year1962.2010 <- rbind(Lobith\_YeU[3,],Lobith\_YeU[4,])

dimnames(Lobith\_YeU\_Year1962.2010) <- list(Year = c("1962","2010"), YeU =c("YeU","Other"))

Lobith\_YeU\_Year1962.2010

Lobith\_YeU\_Xsq\_Year1962.2010 <- chisq.test(Lobith\_YeU\_Year1962.2010[2,1:2], p = Lobith\_YeU\_Year1962.2010[1,1:2]/sum(Lobith\_YeU\_Year1962.2010[1,1:2]), correct = FALSE)

Lobith\_YeU\_Xsq\_Year1962.2010

for (obj in objects(pattern = "Xsq")){

 print(obj)

 print(paste("statistic = ", round(get(obj)$statistic,3), ",", "d.f.=",(get(obj)$parameter), "p =", round(get(obj)$p.value,3)))

 print(round(get(obj)$residuals),3)

 print(round(get(obj)$stdres)\*(get(obj)$stdres),3)

 print(round(1-pchisq(((get(obj)$stdres)\*(get(obj)$stdres)),get(obj)$parameter),3))

 print(round(1-pchisq(((get(obj)$stdres)\*(get(obj)$stdres)),get(obj)$parameter),3) <= (0.05/(get(obj)$parameter+1)))

 print("--------------------")

}

###graphs

library(ggplot2)

library(plyr)

library(RColorBrewer)

Allemansgeest\_YeU <- data.frame(Allemansgeest\_YeU)

Ayeuprop <- ddply(Allemansgeest\_YeU, "Year", transform, prop.freq=Freq/sum(Freq)\*100)

Ayeuprop <- ddply(Ayeuprop, "Year", transform, label\_y=cumsum(prop.freq))

Lobith\_YeU <- data.frame(Lobith\_YeU)

Lyeuprop <- ddply(Lobith\_YeU, "Year", transform, prop.freq=Freq/sum(Freq)\*100)

Lyeuprop <- ddply(Lyeuprop, "Year", transform, label\_y=cumsum(prop.freq))

Empe\_YeU <- data.frame(Empe\_YeU)

Eyeuprop <- ddply(Empe\_YeU, "Year", transform, prop.freq=Freq/sum(Freq)\*100)

Eyeuprop <- ddply(Eyeuprop, "Year", transform, label\_y=cumsum(prop.freq))

#numbers plot

ggplot(Allemansgeest\_colour, aes(x=Year, y=Freq,fill=YeU))+

 geom\_bar(stat="identity")

#proportion plot

ggplot(Ayeuprop, aes(x=Year, y=prop.freq,fill=YeU))+ geom\_bar(stat="identity")+theme\_bw()+theme(panel.grid.major = element\_blank(),panel.grid.minor = element\_blank())+

 scale\_fill\_manual(values=c("goldenrod1","#bdbdbd")) + guides(fill=guide\_legend(reverse=TRUE))+

 ylab("Proportion (%)")+ scale\_y\_continuous(breaks=c(0,25,50,75,100))+

 ggtitle("Allemansgeest")+geom\_text(aes(y=label\_y,label=Freq), vjust=c(1.5), colour="black")+

 annotate("text", x=3, y=114, label="")+

 #annotate("segment", x=2, xend=3, y=102, yend=102,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("segment", x=1, xend=2, y=105, yend=105,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("segment", x=1, xend=3, y=108, yend=108,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("text", x=1.5, y=106, label="\*\*\*", size=7)+

 annotate("text", x=2, y=109, label="\*\*\*", size=7)

ggplot(Lyeuprop, aes(x=Year, y=prop.freq,fill=YeU))+ geom\_bar(stat="identity")+theme\_bw()+theme(panel.grid.major = element\_blank(),panel.grid.minor = element\_blank())+

 scale\_fill\_manual(values=c("goldenrod1","#bdbdbd"))+ guides(fill=guide\_legend(reverse=TRUE))+

 ylab("Proportion (%)")+ scale\_y\_continuous(breaks=c(0,25,50,75,100))+

 ggtitle("Lobith")+

 annotate("text", x=3, y=114, label="")+ geom\_text(aes(y=label\_y,label=Freq), vjust=c(1.5), colour="black")+

 annotate("segment", x=2, xend=3, y=103, yend=103,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("segment", x=1, xend=2, y=106, yend=106,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("segment", x=3, xend=4, y=106, yend=106,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("segment", x=1, xend=3, y=108, yend=108,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("segment", x=2, xend=4, y=111, yend=111,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("segment", x=1, xend=4, y=115, yend=115,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 annotate("text", x=1.5, y=107, label="\*", size=7)+

 annotate("text", x=2.5, y=116, label="\*", size=7)+

 annotate("text", x=2.5, y=104, label="\*\*\*", size=7)+

 annotate("text", x=3, y=112, label="\*\*\*", size=7)+

 #annotate("text", x=3.5, y=107, label="\*\*\*", size=7)+

 annotate("text", x=2, y=109, label="\*\*\*", size=7)

ggplot(Eyeuprop, aes(x=Year, y=prop.freq,fill=YeU))+ geom\_bar(stat="identity")+theme\_bw()+theme(panel.grid.major = element\_blank(),panel.grid.minor = element\_blank())+

 scale\_fill\_manual(values=c("goldenrod1","#bdbdbd"))+ guides(fill=guide\_legend(reverse=TRUE))+

 ylab("Proportion (%)")+scale\_y\_continuous(breaks=c(0,25,50,75,100))+

 ggtitle("Empe")+ geom\_text(aes(y=label\_y,label=Freq), vjust=c(1.5), colour="black")+

 annotate("text", x=3, y=114, label="")+

 annotate("segment", x=1, xend=2, y=105, yend=105,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("segment", x=1, xend=2, y=107, yend=107,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("segment", x=1, xend=3, y=108, yend=108,arrow=arrow(ends="both", angle=90, length=unit(.1,"cm")))+

 #annotate("text", x=1.5, y=108, label="\*\*\*", size=7)+

 annotate("text", x=1.5, y=106, label="\*", size=7)