Kiel_Brunner_Poster_WIP

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```
library(rvest)
library(dplyr)
library(ggplot2)
library(RColorBrewer)
library(RSQLite)
library(sqldf)
library(alluvial)
library(rgdal)
library(sp)
#install.packages("digest")
```

Work in Progress Report

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IST719-0108

The data consists of more than sixty thousand records of the import or export of of species tracked by the Convention on International Trade in Endangered Species of Wild Fauna and Flora or CITES. The data is collected by nearly all UN participating countries on 29000 plant species and 5000 animal species to adhere to limits placed on the trade of these species.

This data does not include the black market trade of species too endangered to be legally traded but about 10 percent of the records in this 2016 data set include those species deemed by scientist to necessitate being highly protected. I know firsthand from my grandfather who breed endangered birds and returned breeding pairs back into the wild that some of the trade of these species may be altruistic but it is also possible that analysis of this data will find that more likely the goal of trade is for commercial purposes that do not help propagate the species back to sustainable levels.

There is a great deal of interest in the maintaining our fragile balance within healthy ecosystems. The impact of a balanced ecosystem can be illustrated by the reintroduction of wolves to Yellowstone, a process that started with managing the deer populations and lead to cleaner water after vegitation was allowed to return to normal levels and filtered the streams. Monitoring those balances is critical to direct inhabitants of these ecosystems and those that live the communites they affect.

```
species_trade <- read.csv(file = paste0("species_trade.csv")
                  , header = TRUE
                  , stringsAsFactors = FALSE)
species_trade <- species_trade %>%
  mutate_if(is.double, as.integer)
```

```
#species_trade

#is.na(species_trade$Class)
```

```
species_trade$Exporter.reported.quantity[is.na(species_trade$Exporter.reported.quantity)] = 1
species_trade$Importer.reported.quantity[is.na(species_trade$Importer.reported.quantity)] = 1

species_trade$exp_quantity <- ifelse(species_trade$Unit %in% c("kg", "L", "l"), species_trade$Exporter.
species_trade$imp_quantity <- ifelse(species_trade$Unit %in% c("kg", "L", "l"), species_trade$Importer.
species_trade <- species_trade %>%
  mutate_if(is.double, as.integer)
```

```
Purposefunc <- function(Purpose){
  if (Purpose == "B") {
    return("Breeding")
  }
  if (Purpose == "E") {
    return("Educational")
  }
  if (Purpose == "G") {
    return("Garden")
  }
  if (Purpose == "H") {
    return("Hunting")
  }
  if (Purpose == "L") {
    return("Law")
  }
  if (Purpose == "M") {
    return("Medical")
  }
  if (Purpose == "R") {
    return("Reintroduction to Wild")
  }
  if (Purpose == "P") {
    return("Personal")
  }
  if (Purpose == "Q") {
    return("Circus")
  }
  if (Purpose == "T") {
    return("Commercial")
  }
  if (Purpose == "S") {
    return("Scientific")
  }
  if (Purpose == "Z") {
    return("Zoo")
  }
  {
    return ("Unknown")
  }
}
species_trade$Purpose_full <- sapply(species_trade$Purpose, Purposefunc)
```

```
sqldf::sqldf("SELECT Purpose_full, COUNT(Purpose_full) FROM species_trade GROUP BY Purpose_full")
```

```
##    Purpose_full COUNT(Purpose_full)
## 1      Breeding                 384
## 2        Circus                1054
## 3    Commercial               47081
## 4   Educational                 323
## 5        Garden                  91
## 6       Hunting                2145
## 7           Law                  90
## 8       Medical                 867
## 9      Personal                5859
## 10   Scientific                2382
## 11      Unknown                6109
## 12          Zoo                 776
```

```
webpage <- read_html("https://www.iban.com/country-codes")

tbls <- html_nodes(webpage, "table")
country_code <- webpage %>%
        html_nodes("table") %>%
        .[] %>%
        html_table(fill = TRUE,header = TRUE)

country_code <- data.frame(country_code)

importer_join <- country_code %>%
  select(Alpha.2.code, Country) %>%
  add_row(Alpha.2.code = "XV", Country = "Various") %>%
  rename(Importer = Alpha.2.code, Importer_country = Country)

exporter_join <- country_code %>%
  select(Alpha.2.code, Country) %>%
  add_row(Alpha.2.code = "XV", Country = "Various") %>%
  rename(Exporter = Alpha.2.code, Exporter_country = Country)

origin_join <- country_code %>%
  select(Alpha.2.code, Country) %>%
  add_row(Alpha.2.code = "XV", Country = "Various") %>%
  rename(Origin = Alpha.2.code, Origin_country = Country)

species_trade <- left_join(species_trade, importer_join, by = 'Importer')
species_trade <- left_join(species_trade, exporter_join, by = 'Exporter')
species_trade <- left_join(species_trade, origin_join, by = 'Origin')
#species_trade
```

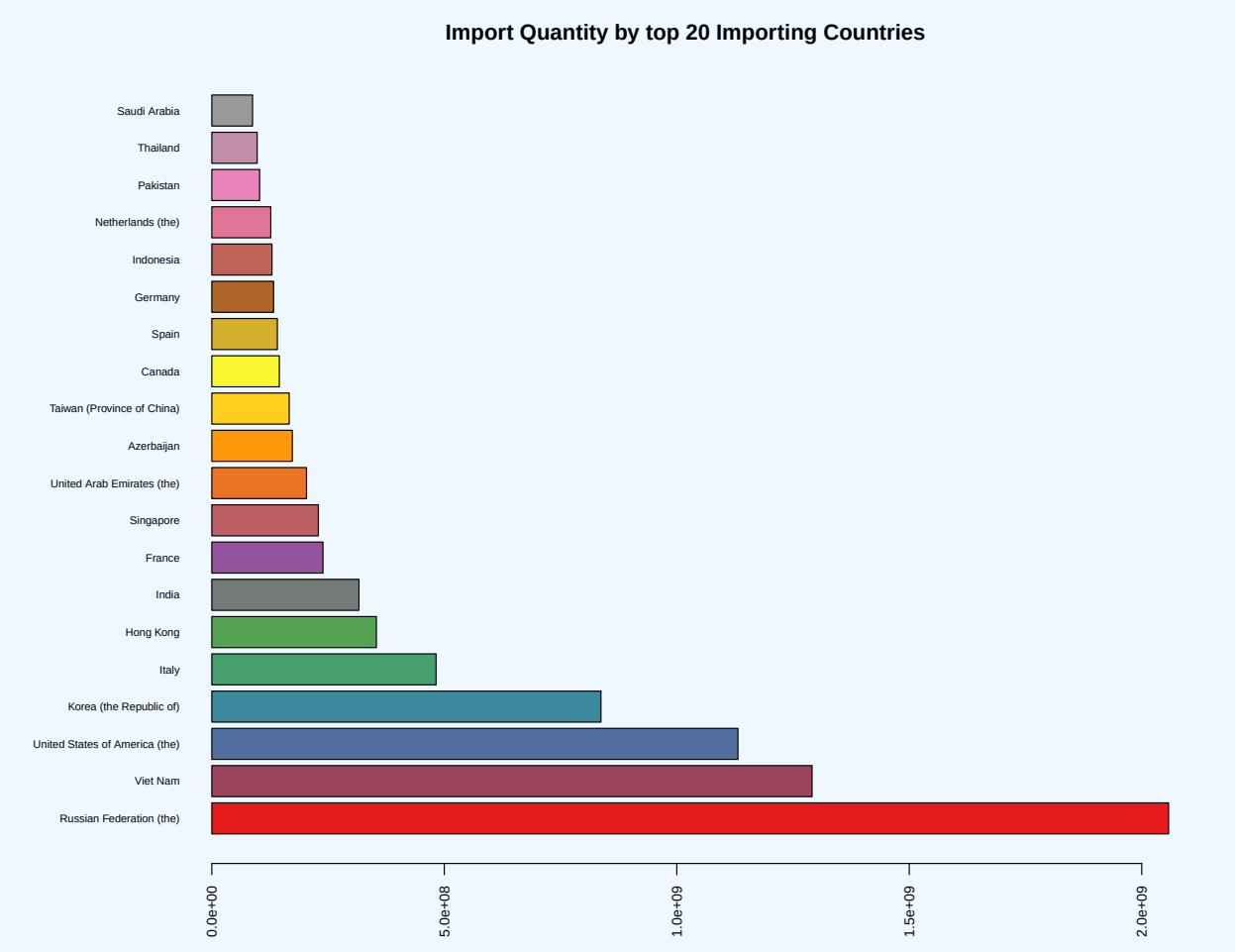
```
#summary(species_trade)
#sqldf::sqldf("SELECT Taxon, COUNT(Taxon) FROM species_trade GROUP BY Taxon")
sqldf::sqldf("SELECT Class, COUNT(Class) FROM species_trade GROUP BY Class")
```

```
##             Class COUNT(Class)
## 1                         20224
## 2     Actinopteri          2759
## 3        Amphibia           420
```

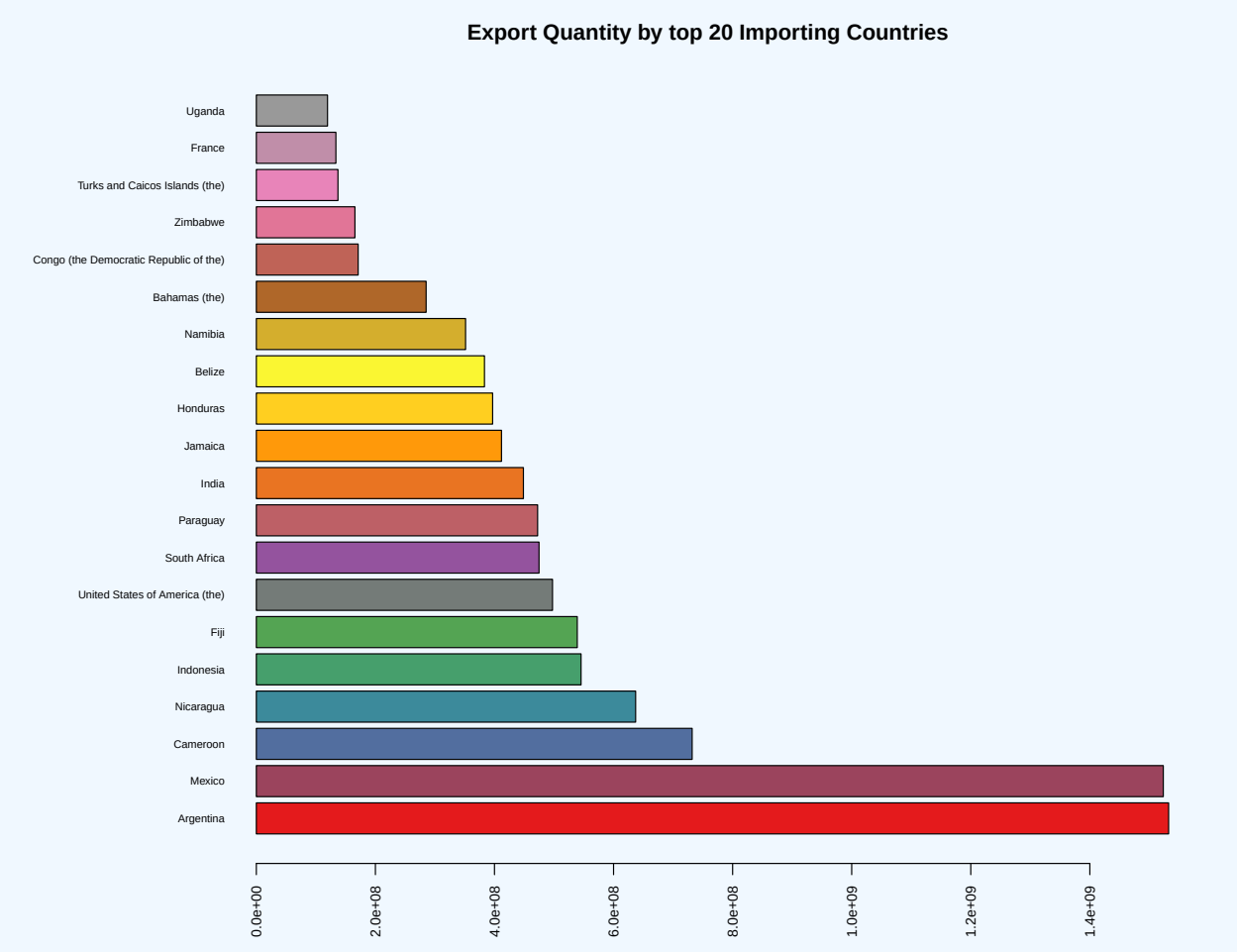
```
## 4        Anthozoa         8781
## 5       Arachnida           67
## 6            Aves         6861
## 7        Bivalvia          269
## 8     Coelacanthi            2
## 9       Dipneusti            4
## 10 Elasmobranchii          113
## 11     Gastropoda          191
## 12   Hirudinoidea           34
## 13  Holothuroidea           10
## 14       Hydrozoa          181
## 15        Insecta          310
## 16       Mammalia         8505
## 17       Reptilia        18430
```

```
#sqldf::sqldf("SELECT Order, COUNT(Order) FROM species_trade GROUP BY Order")
#sqldf::sqldf("SELECT Family, COUNT(Family) FROM species_trade GROUP BY Family")
#sqldf::sqldf("SELECT Genus, COUNT(Genus) FROM species_trade GROUP BY Genus")
```

```
par(mar=c(4,9,3,3), bg="aliceblue")
imp_expdf <- aggregate(species_trade$exp_quantity,list(species_trade$Importer_country),sum)

imp_expdf <- imp_expdf %>%
  arrange(desc(imp_expdf$x)) %>%
  mutate_if(is.double, as.integer) %>%
  top_n(20) %>%
  rename('Import Quantity' = x, Country = 'Group.1')

colourCount = length(unique(imp_expdf$Country))
getPalette = colorRampPalette(brewer.pal(20, "Set1"))

barplot(imp_expdf$`Import Quantity`,names=imp_expdf$Country, main = 'Import Quantity by top 20 Importin
```




```r
par(mar=c(4,11,3,3), bg="aliceblue")
exp_impdf <- aggregate(species_trade$imp_quantity,list(species_trade$Exporter_country),sum)

exp_impdf <- exp_impdf %>%
  arrange(desc(exp_impdf$x)) %>%
  mutate_if(is.double, as.integer) %>%
  top_n(20) %>%
  rename('Export Quantity' = x, Country = 'Group.1')

colourCount = length(unique(exp_impdf$Country))
getPalette = colorRampPalette(brewer.pal(20, "Set1"))

barplot(exp_impdf$`Export Quantity`,names=exp_impdf$Country, main = 'Export Quantity by top 20 Importing
```



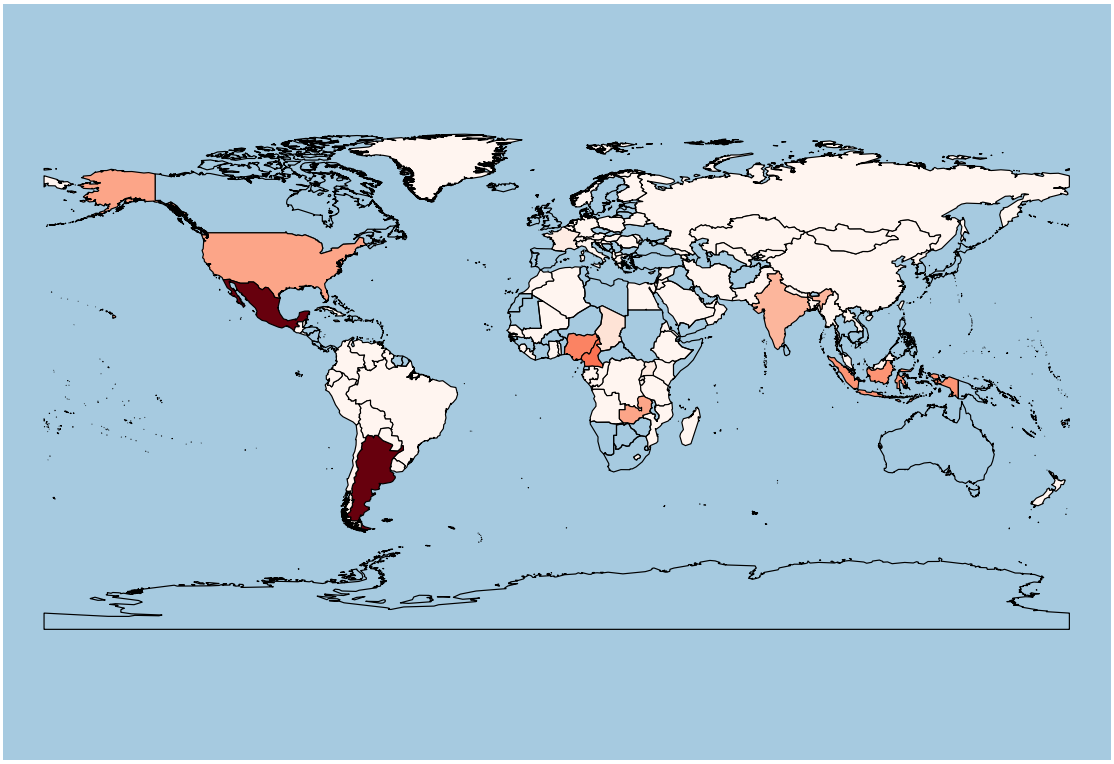

```
download.file("http://thematicmapping.org/downloads/TM_WORLD_BORDERS_SIMPL-0.3.zip" , destfile="world_sh

system("unzip world_shape_file.zip")
```

```
## [1] 127
```

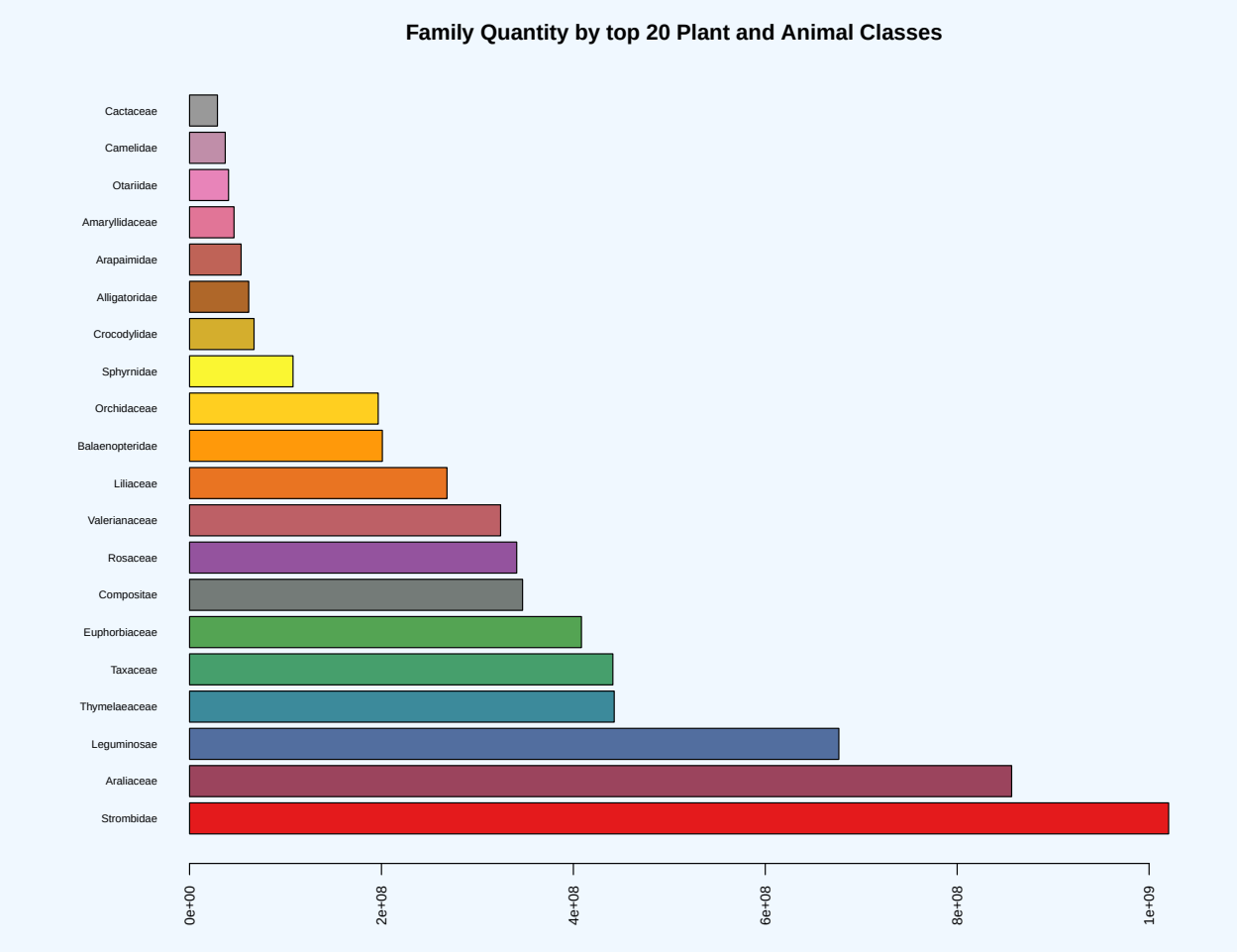
```
my_spdf <- readOGR(dsn = "world_shape_file",
                   layer="TM_WORLD_BORDERS_SIMPL-0.3",verbose=FALSE)



exp_imp_plot_df <- aggregate(species_trade$imp_quantity,list(species_trade$Exporter),sum)
colnames(exp_imp_plot_df) <- c("FIPS","Export Quantity")

my_spdf_merge <- merge(my_spdf, exp_imp_plot_df, by="FIPS" )

my_colors <- brewer.pal(9, "Reds")
my_colors <- colorRampPalette(my_colors)(20)
exp_by_country <- cut(my_spdf_merge@data$`Export Quantity`, 20)
my_colors <- my_colors[as.numeric(exp_by_country)]

plot(my_spdf_merge
     #, xlim=c(-20,60)
     #, ylim=c(-40,40)
```

```
    , col=my_colors ,  bg = "#A6CAE0"
    #, legend =
    , main = "Map of the World by Top Exporters"
    )
```

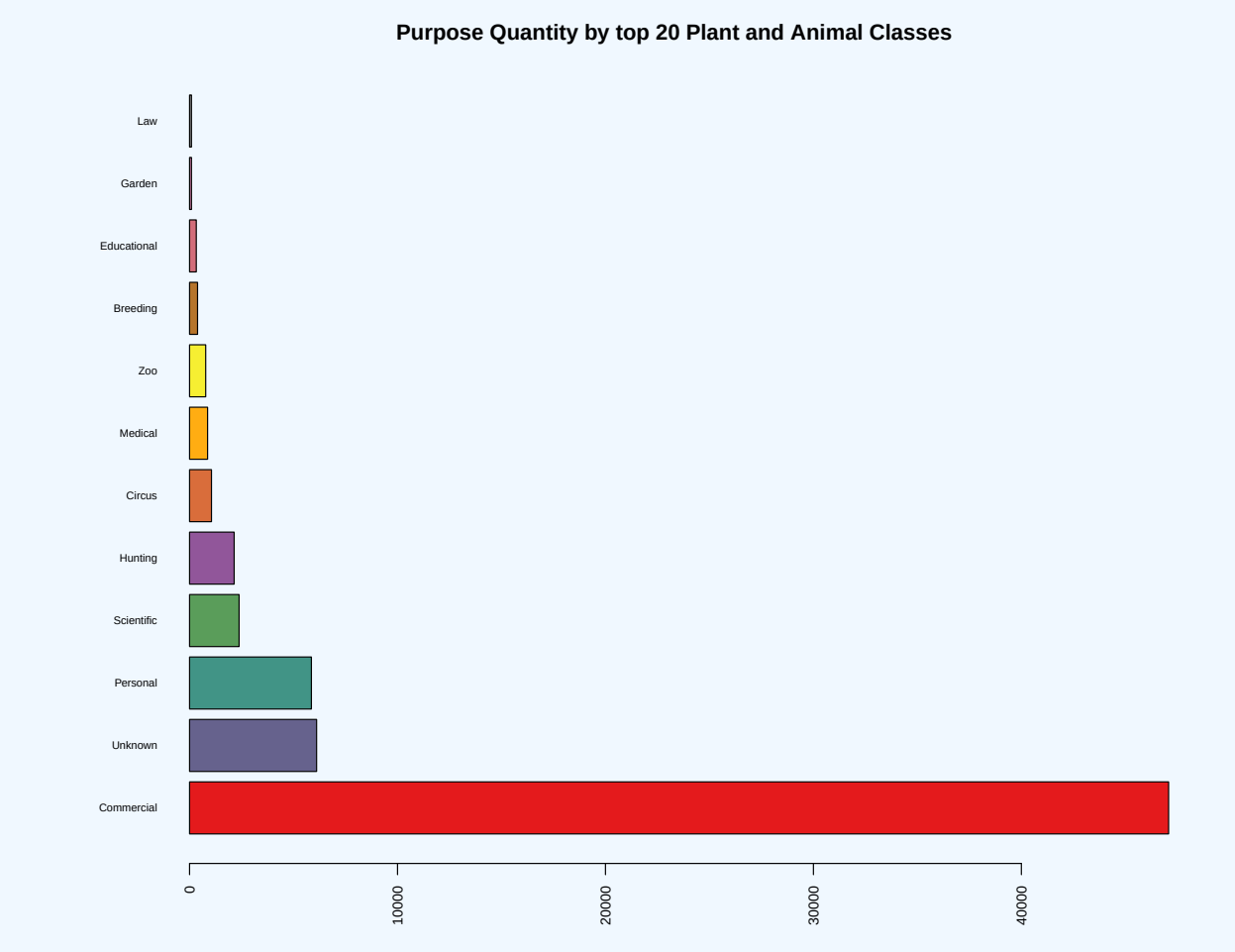
Map of the World by Top Exporters



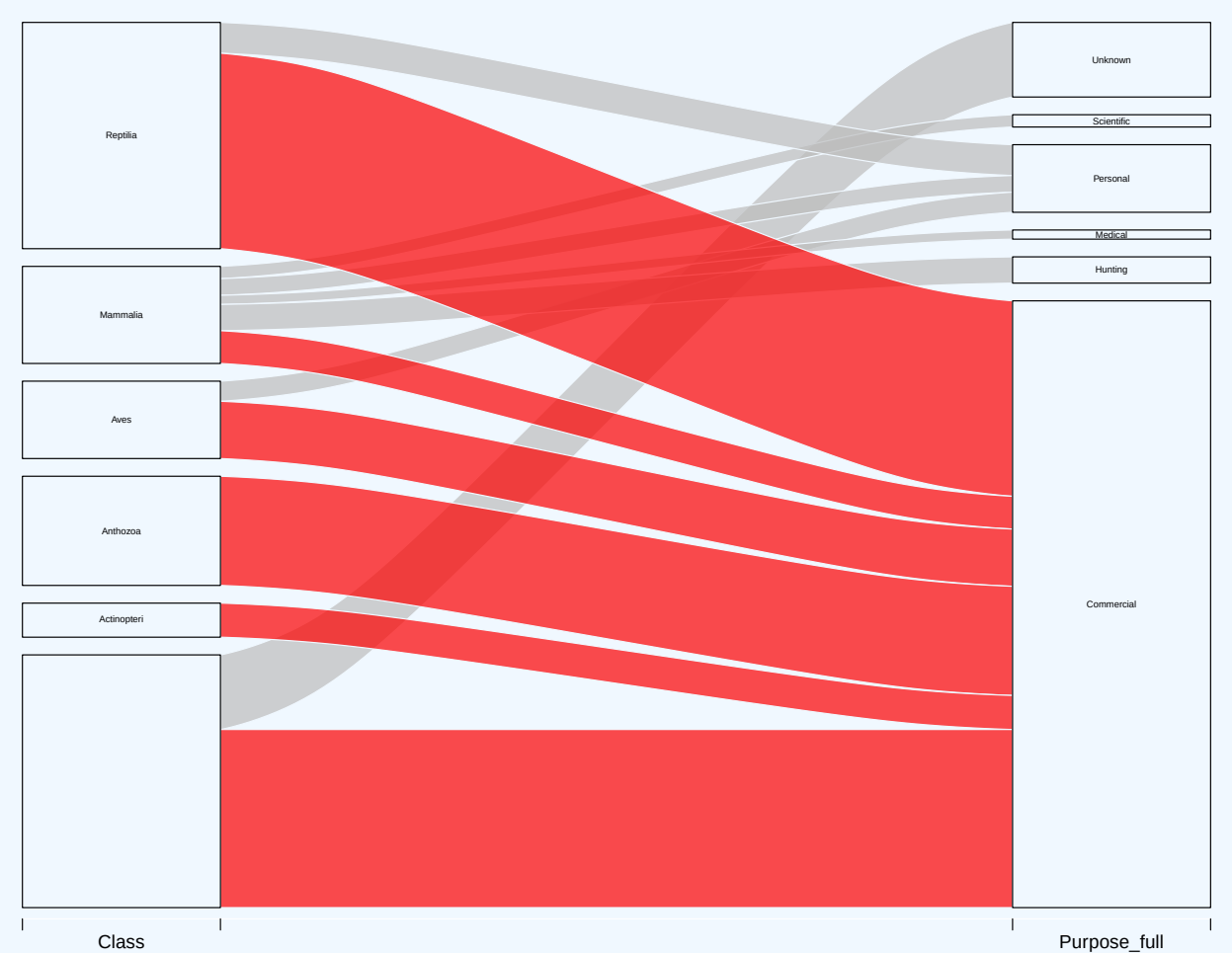
```
par(mar=c(4,8,3,3), bg="aliceblue")
familydf <- aggregate(species_trade$exp_quantity, list(species_trade$Family), sum)

familydf <- familydf %>%
  arrange(desc(familydf$x)) %>%
  mutate_if(is.double, as.integer) %>%
  top_n(20) %>%
  rename('Family Quantity' = x, Family = 'Group.1')

colourCount = length(unique(familydf$Family))
getPalette = colorRampPalette(brewer.pal(20, "Set1"))

barplot(familydf$`Family Quantity`,names=familydf$Family, main = 'Family Quantity by top 20 Plant and A
```




```
par(mar=c(4,8,3,3), bg="aliceblue")
purposedf <- aggregate(species_trade$exp_quantity, list(species_trade$Purpose_full), length)

purposedf <- purposedf %>%
  arrange(desc(purposedf$x)) %>%
  mutate_if(is.double, as.integer) %>%
  rename('Purpose Quantity' = x, Purpose = 'Group.1')

colourCount = length(unique(purposedf$Purpose))
getPalette = colorRampPalette(brewer.pal(12, "Set1"))

barplot(purposedf$`Purpose Quantity`,names=purposedf$Purpose, main = 'Purpose Quantity by top 20 Plant a
```




```
par(mar=c(4,8,3,3), bg="aliceblue")
alluv_df <- aggregate(species_trade$exp_quantity
                      , list(species_trade$Class
                      , species_trade$Purpose_full)
                      , length)
colnames(alluv_df) <- c("Class","Purpose_full", "exp_quantity")

alluv_df <- alluv_df %>%
  mutate_if(is.double, as.integer) %>%
  filter(alluv_df$exp_quantity > 500)


alluvial(alluv_df[, 1:2], freq = alluv_df$exp_quantity
         , alpha = .7
         , cw = .1
         , gap.width = .1
         , cex = .5
         , col = ifelse(alluv_df$Purpose_full == "Commercial", "red","grey")
         #, hide=alluv.df$exp_quantity < 500
         )
```


Reptilia
Mammalia
Aves
Anthozoa
Actinopteri
Unknown
Scientific
Personal
Medical
Hunting
Commercial
Class
Purpose_full