Cantones sin IC

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Paquetes

```
library(keras) # for deep learning
library(tidyverse) # general utility functions
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --

## v ggplot2 3.3.6     v purrr   0.3.4
## v tibble  3.1.6     v dplyr   1.0.9
## v tidyr   1.2.0     v stringr 1.4.0
## v readr   2.1.2     v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(caret) # machine learning utility functions
```

```
## Loading required package: lattice

##
## Attaching package: 'caret'

## The following object is masked from 'package:purrr':
##
##     lift
```

```
library(tibble)
library(readr)
library(ggplot2)
library(tensorflow)
```

```
##
## Attaching package: 'tensorflow'

## The following object is masked from 'package:caret':
##
##     train
```

```
library(neuralnet)
```

```
##
## Attaching package: 'neuralnet'
```

```
## The following object is masked from 'package:dplyr':
##
##     compute
```

Datos

```
load("C:/Users/usuario1/Desktop/CIMPA/Github_CIMPA/PRACTICA_CIMPA/base_cantones.RData")


basecanton = basecanton  %>%

  dplyr::select(Canton, Year,Month,Nino12SSTA, Nino3SSTA, Nino4SSTA,Nino34SSTA,Nino34SSTA1, Nino34SSTA2

  arrange(Canton,Year,Month) %>% ungroup() %>% mutate(Month=as.numeric(Month))

#Funciones

normalize <- function(x) {
  return ((x - min(x)) / (max(x) - min(x)))
}

denorm <- function(x,base) {
  return (x*(max(base$RR) - min(base$RR))+min(base$RR))
}

metricas <- function(tabla){
  NRMSE <- mean((tabla$y_pred-tabla$RR)^2)/mean(tabla$RR)
  return(data.frame(NRMSE))
}




basecanton2 = basecanton %>% group_by(basecanton$Canton) %>%
  mutate_if(is.numeric, normalize)
```

```
## `mutate_if()` ignored the following grouping variables:
## * Column `basecanton$Canton`
```

```
basecanton2 = basecanton2[,-35]


#Train y test

data_train = as.data.frame(basecanton2) %>% filter(Year < 1)#PARA ENTRENAR HASTA 2018
```

```
data_test = as.data.frame(basecanton2) %>% filter(Year >= 1)

X_train = data_train[,-ncol(data_train)]
y_train = as.data.frame(data_train[,c("Canton","RR")])

X_test = as.data.frame(data_test[,-ncol(data_test)])
y_test = as.data.frame(data_test[,c("Canton","RR")])



Fecha = paste(basecanton$Year, basecanton$Month)
Fecha = Fecha[1:235]
```

Arquitectura del modelo

```
model <- keras_model_sequential()
```

```
## Loaded Tensorflow version 2.8.0
```

```
# our input layer
model %>%
  layer_simple_rnn(units = 100, input_shape = c(ncol(X_train)-1,1), activation='tanh',
                   kernel_initializer= initializer_constant(0.5),
                   bias_initializer=initializer_zeros()) %>%
  layer_dense(units = 50, activation = "relu")%>%
  layer_dense(units = 50, activation = "relu")%>%
  layer_dense(units = 50, activation = "relu")%>%
  layer_dropout(rate = 0.1)%>%
  layer_dense(units = 25, activation = "relu")%>%
  layer_dense(units = 25, activation = "relu")%>%
  layer_dense(units = 25, activation = "relu")%>%
  layer_dropout(rate = 0.1)%>%
  layer_dense(units = 12, activation = "relu")%>%
  layer_dense(units = 12, activation = "relu")%>%
  layer_dropout(rate = 0.1)%>%
  layer_dense(units = 6, activation = "relu")%>%
  layer_dense(units = 6, activation = "relu")%>%

  layer_dense(units = 1, activation = "sigmoid")
```

Entrenamiento y predicciones

```
Cantones = unique(basecanton$Canton)
Eval.pd = NULL
Eval.tot = NULL
```

```
p1 = list()
p2 = list()

df1 = list()
df2 = list()

Predicciones = matrix(NA, ncol = 2, nrow = 3*length(Cantones))
Index = seq(1,3*length(Cantones), 3)

for (i in 1:length(Cantones)) {

  X_trainc = X_train %>% filter(Canton == Cantones[i])
  X_trainc = as.matrix(X_trainc[,-1])
  y_trainc = y_train %>% filter(Canton == Cantones[i])
  y_trainc = as.matrix(y_trainc[,-1])

  X_testc = X_test %>% filter(Canton == Cantones[i])
  X_testc = as.matrix(X_testc[,-1])
  y_testc = y_test %>% filter(Canton == Cantones[i])
  y_testc = as.matrix(y_testc[,-1])

  X_all = basecanton2 %>% filter(Canton == Cantones[i])
  X_all = as.matrix(X_all[,-c(1,33)])


  base = as.data.frame(basecanton %>% filter(Canton == Cantones[i]) %>% dplyr::select(RR))



  model %>% compile(loss = "mse",
                    optimizer = optimizer_adam(lr = 0.0007),
                    metric = "mean_absolute_error")


  trained_model <- model %>% fit(
    x = X_trainc,
    y = y_trainc,
    batch_size = 18,
    epochs = 100,
    validation_split = 0.1,
    shuffle = F)


  predice = function(x) {
  y_values = (model %>% predict(x))
  result = (y_values*(max(base$RR) - min(base$RR))+min(base$RR))
  return (as.numeric(result))
  }



  Predicciones[Index[i]:(Index[i]+2),1:2] = cbind(Cantones[i], predice(X_testc))
```

```
  df1[[i]] = as.data.frame(cbind(predice(X_testc), y_testc, Fecha[233:235]))
  colnames(df1[[i]]) = c("y_pred", "RR", "Fecha")
  df1[[i]]$RR = as.numeric(df1[[i]]$RR)
  df1[[i]]$y_pred = as.numeric(df1[[i]]$y_pred)



  p1[[i]] = ggplot(df1[[i]], aes(x = Fecha, y = RR, group = 1)) + geom_line(colour = "blue") +
  geom_line( aes(x = Fecha, y = y_pred, colour = "red"))+
  theme(panel.grid.major = element_blank(), panel.grid.minor = element_blank(),
  panel.background = element_blank(), axis.text.x = element_text(angle = 45), legend.position = "none" )
  labs (x = "Fecha", y = "Riesgo Relativo") +
  ggtitle(paste("Predicciones 2021 del cantón", Cantones[i], sep = " "))

  Eval.pd[i] = as.numeric(metricas(df1[[i]]))


  #### VALORES APROXIMADOS ####

  ## Generar valores ajustados

  df2[[i]] = as.data.frame(cbind(predice(X_all), base$RR, Fecha))
  colnames(df2[[i]]) = c("y_pred", "RR", "Fecha")
  df2[[i]]$RR = as.numeric(df2[[i]]$RR)
  df2[[i]]$y_pred = as.numeric(df2[[i]]$y_pred)


  everyother1 <- function(x) x[(seq_along(Fecha) + 5)%%12 == 6]

  p2[[i]] = ggplot(df2[[i]], aes(x = Fecha, y = RR, group = 1)) + geom_line(colour = "blue") +
  geom_line(aes(x = Fecha, y = y_pred, colour = "red"))+
  theme(panel.grid.major = element_blank(), panel.grid.minor = element_blank(),
  panel.background = element_blank(), axis.text.x = element_text(angle = 45), legend.position = "none" )
  scale_x_discrete(breaks = everyother1) + labs (x = "Fecha", y = "Riesgo Relativo") +
  ggtitle(paste("Valores aproximados de training del cantón", Cantones[i], sep = " "))



  Eval.tot[i] = as.numeric(metricas(df2[[i]]))


  k_clear_session()
}
```

```
## Warning in backcompat_fix_rename_lr_to_learning_rate(...): the ‘lr‘ argument has
## been renamed to ‘learning_rate‘.

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```

Resultados de métricas

```
Metricas = cbind (Eval.pd, Eval.tot)
colnames(Metricas) = c("NMRSE 2021", "NMRSE total")
rownames(Metricas) = Cantones
as.data.frame(Metricas)
```

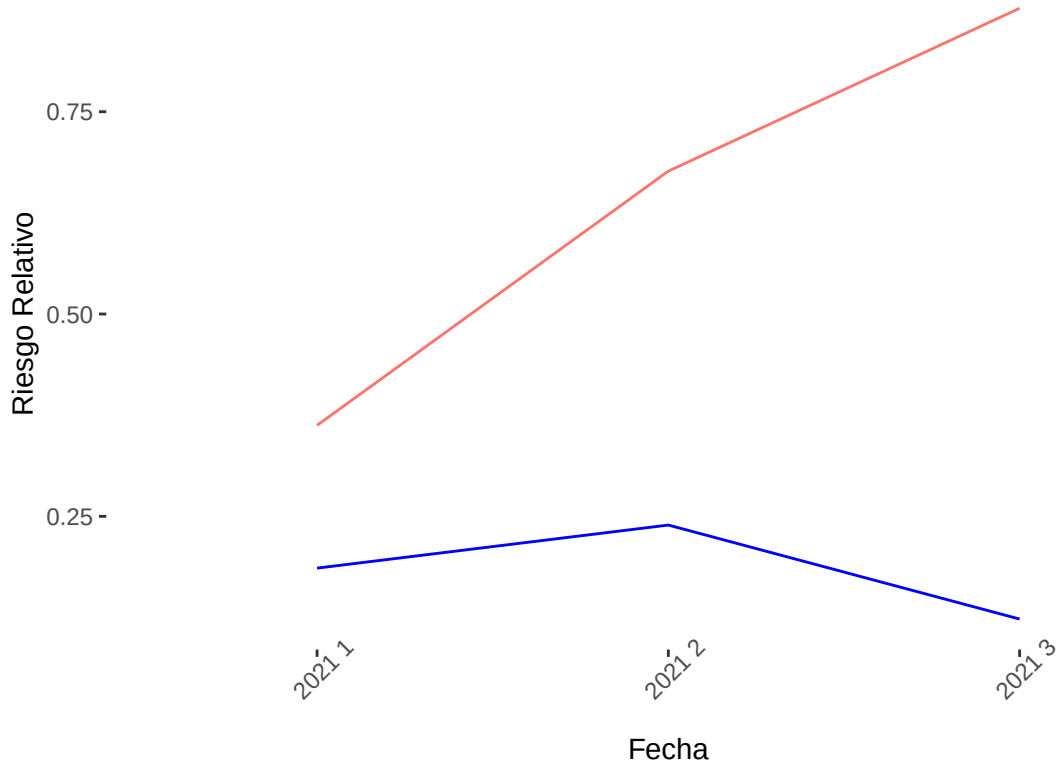
```
##                   NMRSE 2021 NMRSE total
## Alajuela           1.4446560  0.16663460
## Alajuelita         0.2047494  0.07196857
## Atenas             2.2815372  0.52214852
## Cañas            821.8338024  2.74762847
## Carrillo         692.4684731  2.38784369
## Corredores        78.4748838  0.71880550
## Desamparados       0.1310240  0.04601074
## Esparza          221.9349498  0.55024083
## Garabito        3700.0394719  2.49432232
## Golfito           80.1352735  1.12764540
## Guacimo          303.0959877  0.43839840
```

```
## La Cruz       1010.1042826  4.24121154
## Liberia         82.0557757  0.80820981
## Limon           48.6798393  0.37463552
## Matina         334.5840323  0.69806593
## Montes de Oro  622.6823104  2.29422619
## Nicoya         524.6406187  1.49309352
## Orotina         99.9195521  4.55660260
## Osa              6.6662544  0.61083310
## Parrita       2122.7292768  5.69426665
## Perez Zeledón    0.3282686  0.49367758
## Pococí          81.6122676  0.55843133
## Puntarenas     166.4292687  0.69336345
## Quepos        2901.4815820  3.37209411
## San Jose         0.7877130  0.04893541
## Santa Ana       13.7528285  0.43520149
## SantaCruz      435.5076798  2.20131794
## Sarapiquí      302.2053124  1.49076657
## Siquirres       98.7920736  0.52896842
## Talamanca      120.8983874  1.53538331
## Turrialba       44.3300019  1.26904355
## Upala                 Inf  0.29555310
```

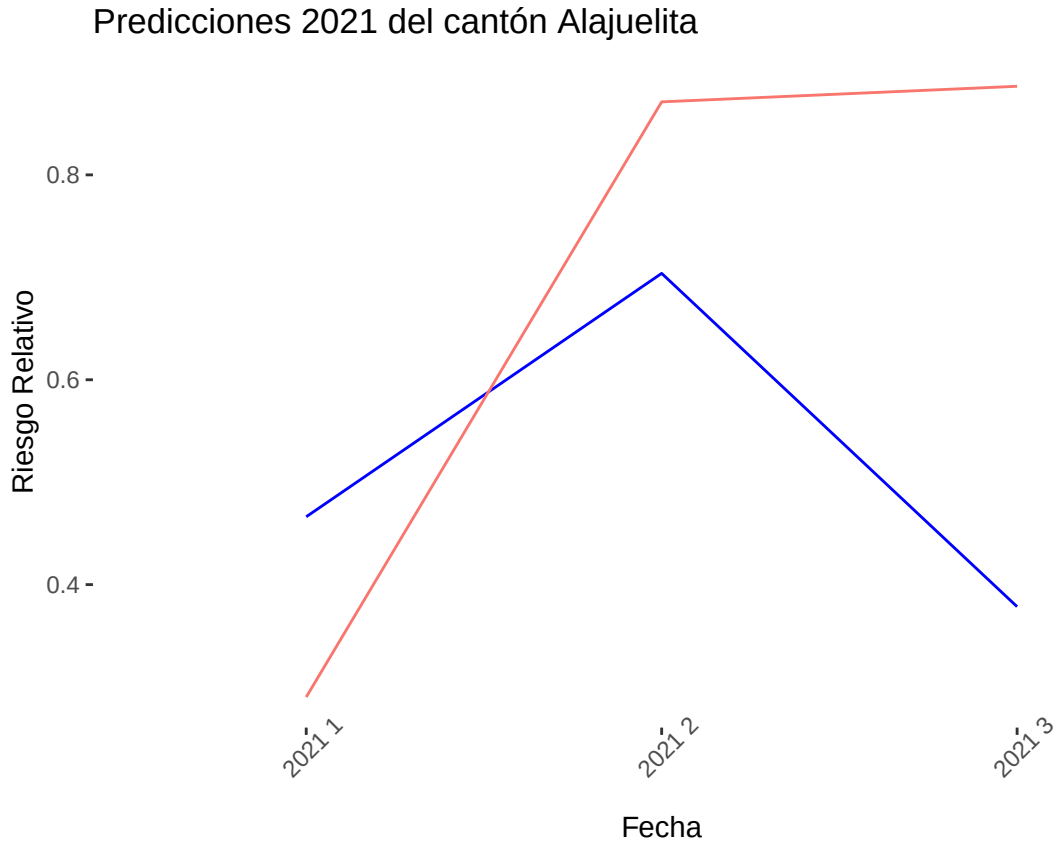
Gráficos

```
p1
```

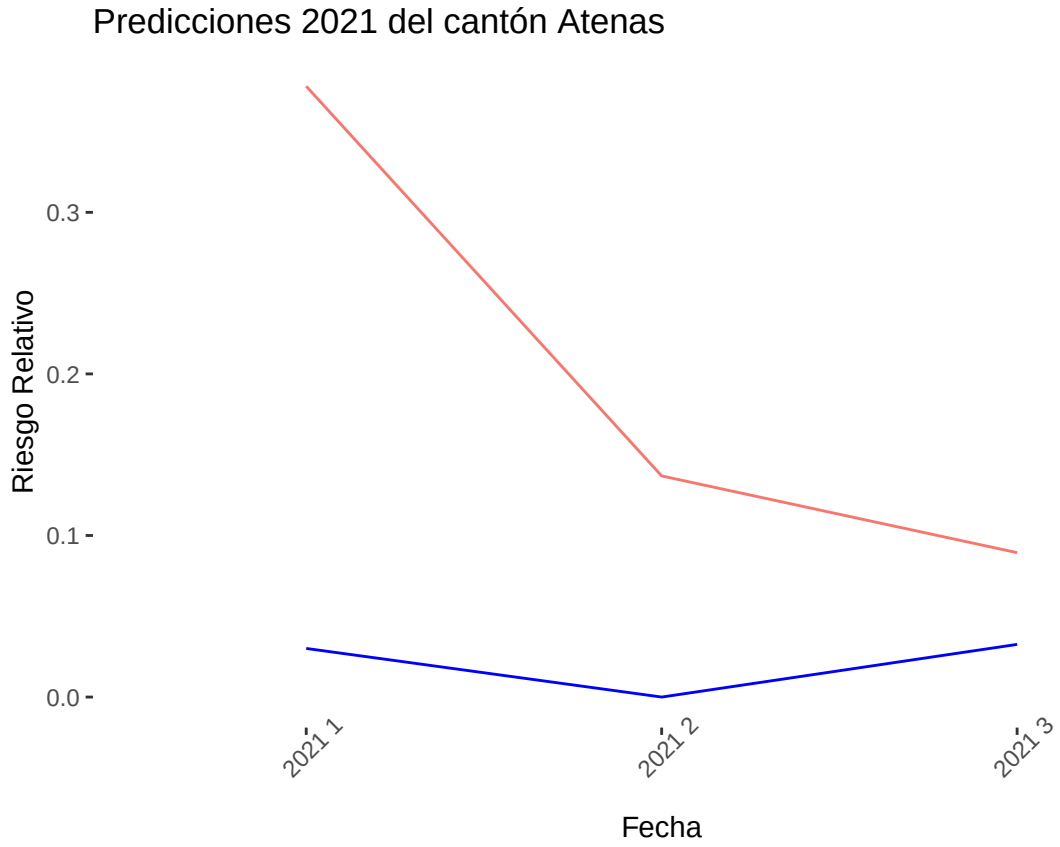
```
## [[1]]
```


Predicciones 2021 del cantón Alajuela
Riesgo Relativo
0.75
0.50
0.25
2021.1
2021.2
2021.3
Fecha

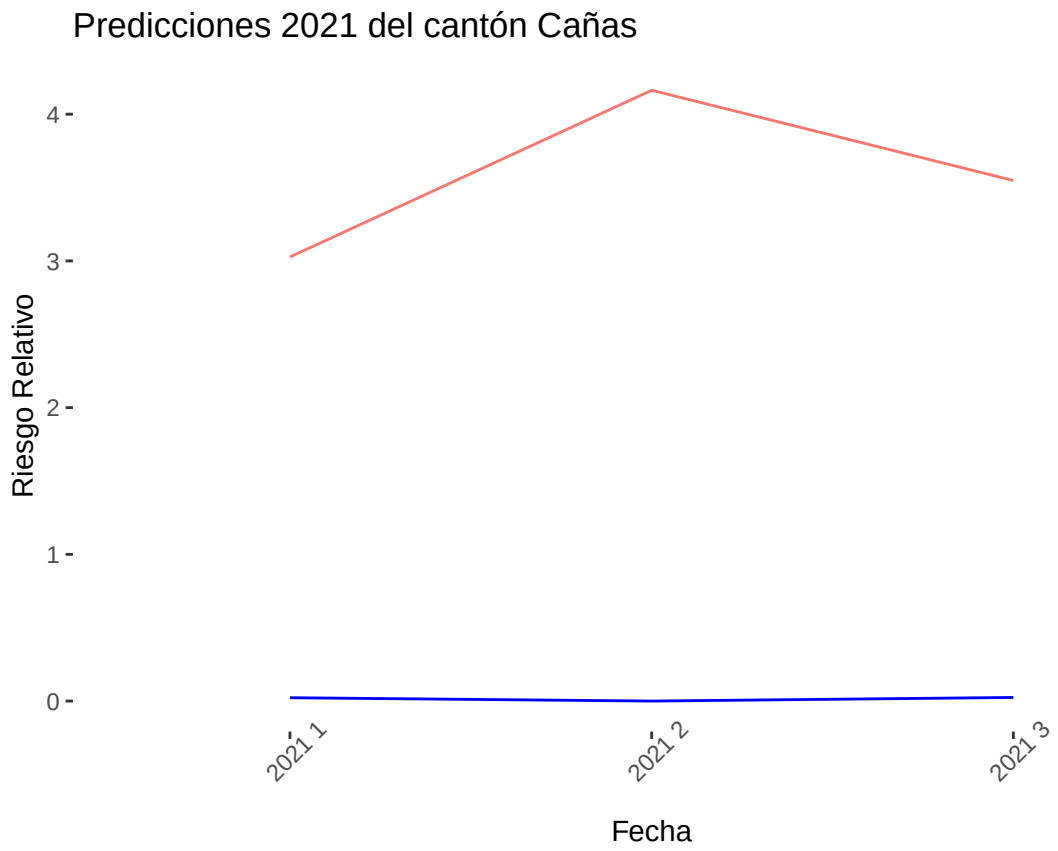
```
##
## [[2]]
```


Predicciones 2021 del cantón Alajuelita
Riesgo Relativo
0.8
0.6
0.4
2021-1
2021-2
2021-3
Fecha

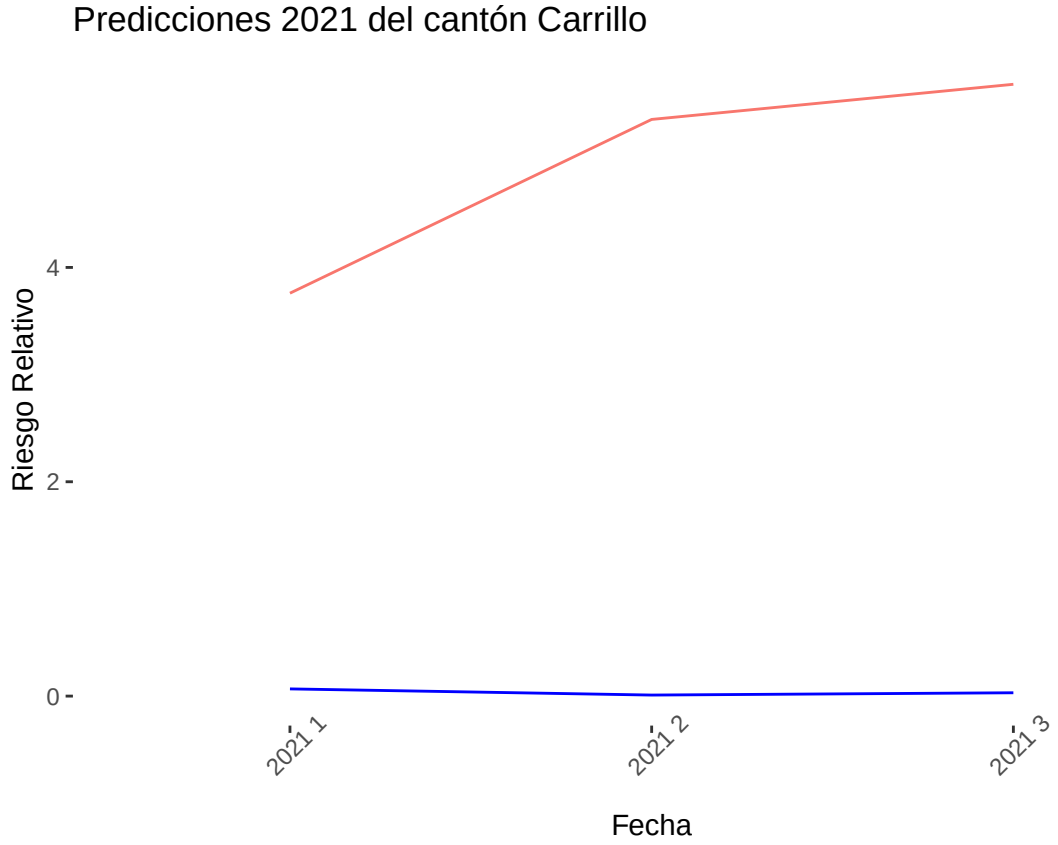
```
##
## [[3]]
```


Predicciones 2021 del cantón Atenas
Riesgo Relativo
0.3
0.2
0.1
0.0
2021-1
2021-2
2021-3
Fecha

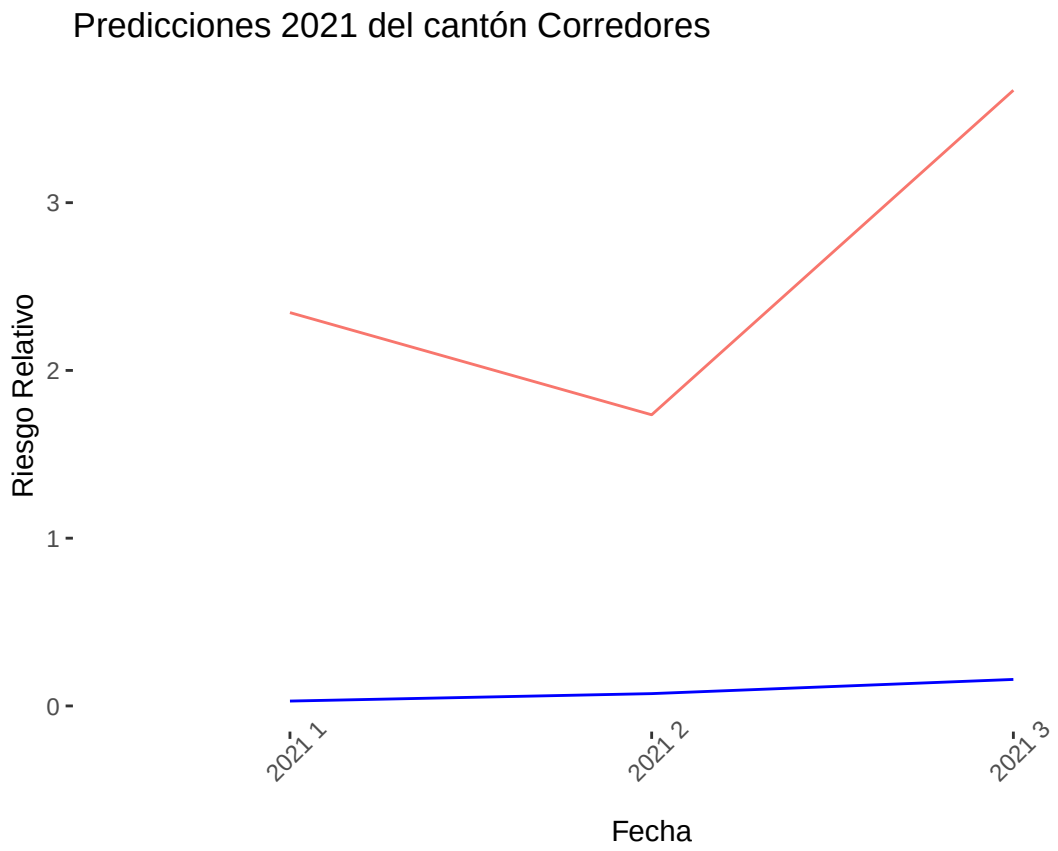
```
##
## [[4]]
```


Predicciones 2021 del cantón Cañas
Riesgo Relativo
4
3
2
1
0
2021 1
2021 2
2021 3
Fecha

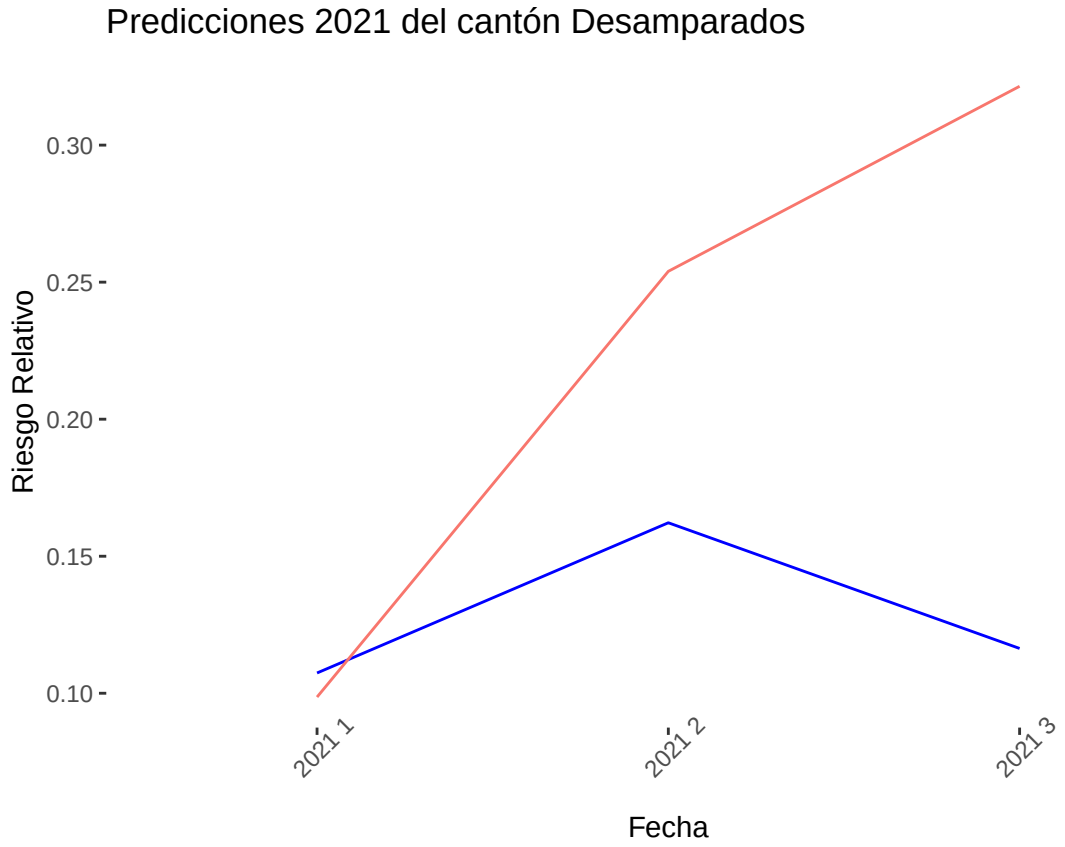
```
##
## [[5]]
```


Predicciones 2021 del cantón Carrillo
Riesgo Relativo
4
2
0
2021 1
2021 2
2021 3
Fecha

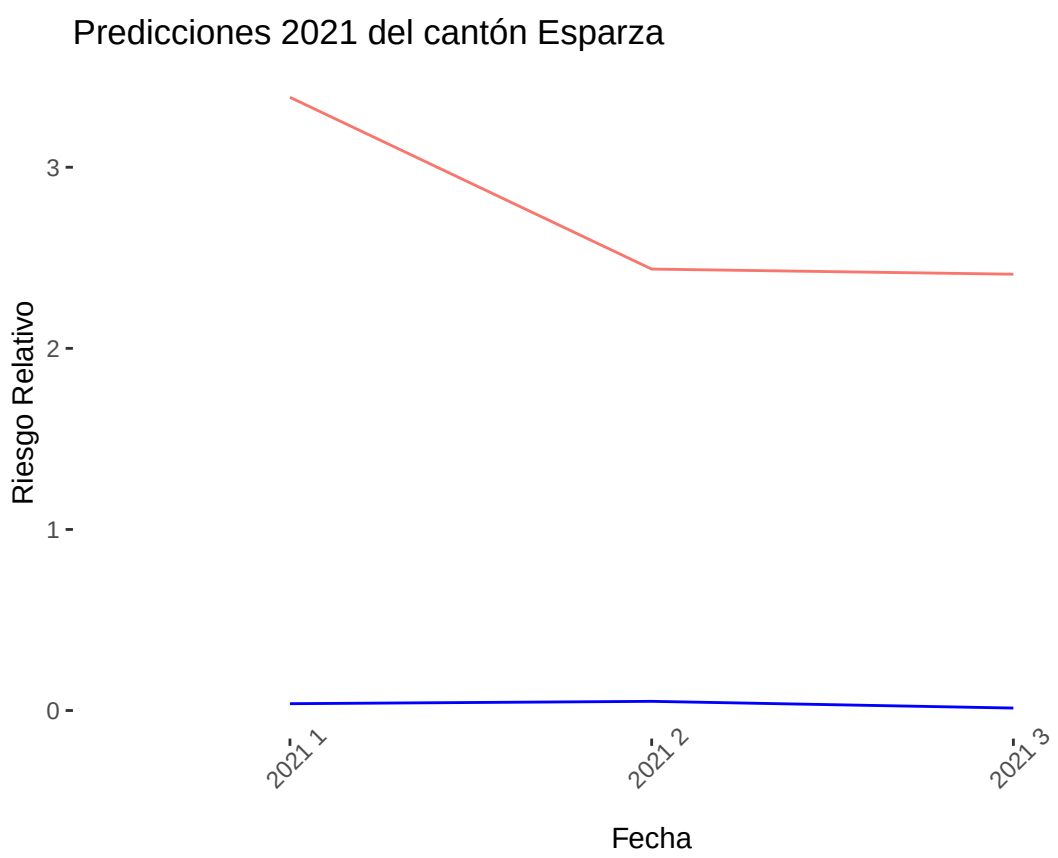
```
##
## [[6]]
```


Predicciones 2021 del cantón Corredores
Riesgo Relativo
3
2
1
0
2021-1
2021-2
2021-3
Fecha

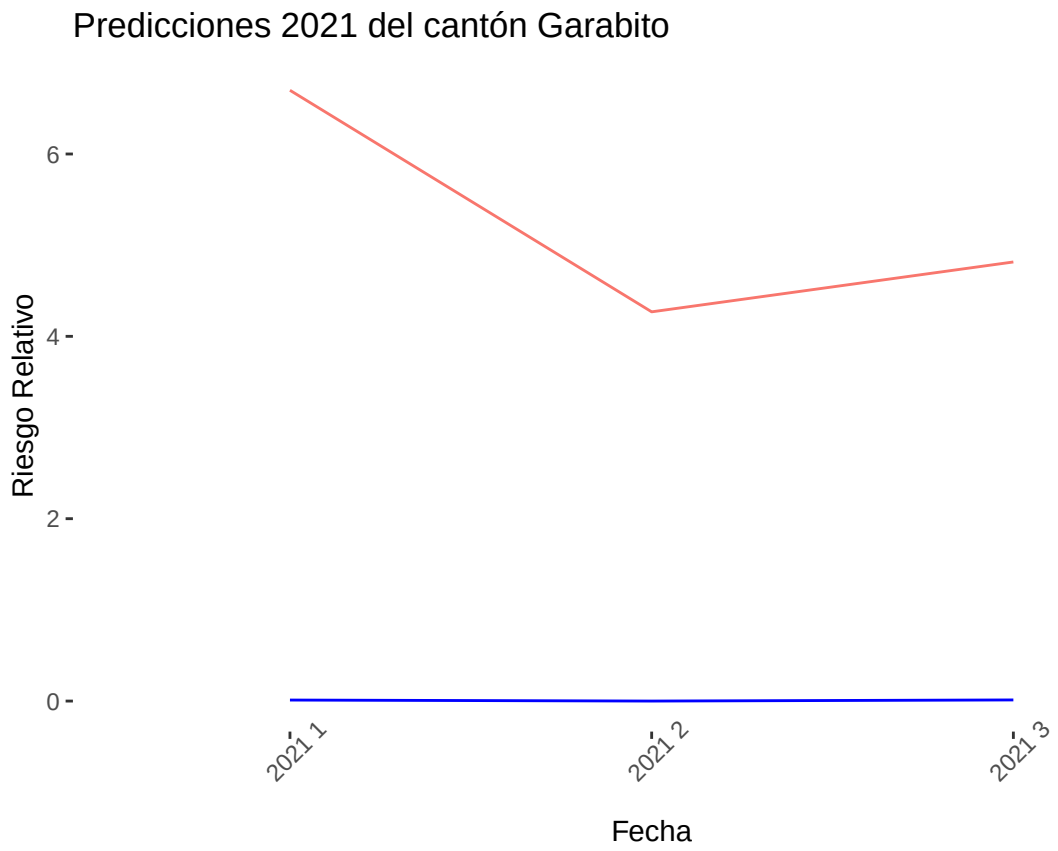
```
##
## [[7]]
```


Predicciones 2021 del cantón Desamparados
Riesgo Relativo
0.30
0.25
0.20
0.15
0.10
2021-1
2021-2
2021-3
Fecha

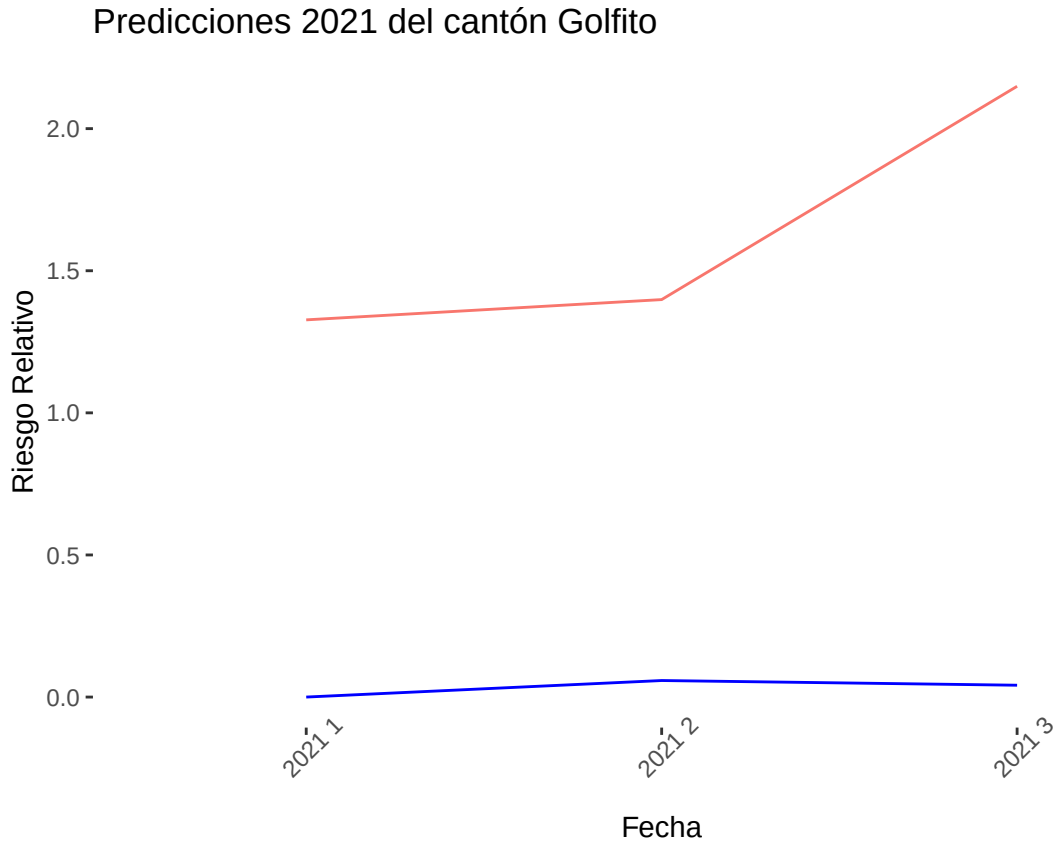
```
##
## [[8]]
```


Predicciones 2021 del cantón Esparza
Riesgo Relativo
3
2
1
0
2021 1
2021 2
2021 3
Fecha

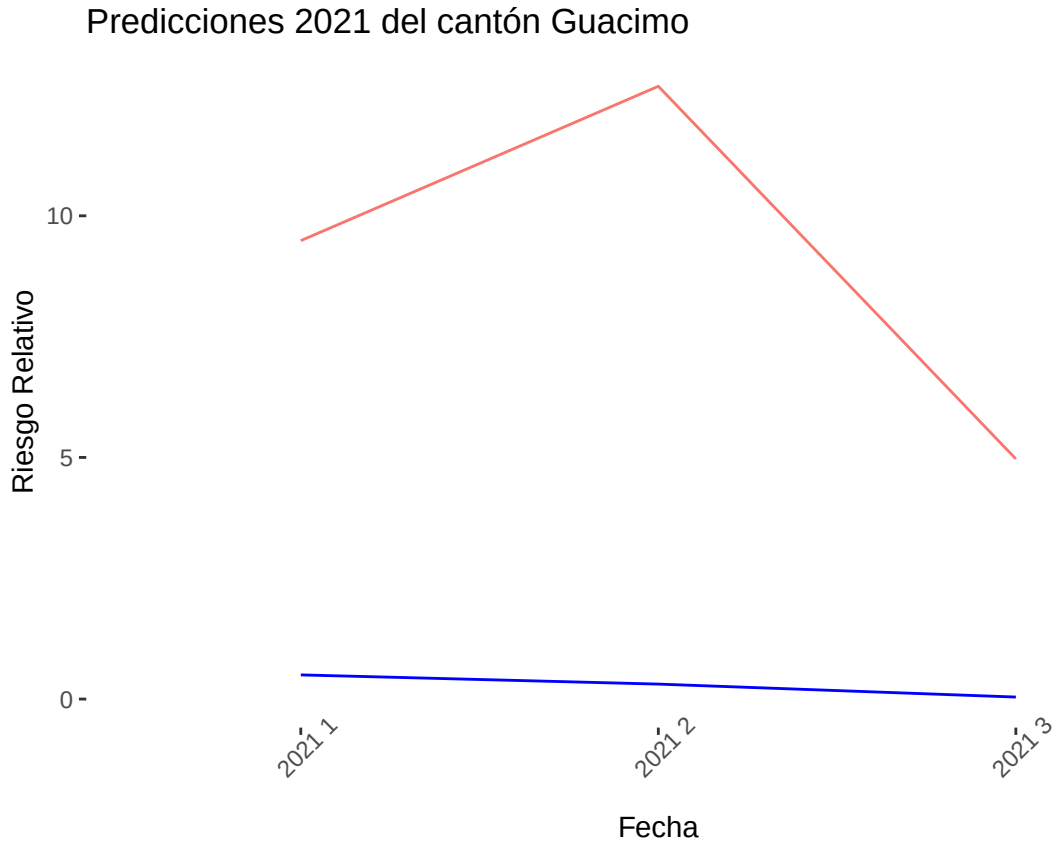
```
##
## [[9]]
```


Predicciones 2021 del cantón Garabito
Riesgo Relativo
6
4
2
0
2021 1
2021 2
2021 3
Fecha

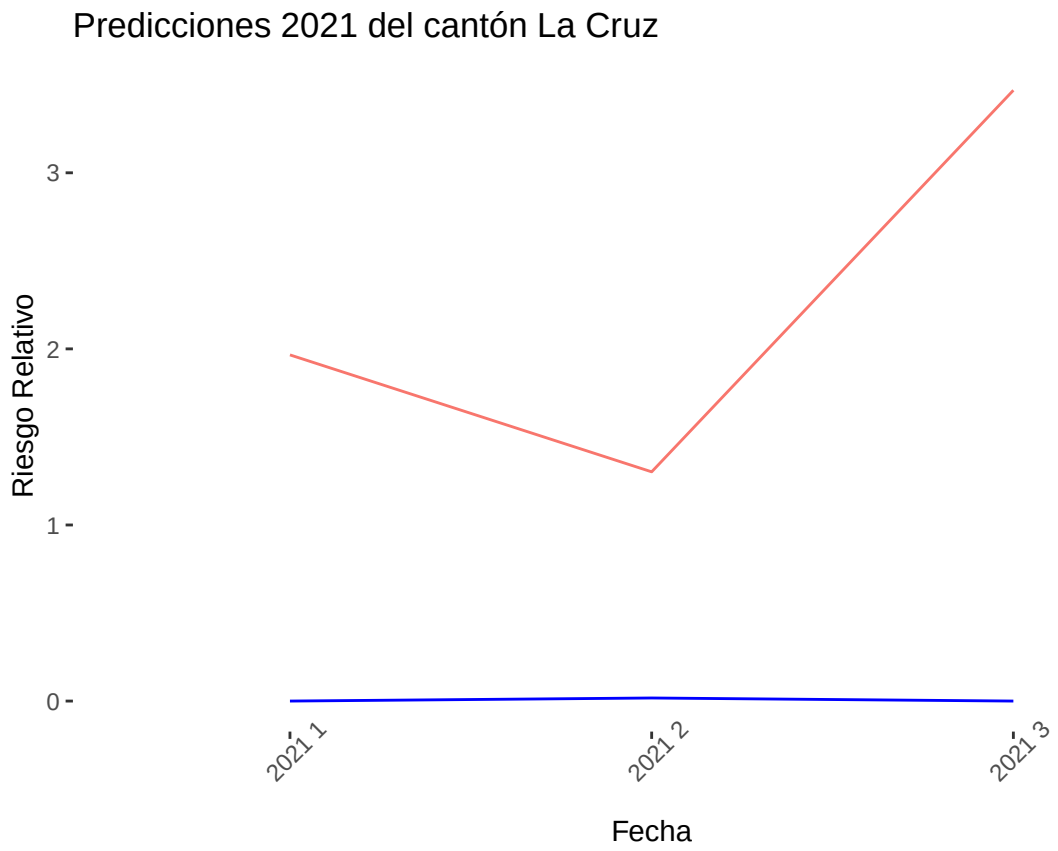
```
##
## [[10]]
```


Predicciones 2021 del cantón Golfito
Riesgo Relativo
2.0
1.5
1.0
0.5
0.0
2021-1
2021-2
2021-3
Fecha

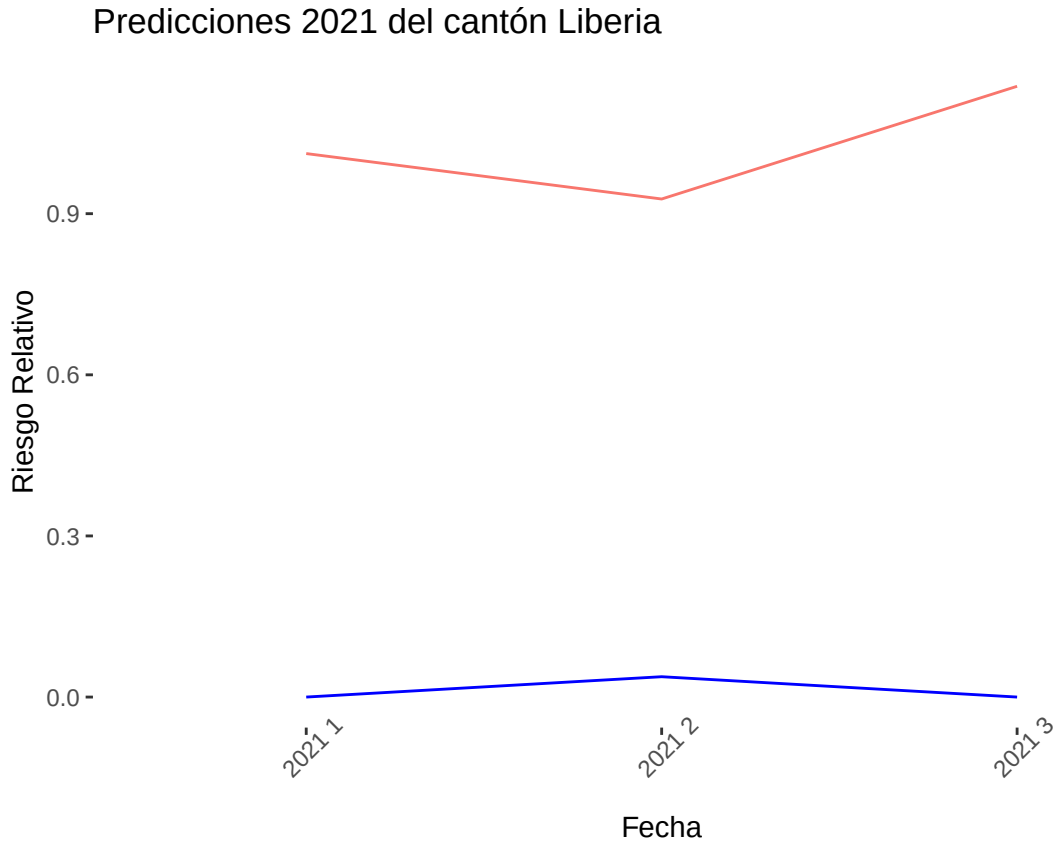
```
##
## [[11]]
```


Predicciones 2021 del cantón Guacimo
Riesgo Relativo
10
5
0
2021 1
2021 2
2021 3
Fecha

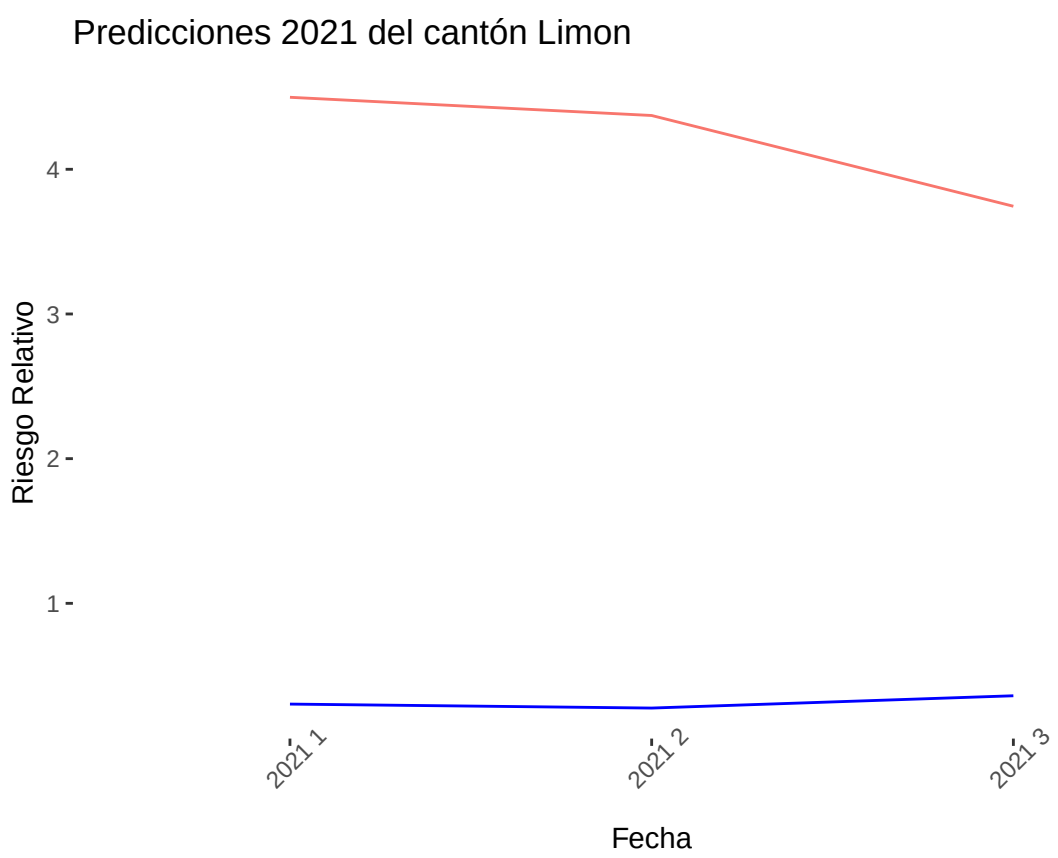
```
##
## [[12]]
```


Predicciones 2021 del cantón La Cruz
Riesgo Relativo
3
2
1
0
2021 1
2021 2
2021 3
Fecha

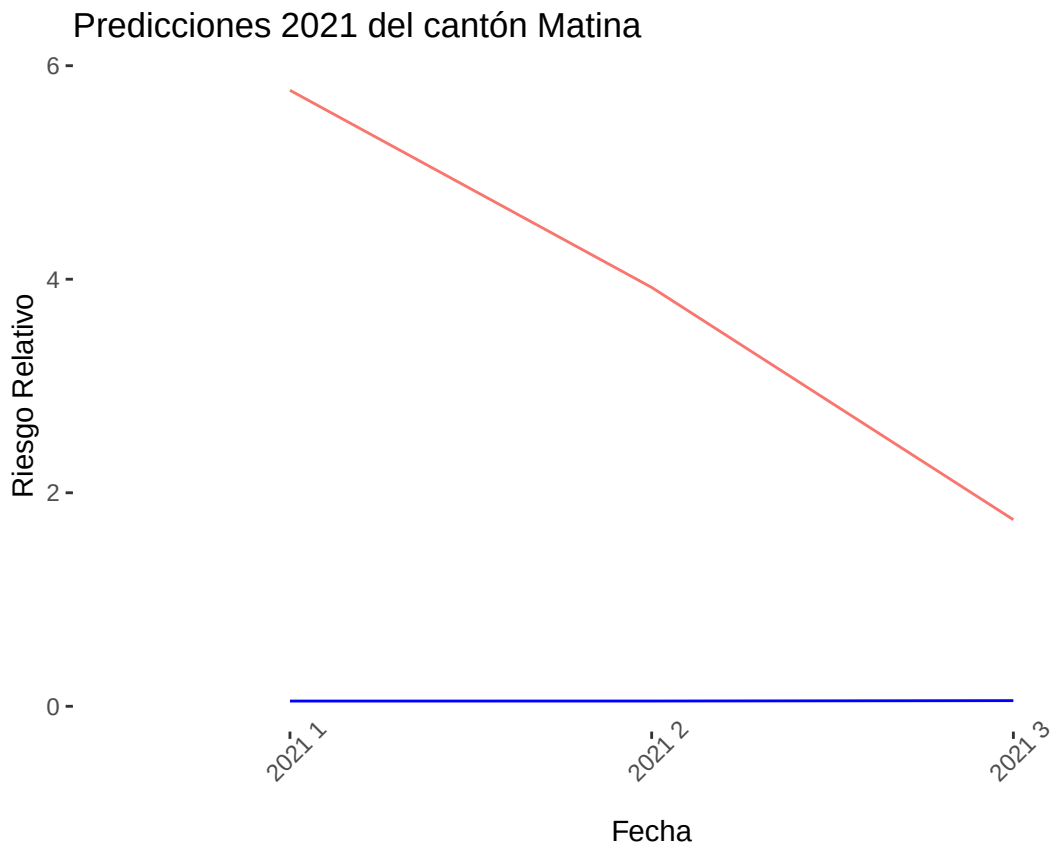
```
##
## [[13]]
```


Predicciones 2021 del cantón Liberia
Riesgo Relativo
0.9
0.6
0.3
0.0
2021-1
2021-2
2021-3
Fecha

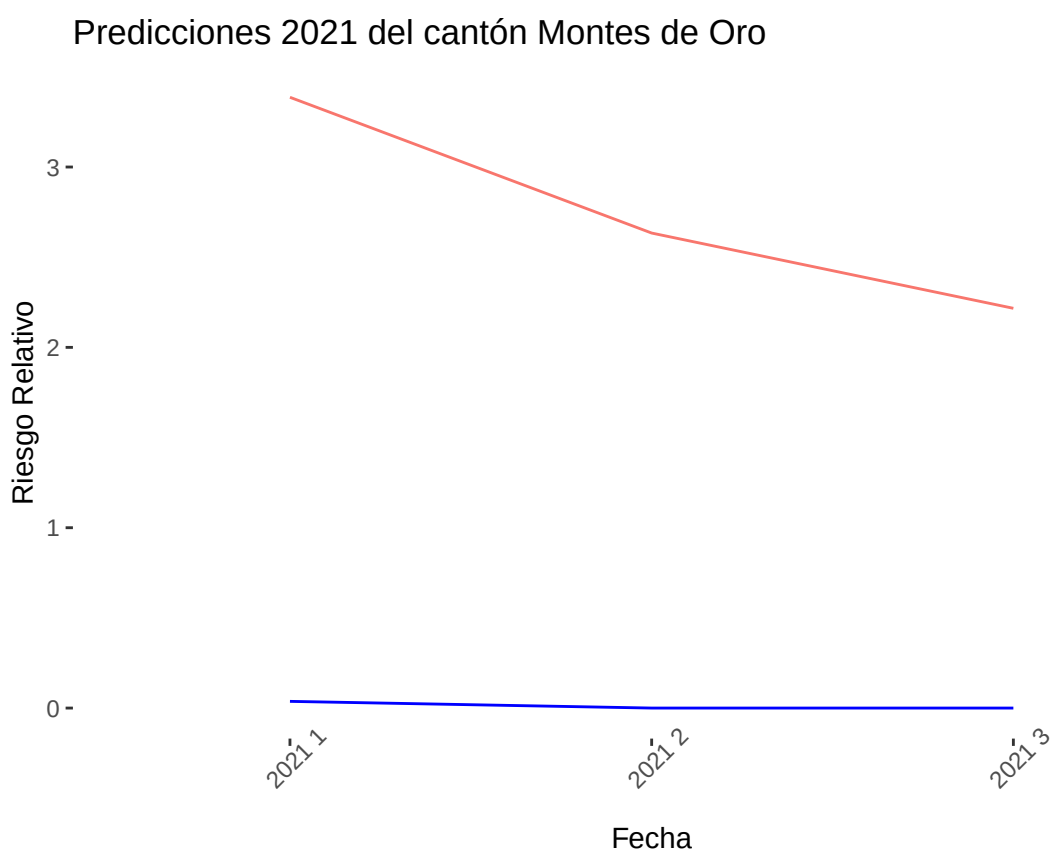
```
##
## [[14]]
```


Predicciones 2021 del cantón Limon
Riesgo Relativo
4
3
2
1
2021 1
2021 2
2021 3
Fecha

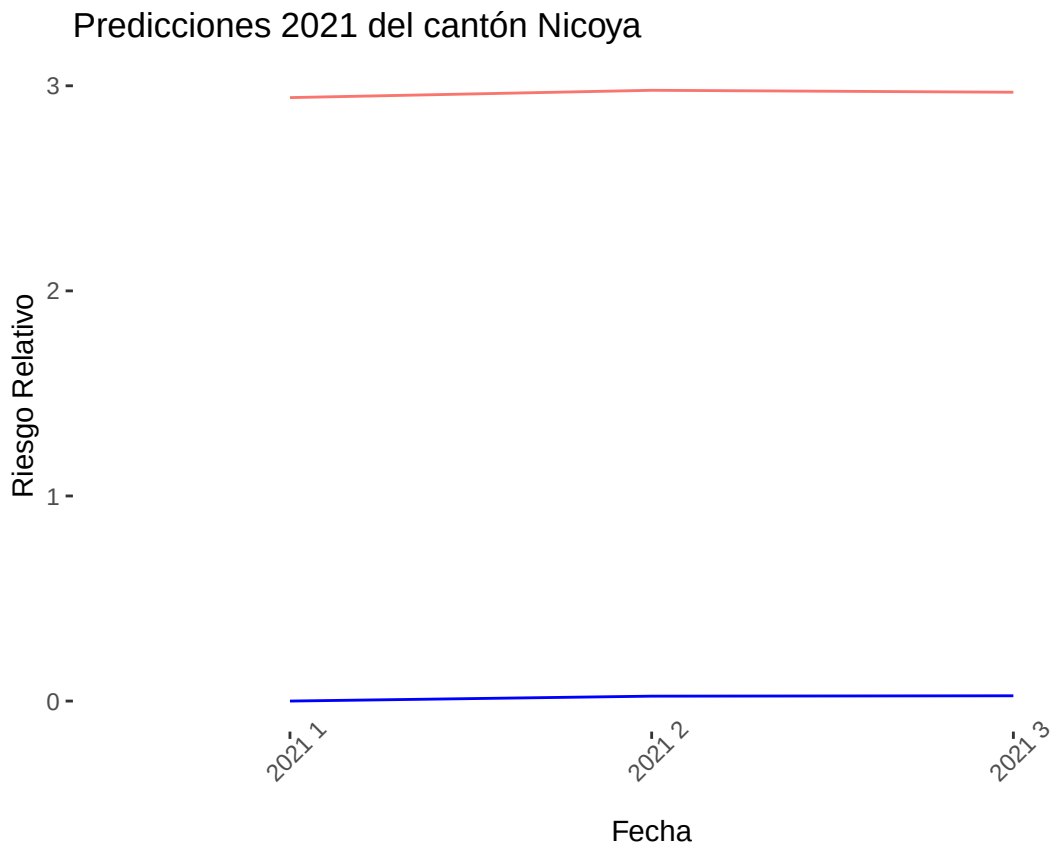
```
##
## [[15]]
```


Predicciones 2021 del cantón Matina
Riesgo Relativo
6
4
2
0
2021 1
2021 2
2021 3
Fecha

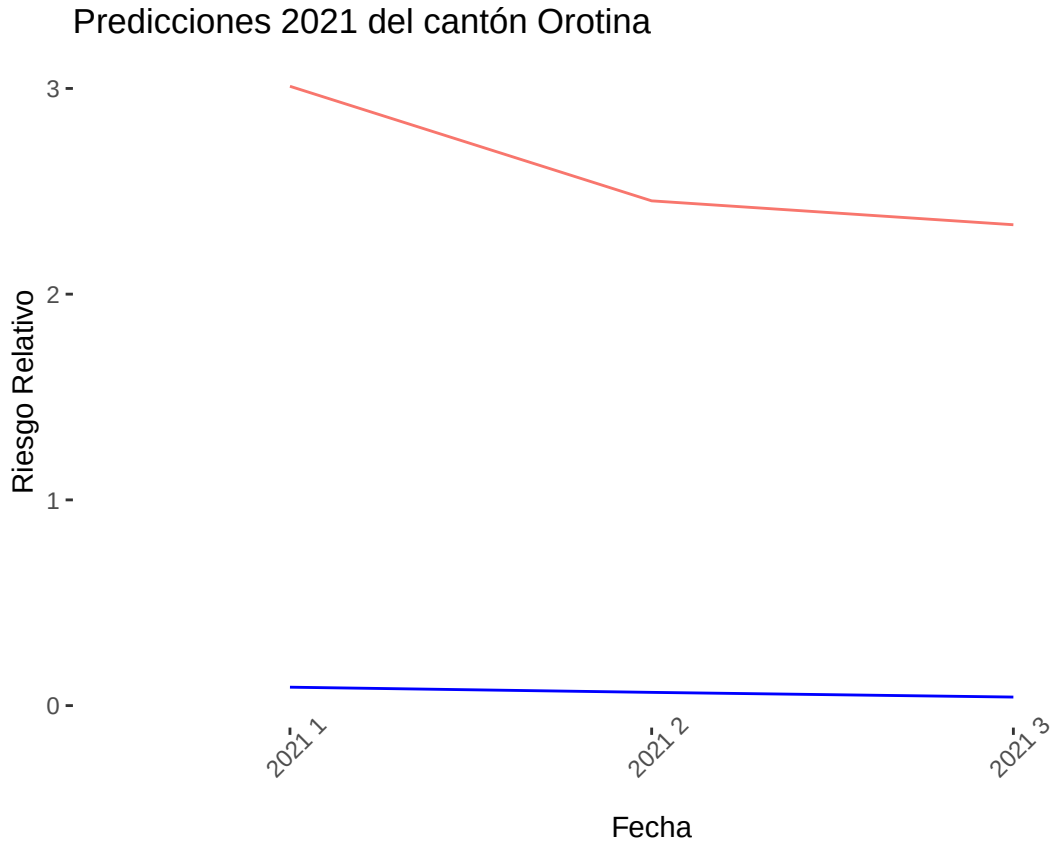
```
##
## [[16]]
```


Predicciones 2021 del cantón Montes de Oro
Riesgo Relativo
3
2
1
0
2021 1
2021 2
2021 3
Fecha

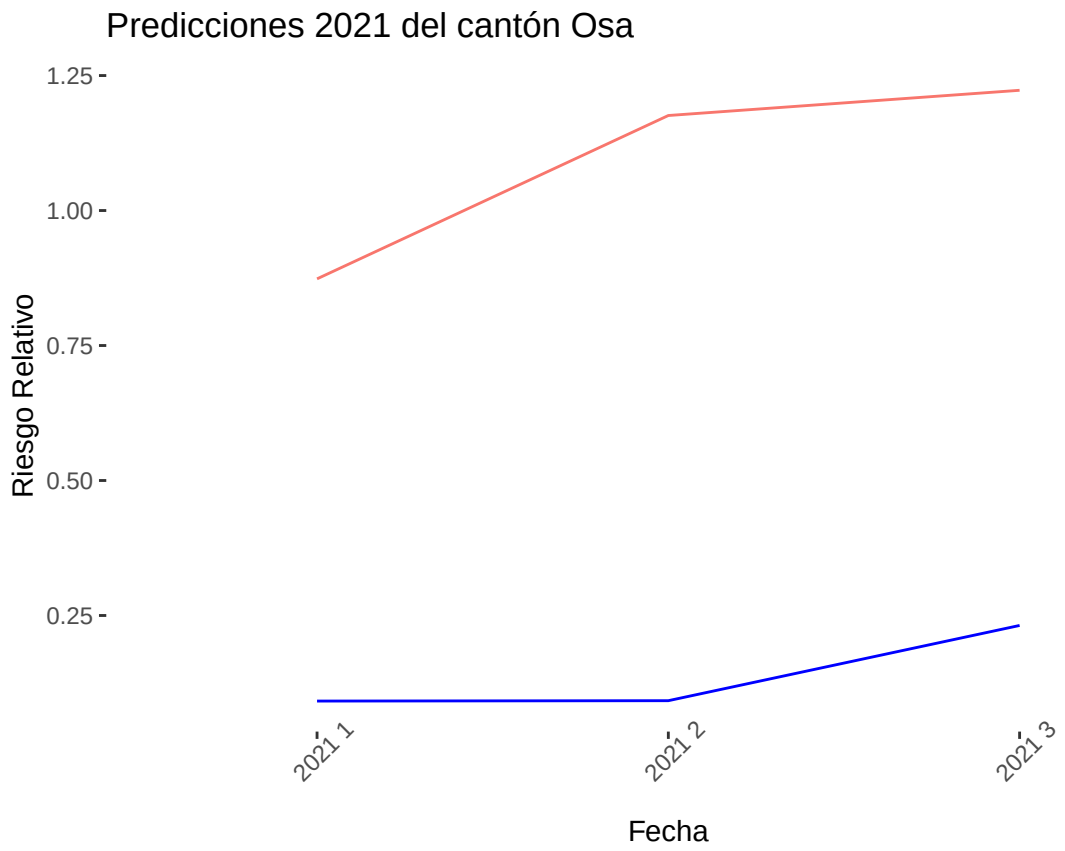
```
##
## [[17]]
```


Predicciones 2021 del cantón Nicoya
Riesgo Relativo
3
2
1
0
2021 1
2021 2
2021 3
Fecha

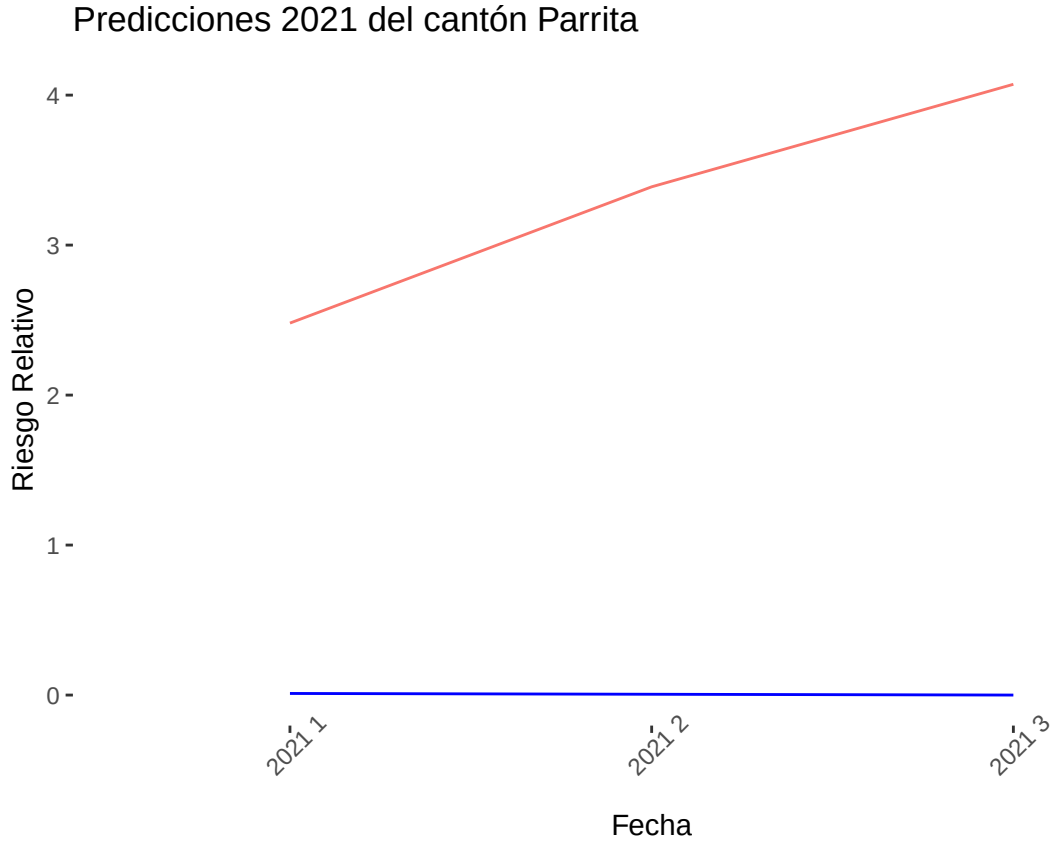
```
##
## [[18]]
```


Predicciones 2021 del cantón Orotina
Riesgo Relativo
3
2
1
0
2021 1
2021 2
2021 3
Fecha

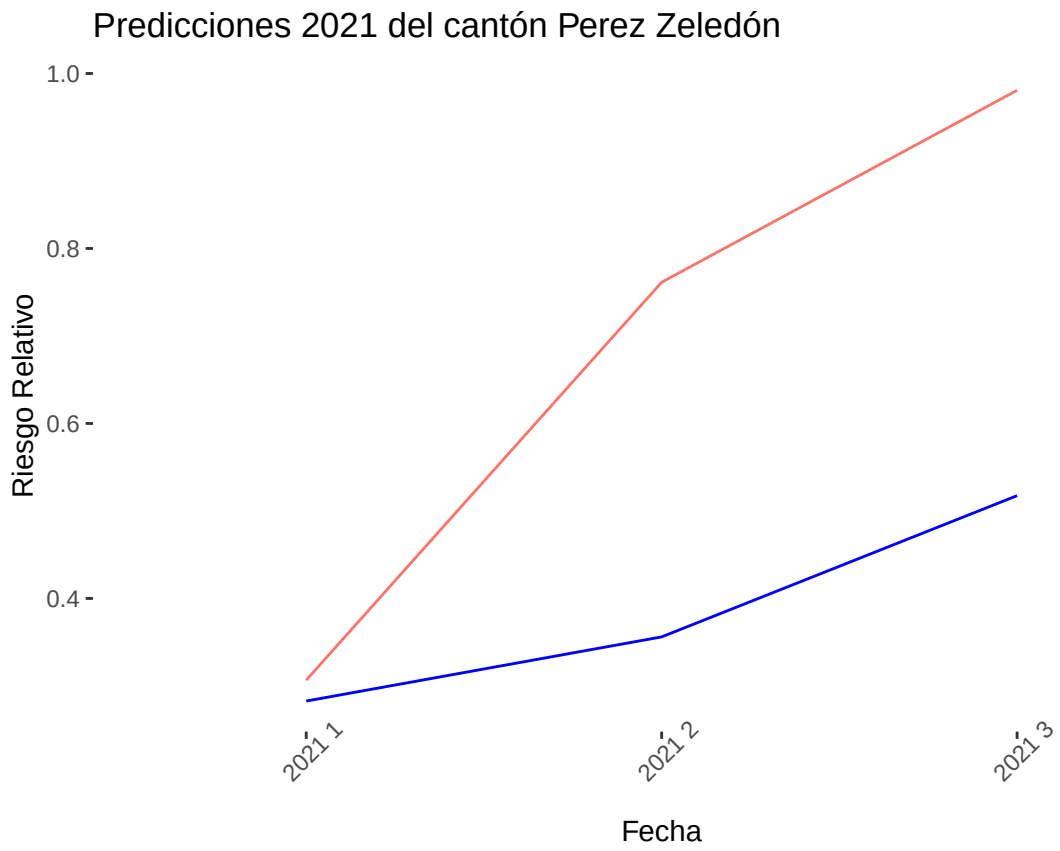
```
##
## [[19]]
```


Predicciones 2021 del cantón Osa
1.25
1.00
0.75
0.50
0.25
Riesgo Relativo
2021 1
2021 2
2021 3
Fecha

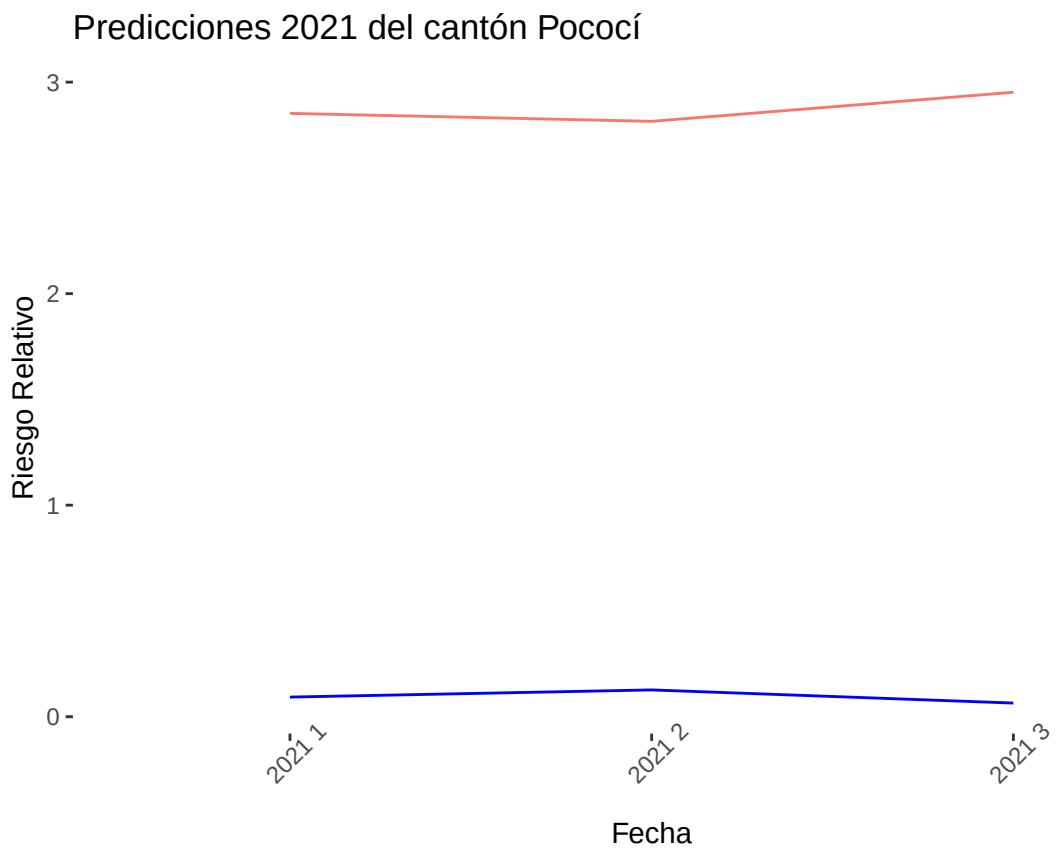
```
##
## [[20]]
```


Predicciones 2021 del cantón Parrita
Riesgo Relativo
4
3
2
1
0
2021 1
2021 2
2021 3
Fecha

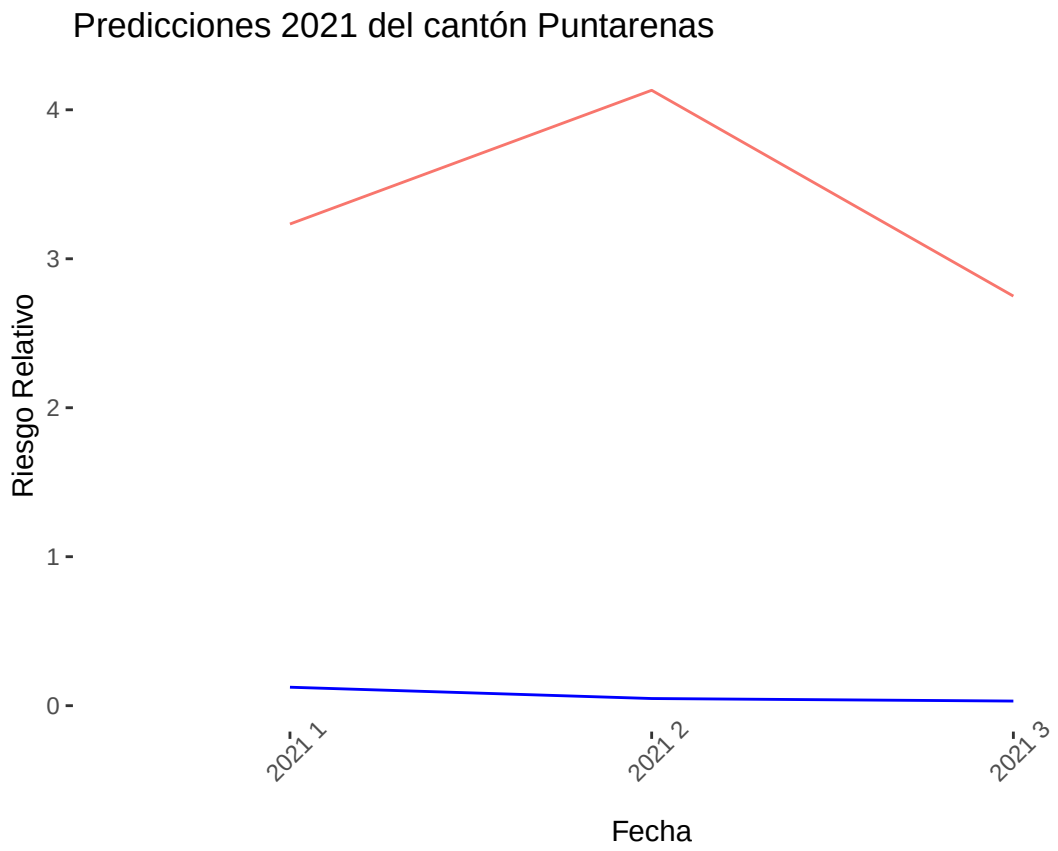
```
##
## [[21]]
```


Predicciones 2021 del cantón Perez Zeledón
1.0
0.8
0.6
0.4
Riesgo Relativo
2021-1
2021-2
2021-3
Fecha

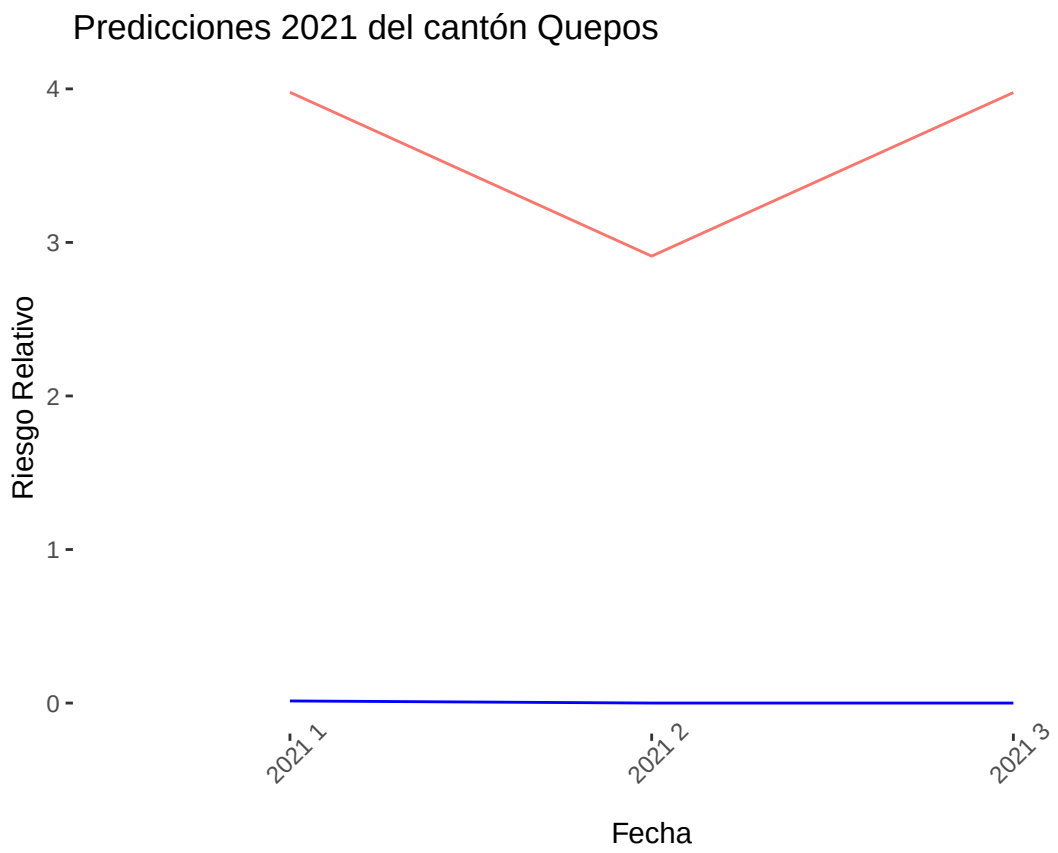
```
##
## [[22]]
```


Predicciones 2021 del cantón Pococí
Riesgo Relativo
3
2
1
0
2021 1
2021 2
2021 3
Fecha

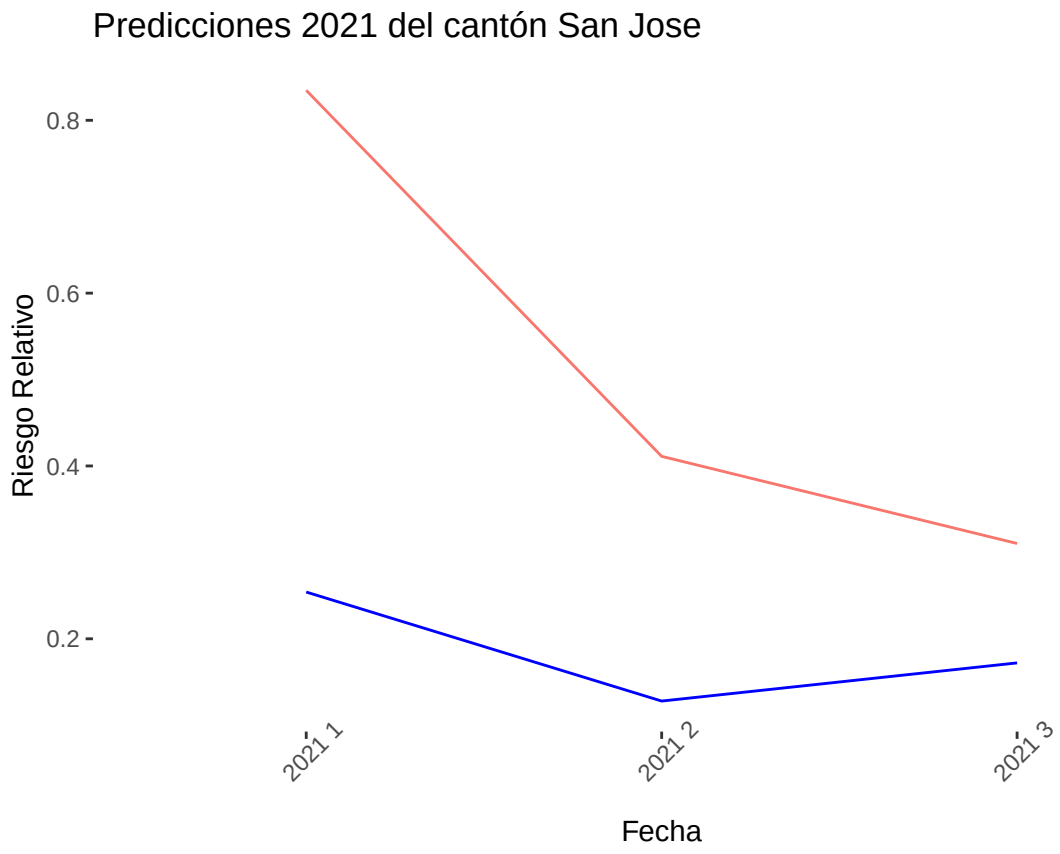
```
##
## [[23]]
```


Predicciones 2021 del cantón Puntarenas
Riesgo Relativo
4
3
2
1
0
2021 1
2021 2
2021 3
Fecha

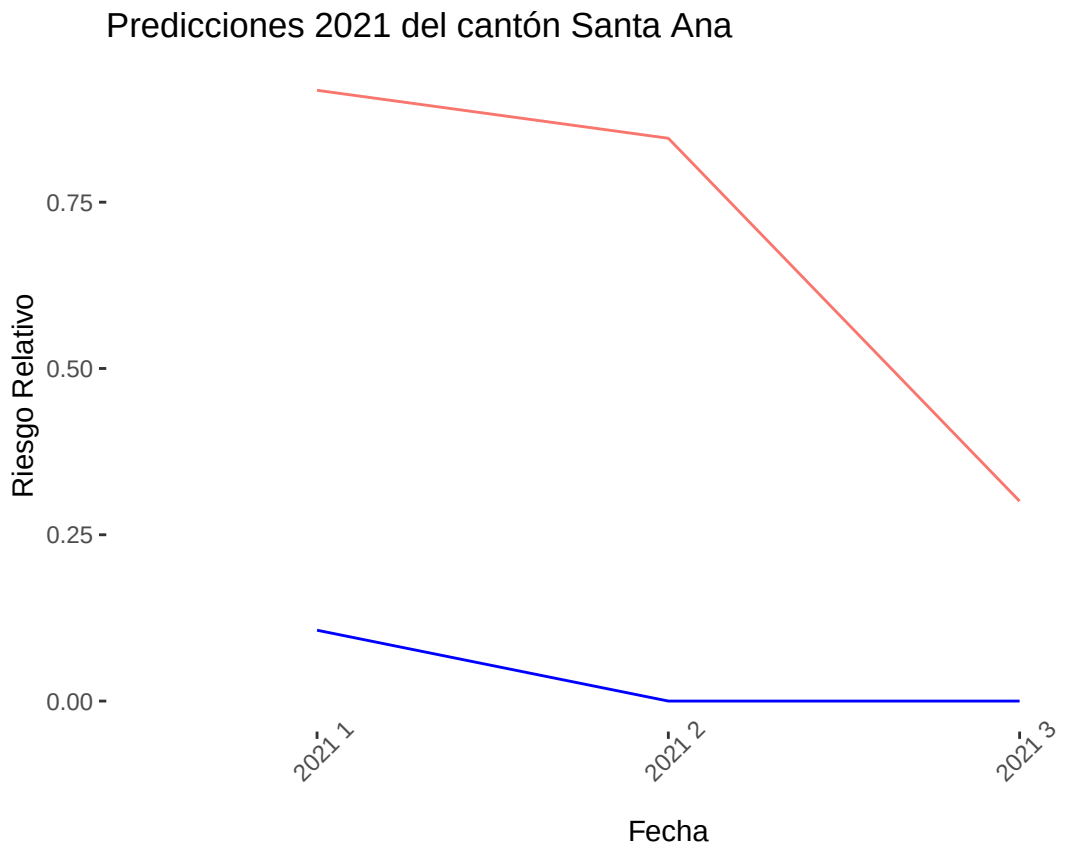
```
##
## [[24]]
```


Predicciones 2021 del cantón Quepos
Riesgo Relativo
4
3
2
1
0
2021 1
2021 2
2021 3
Fecha

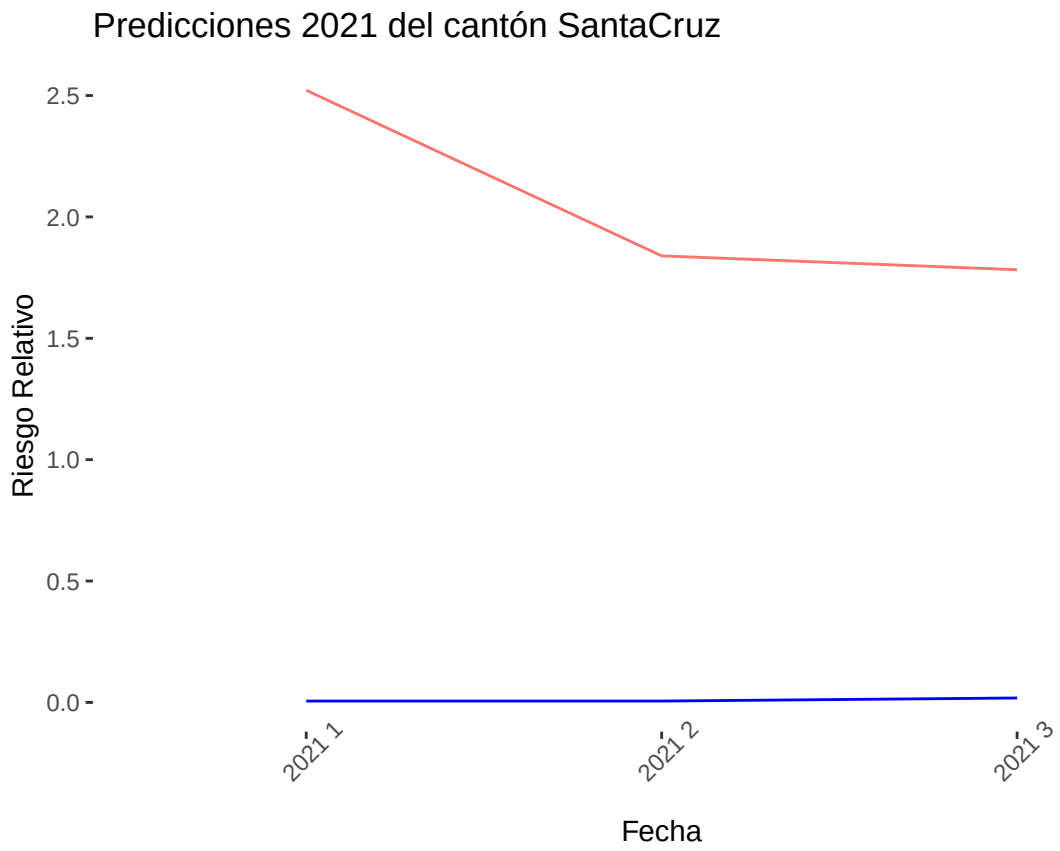
```
##
## [[25]]
```


Predicciones 2021 del cantón San Jose
Riesgo Relativo
0.8
0.6
0.4
0.2
2021-1
2021-2
2021-3
Fecha

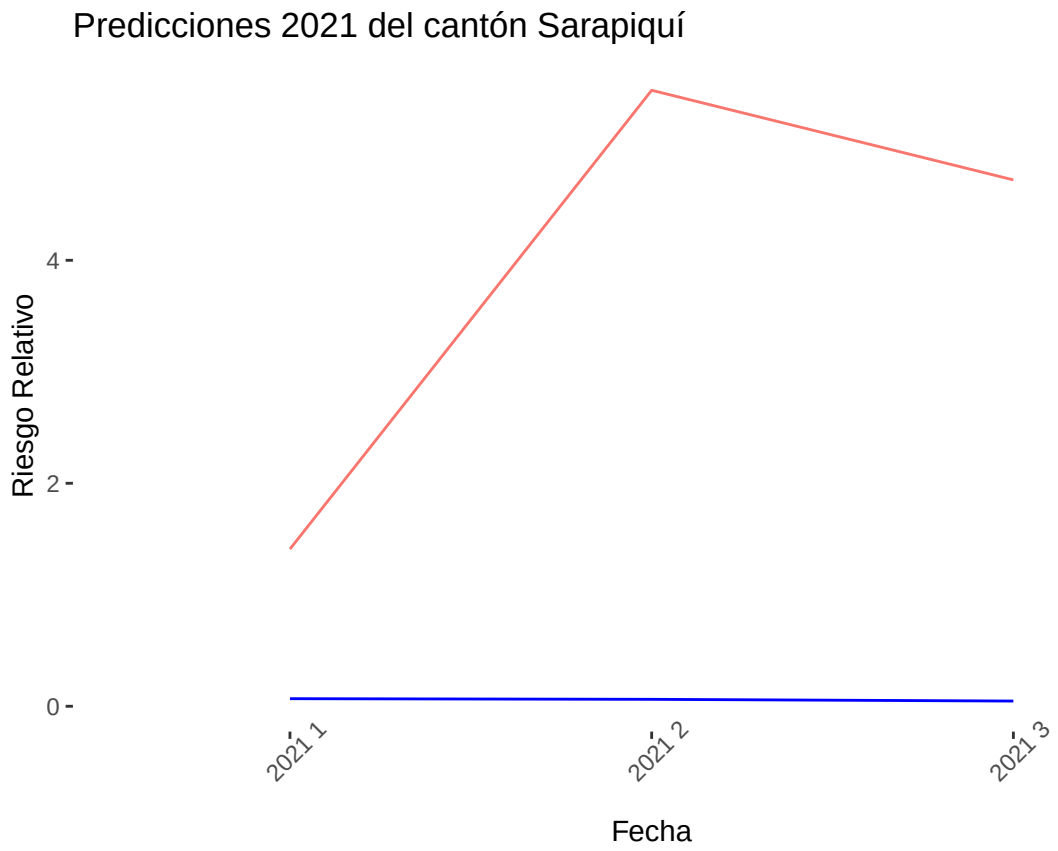
```
##
## [[26]]
```


Predicciones 2021 del cantón Santa Ana
Riesgo Relativo
0.75
0.50
0.25
0.00
2021 1
2021 2
2021 3
Fecha

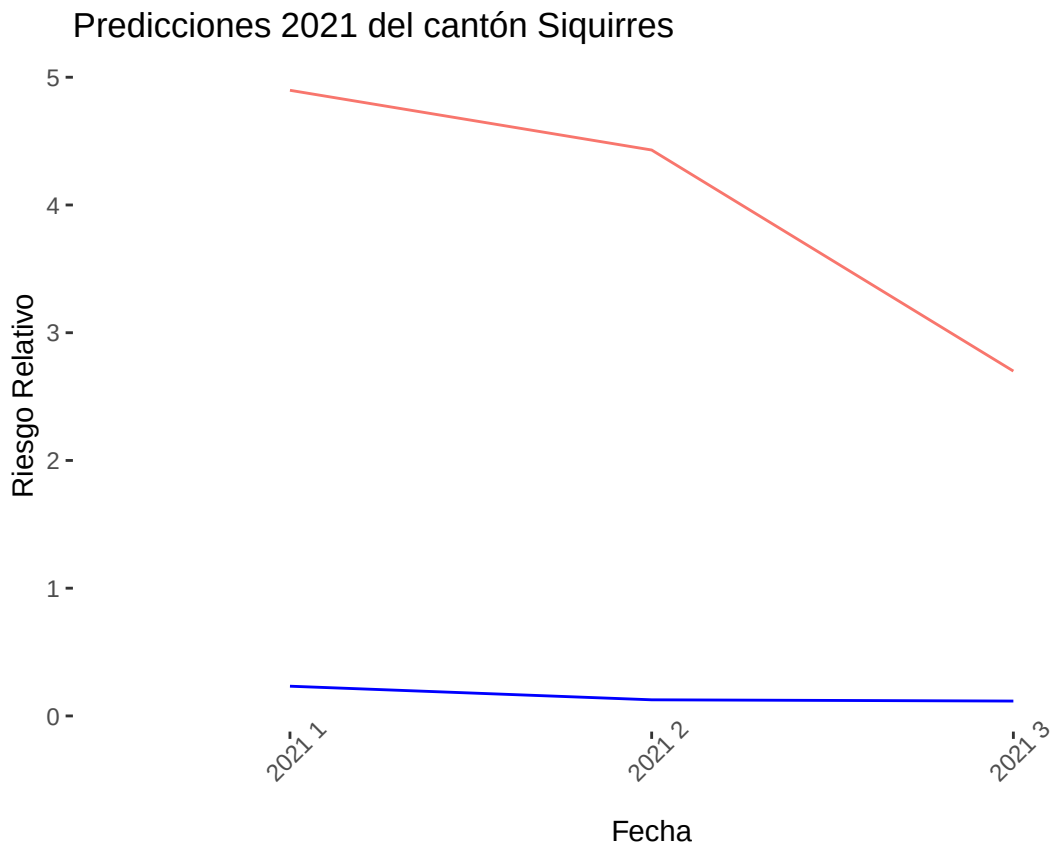
```
##
## [[27]]
```


Predicciones 2021 del cantón SantaCruz
Riesgo Relativo
2.5
2.0
1.5
1.0
0.5
0.0
2021 1
2021 2
2021 3
Fecha

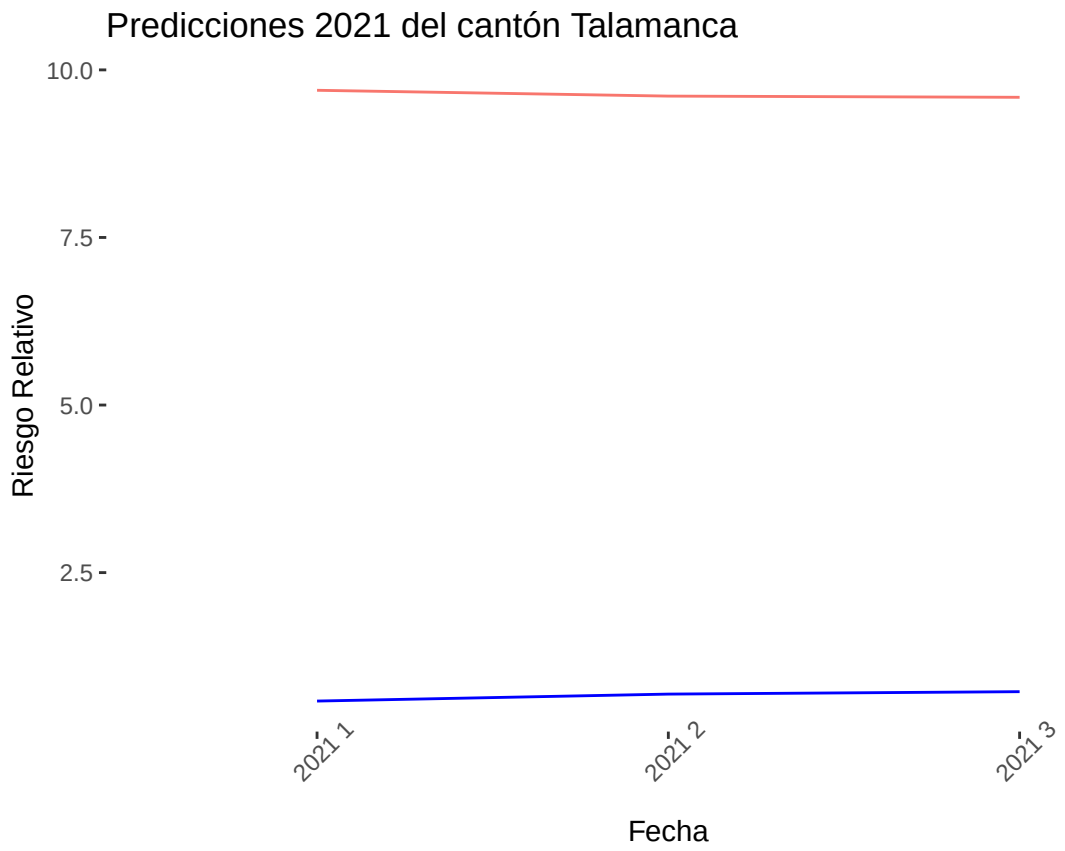
```
##
## [[28]]
```


Predicciones 2021 del cantón Sarapiquí
Riesgo Relativo
4
2
0
2021 1
2021 2
2021 3
Fecha

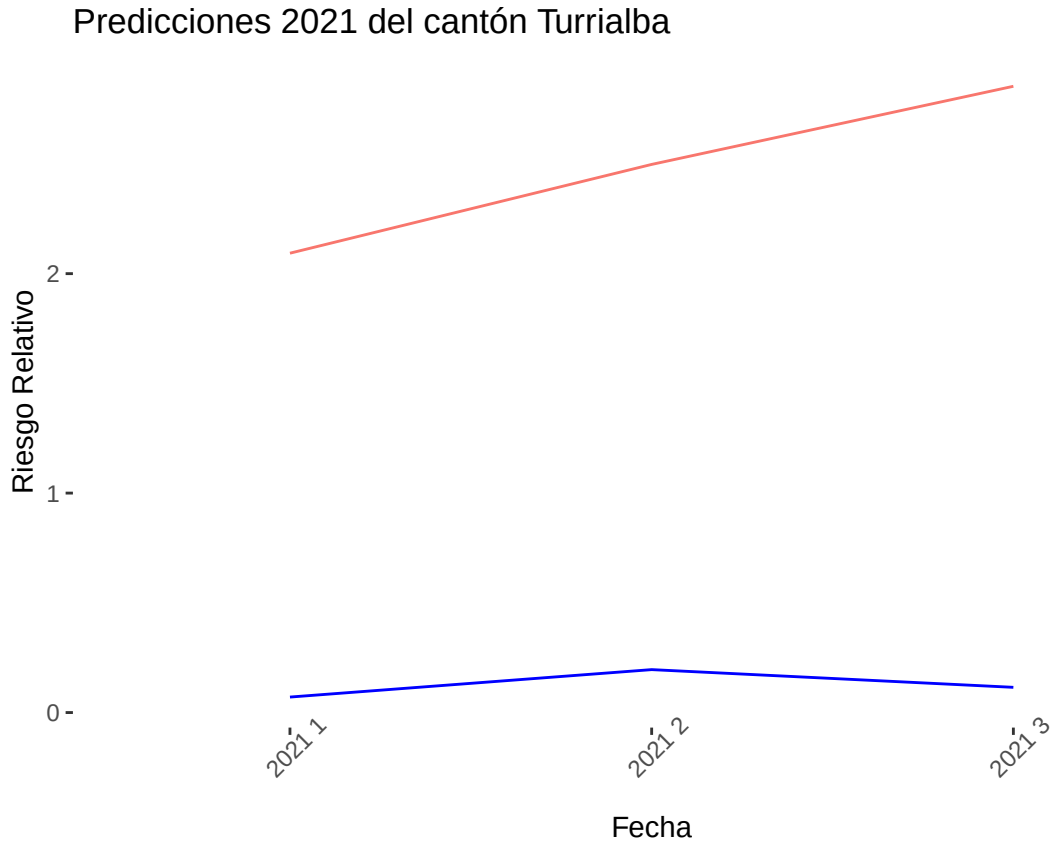
```
##
## [[29]]
```


Predicciones 2021 del cantón Siquirres
Riesgo Relativo
5
4
3
2
1
0
2021 1
2021 2
2021 3
Fecha

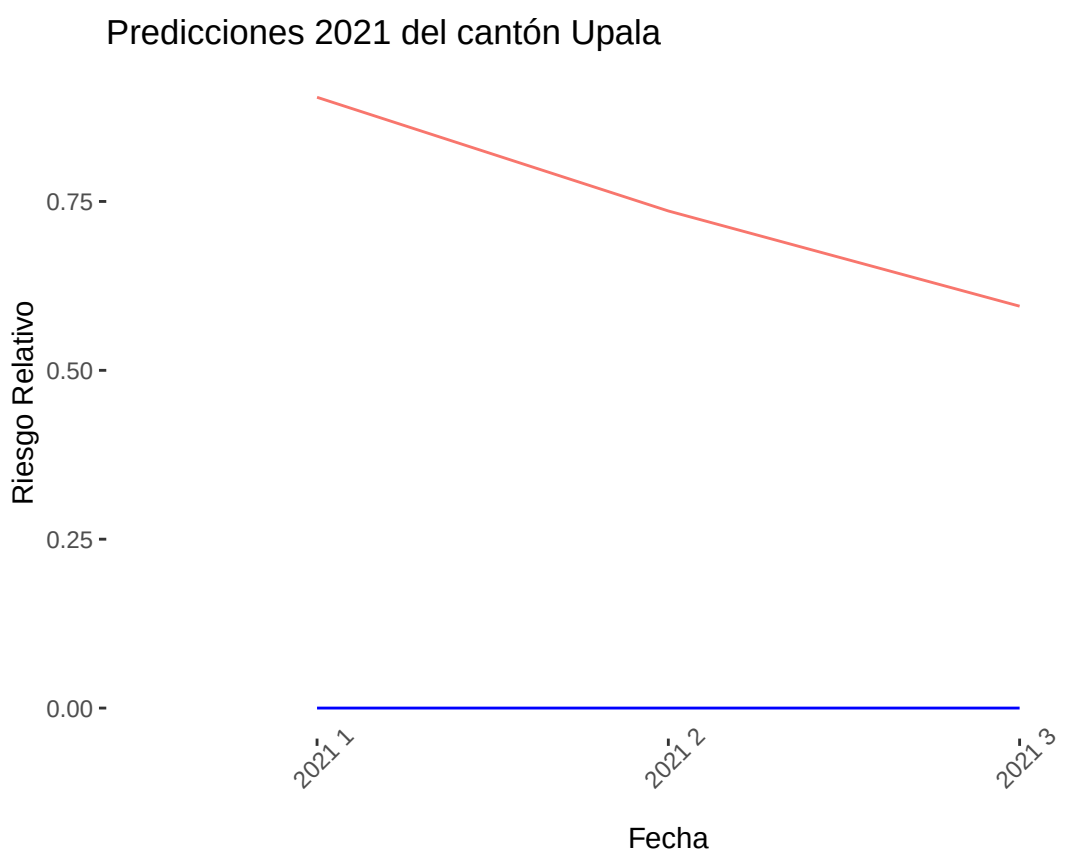
```
##
## [[30]]
```


Predicciones 2021 del cantón Talamanca
10.0
7.5
5.0
2.5
Riesgo Relativo
2021 1
2021 2
2021 3
Fecha

```
##
## [[31]]
```

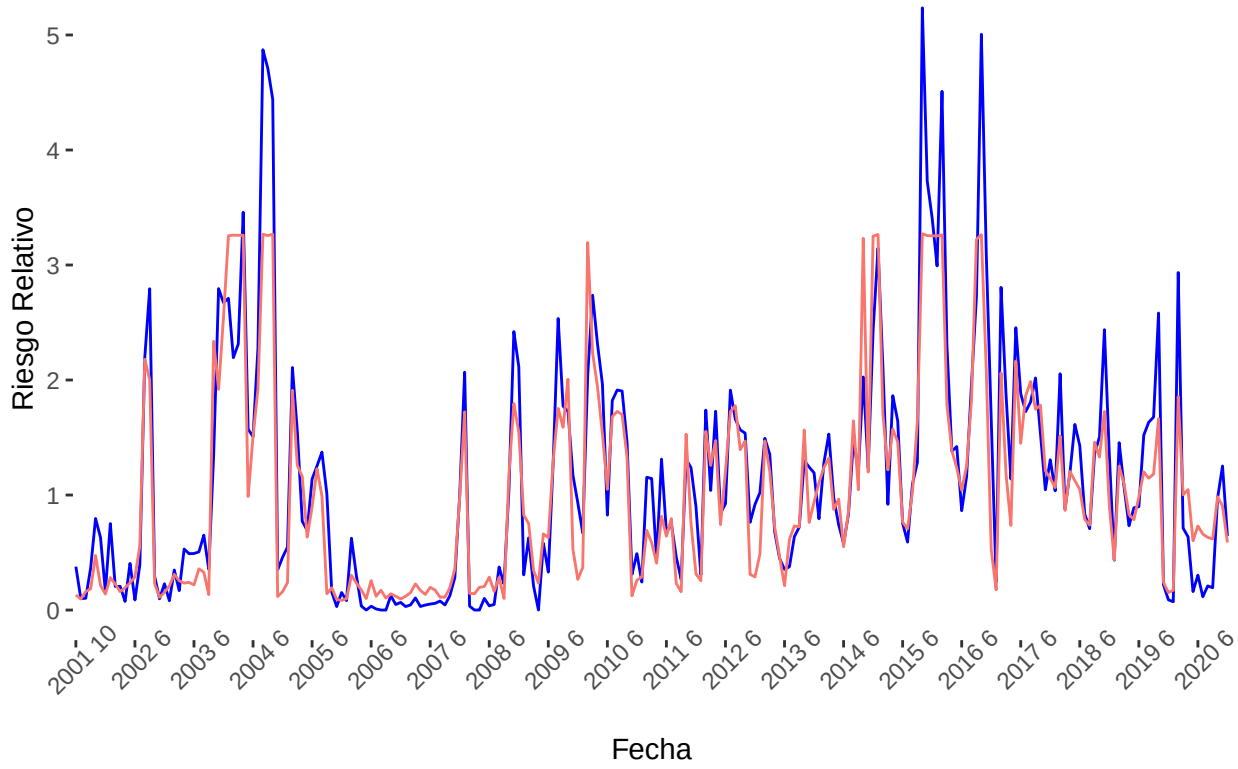

Predicciones 2021 del cantón Turrialba
Riesgo Relativo
2
1
0
2021-1
2021-2
2021-3
Fecha

```
##
## [[32]]
```

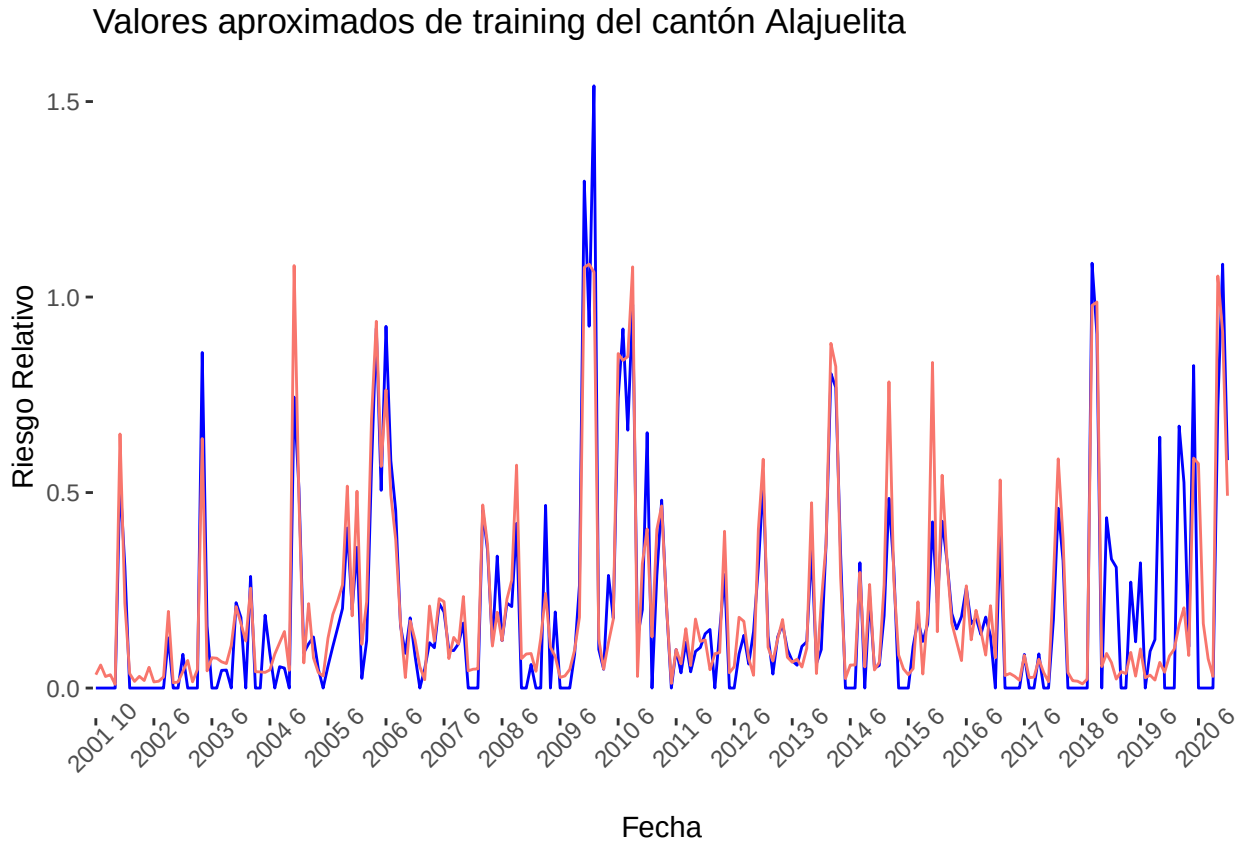

Predicciones 2021 del cantón Upala
Riesgo Relativo
0.75
0.50
0.25
0.00
2021 1
2021 2
2021 3
Fecha

```
p2
```

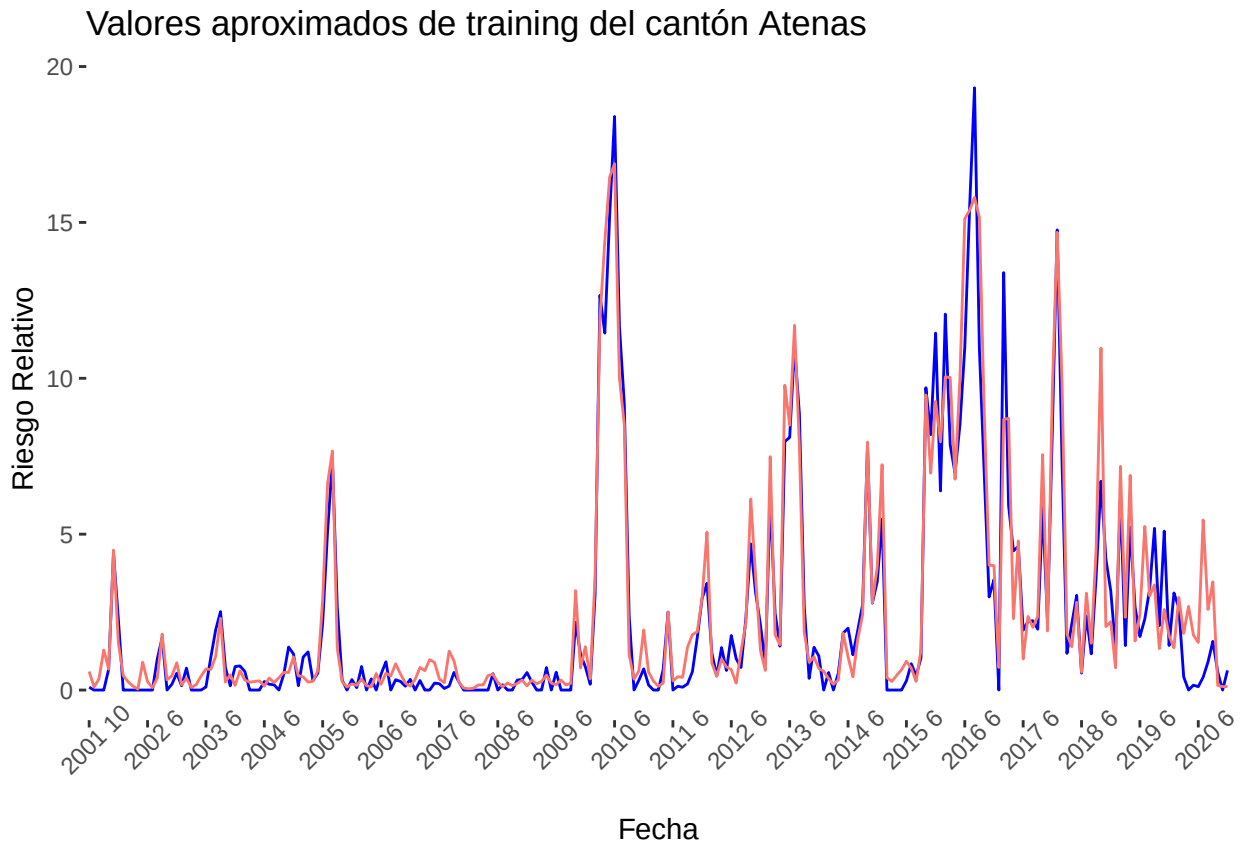
```
## [[1]]
```


Valores aproximados de training del cantón Alajuela
Riesgo Relativo
0
1
2
3
4
5
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

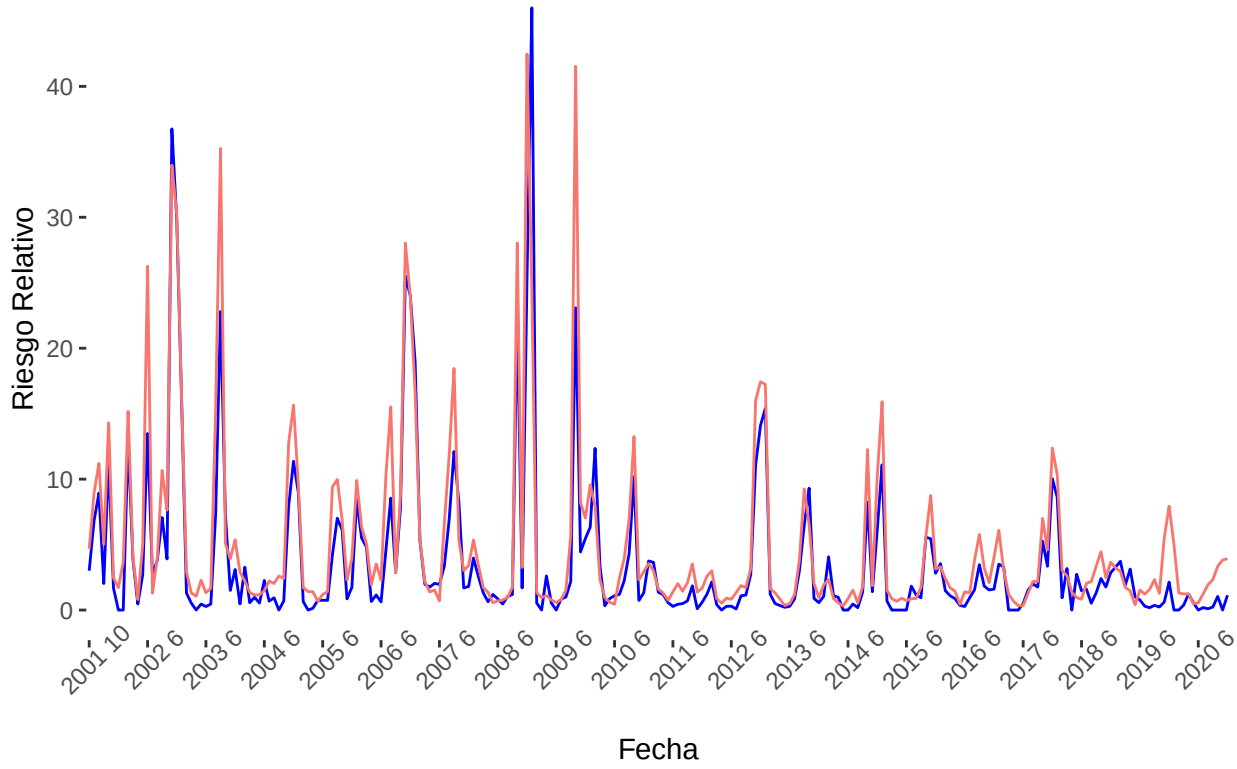
```
##
## [[2]]
```


Valores aproximados de training del cantón Alajuelita
Riesgo Relativo
1.5
1.0
0.5
0.0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

```
##
## [[3]]
```


Valores aproximados de training del cantón Atenas
Riesgo Relativo
20
15
10
5
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

```
##
## [[4]]
```


Valores aproximados de training del cantón Cañas
Riesgo Relativo
0
10
20
30
40
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

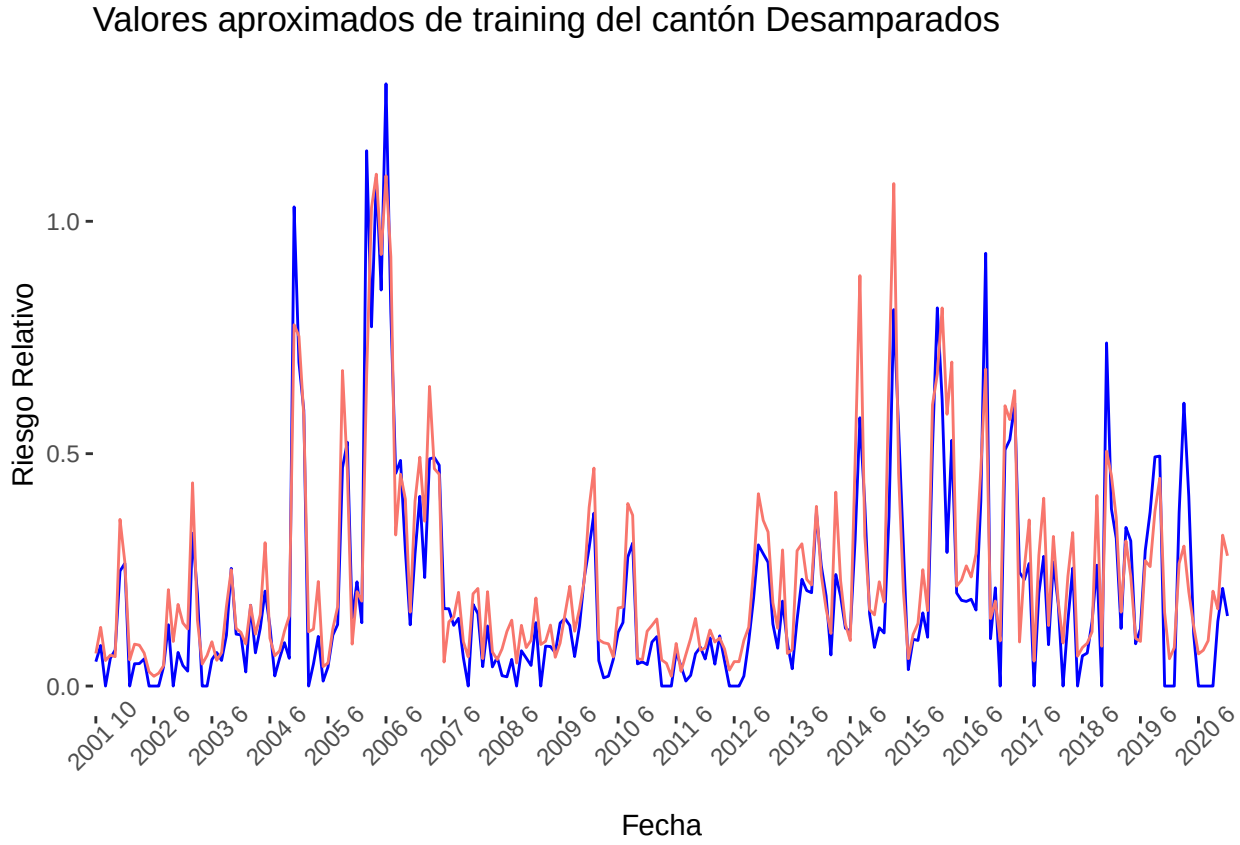
```
##
## [[5]]
```


Valores aproximados de training del cantón Carrillo
Riesgo Relativo
40
30
20
10
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

```
##
## [[6]]
```


Valores aproximados de training del cantón Corredores
Riesgo Relativo
0
5
10
15
20
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

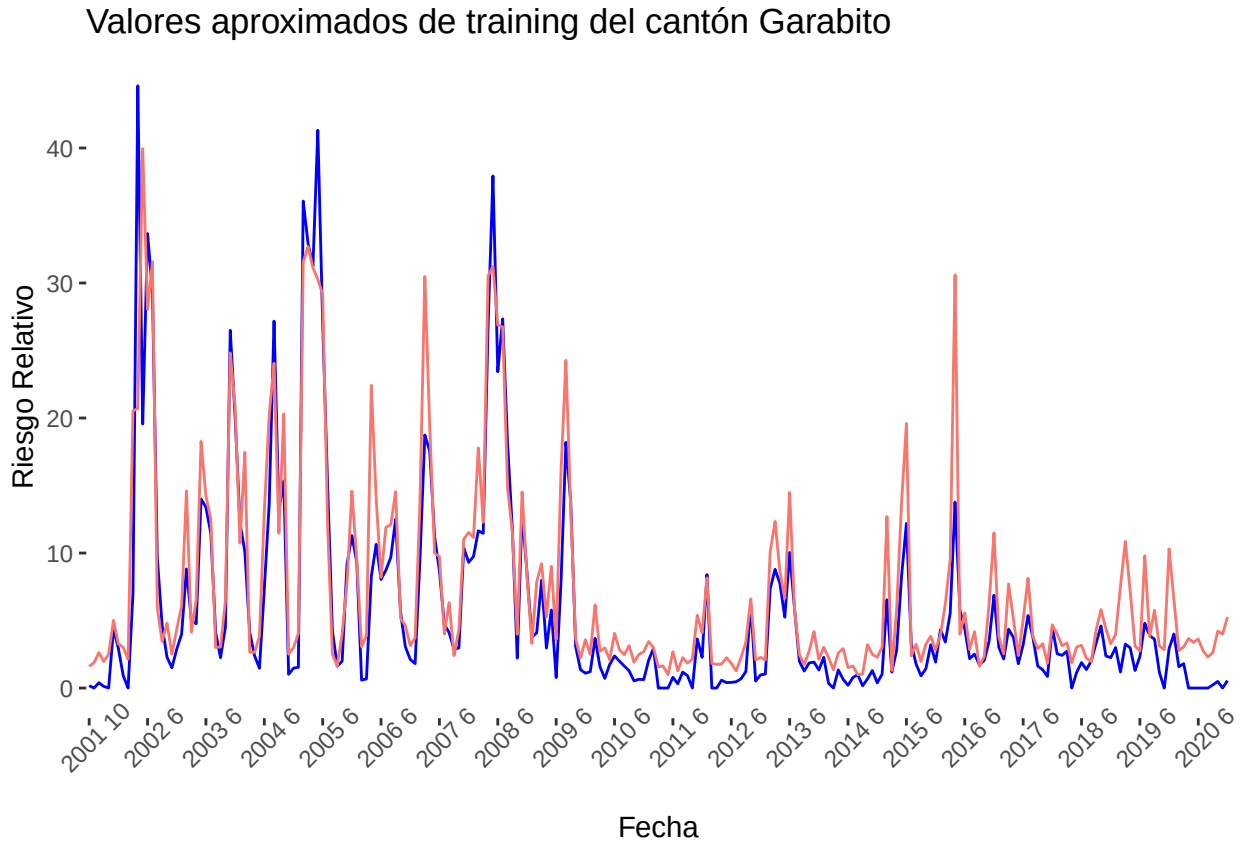
```
##
## [[7]]
```


Valores aproximados de training del cantón Desamparados
Riesgo Relativo
1.0
0.5
0.0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

```
##
## [[8]]
```


Valores aproximados de training del cantón Esparza
Riesgo Relativo
30
20
10
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

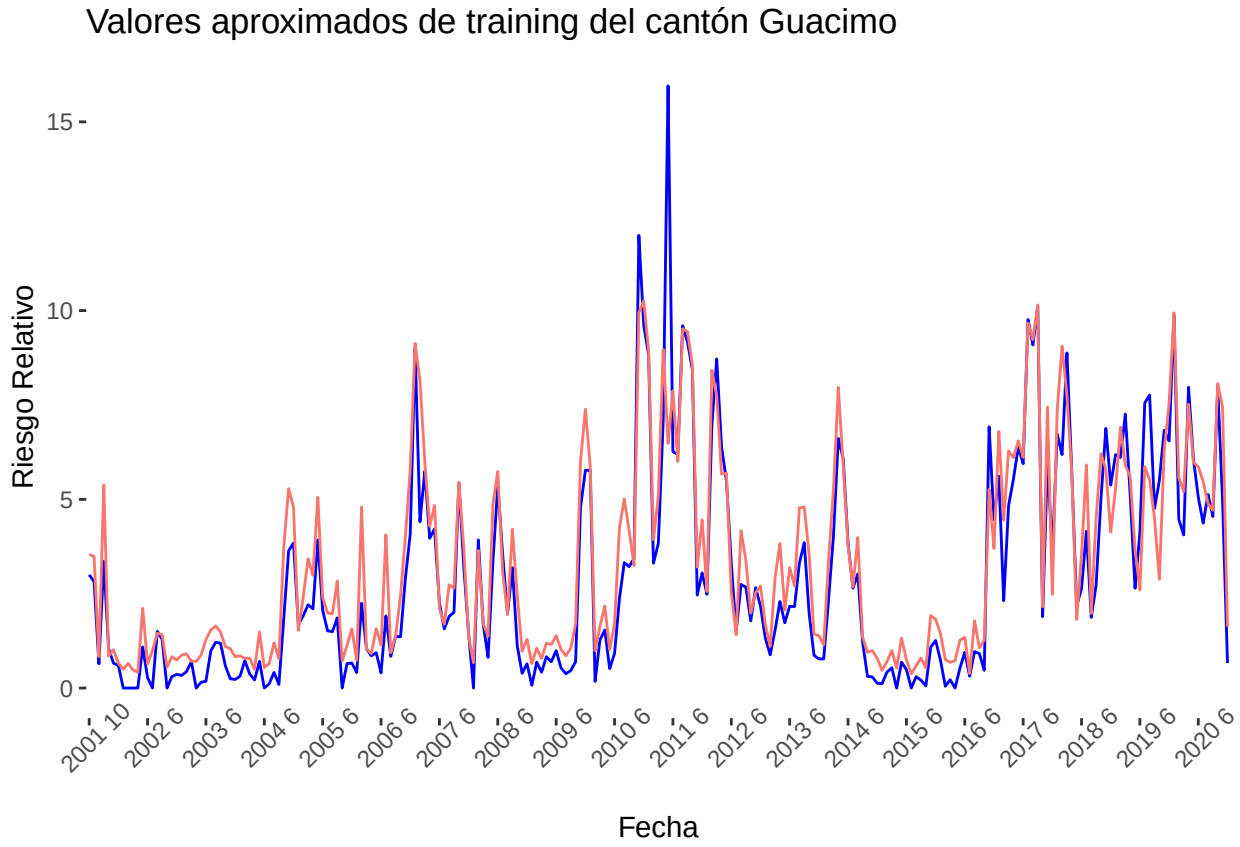
```
##
## [[9]]
```


Valores aproximados de training del cantón Garabito
Riesgo Relativo
0
10
20
30
40
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

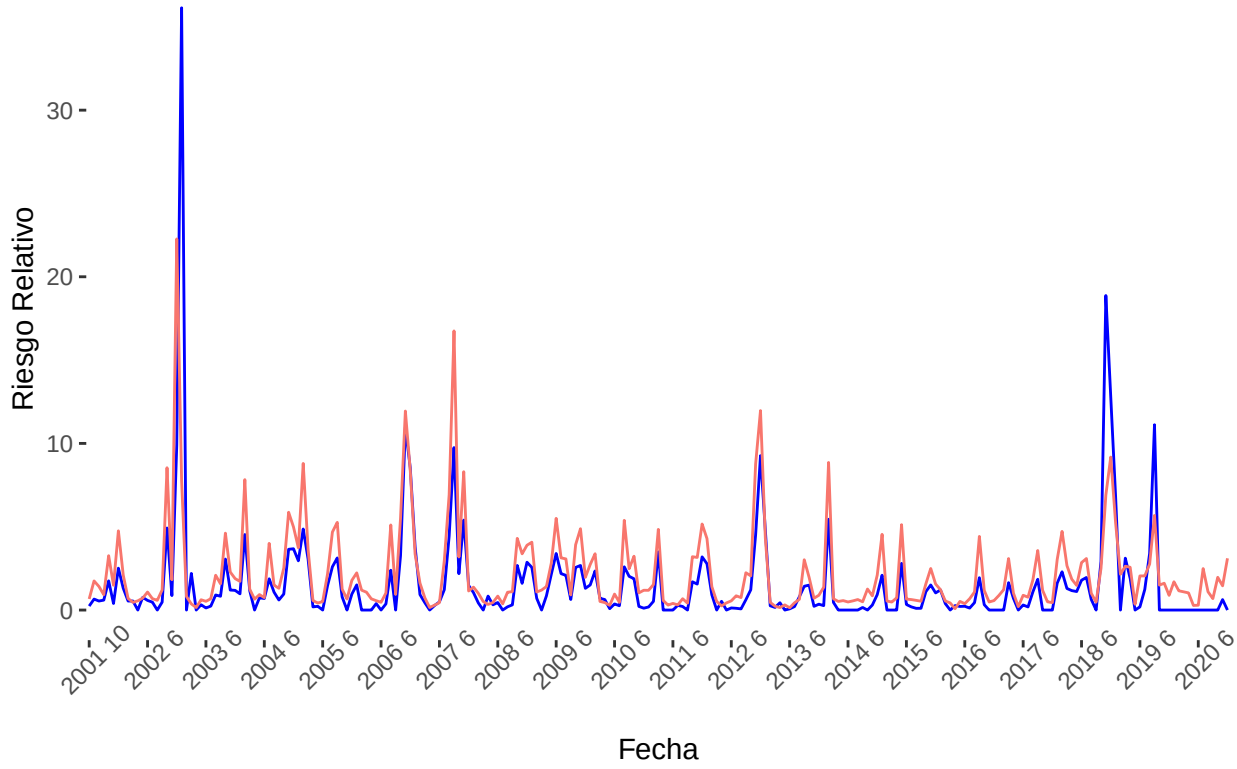
```
##
## [[10]]
```


Valores aproximados de training del cantón Golfito
Riesgo Relativo
20
15
10
5
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

```
##
## [[11]]
```


Valores aproximados de training del cantón Guacimo
Riesgo Relativo
15
10
5
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

```
##
## [[12]]
```


Valores aproximados de training del cantón La Cruz
Riesgo Relativo
30
20
10
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

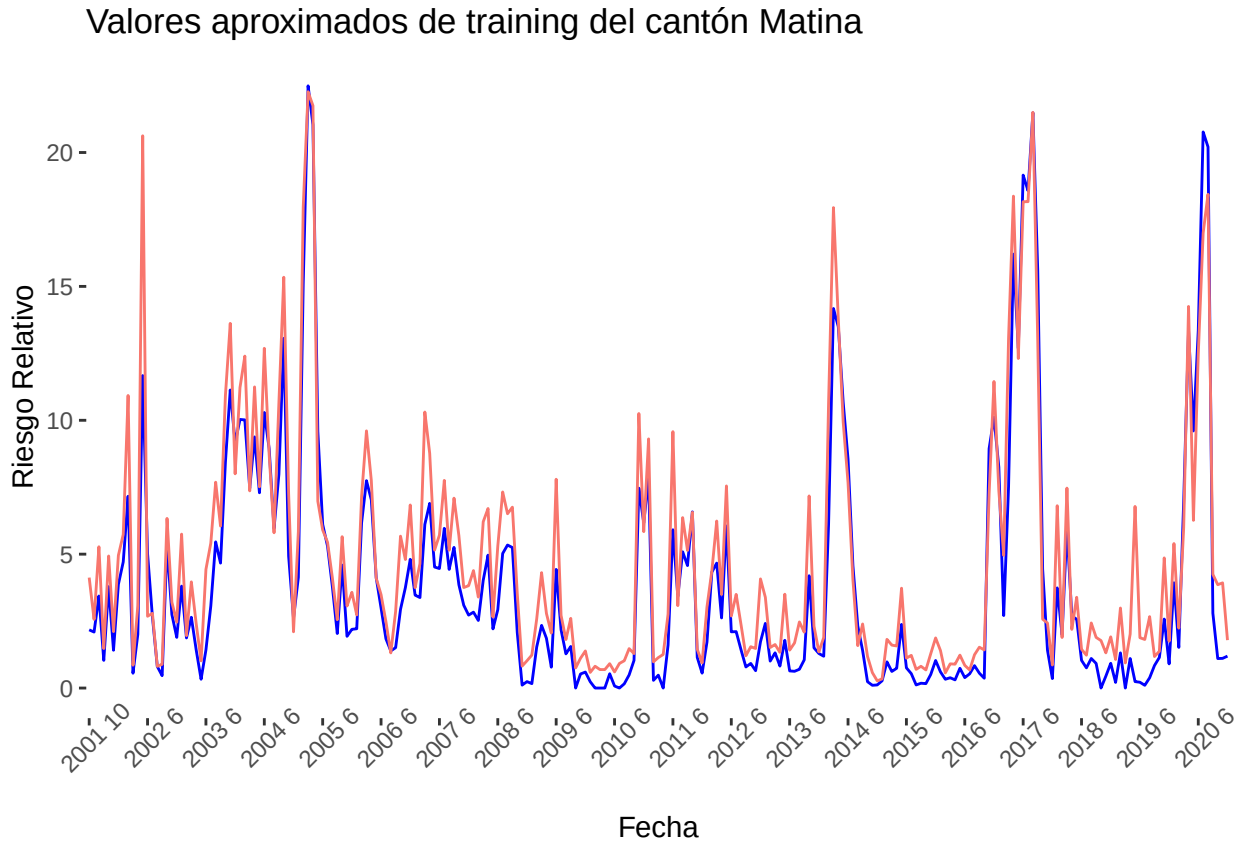
```
##
## [[13]]
```


Valores aproximados de training del cantón Liberia
Riesgo Relativo
15
10
5
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

```
##
## [[14]]
```


Valores aproximados de training del cantón Limon
Riesgo Relativo
0
5
10
15
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

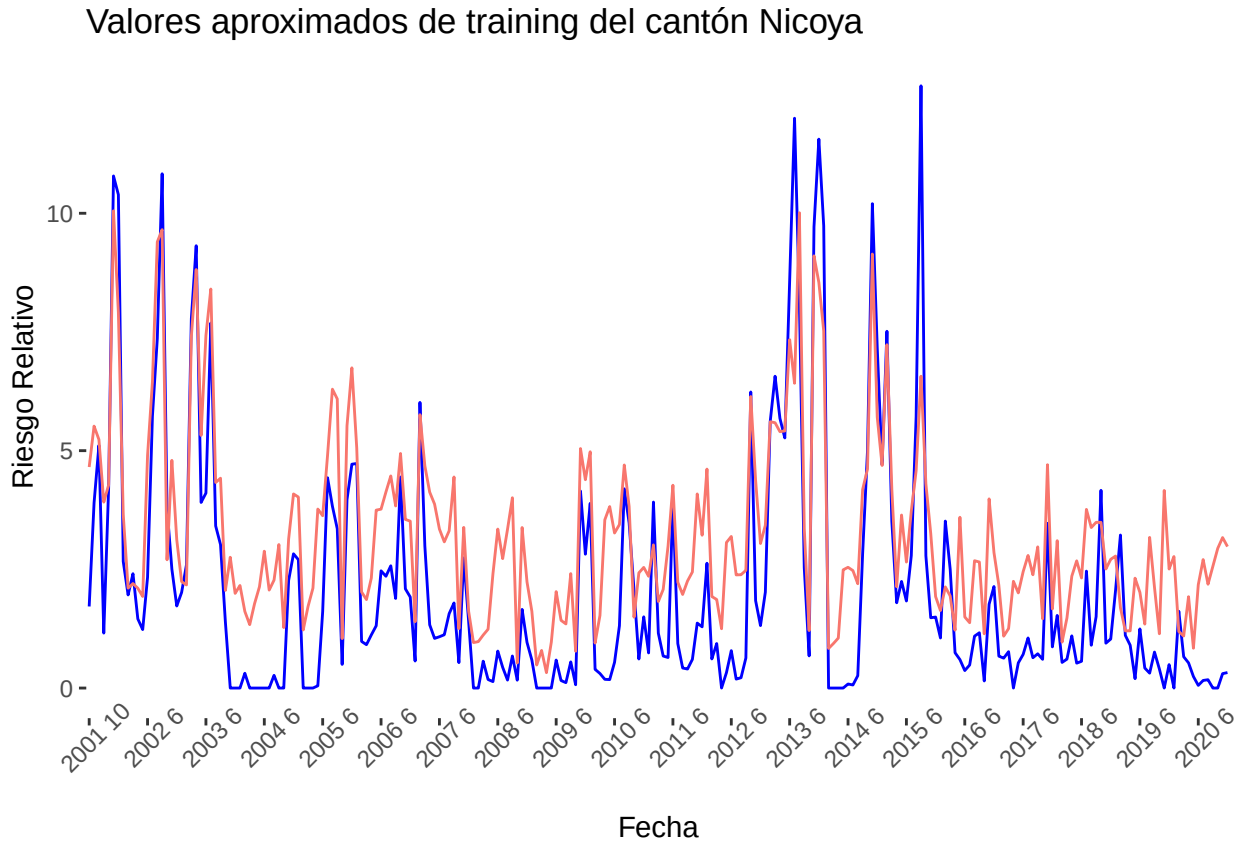
```
##
## [[15]]
```


Valores aproximados de training del cantón Matina
Riesgo Relativo
0
5
10
15
20
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

```
##
## [[16]]
```


Valores aproximados de training del cantón Montes de Oro
Riesgo Relativo
30
20
10
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

```
##
## [[17]]
```


Valores aproximados de training del cantón Nicoya
Riesgo Relativo
10
5
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

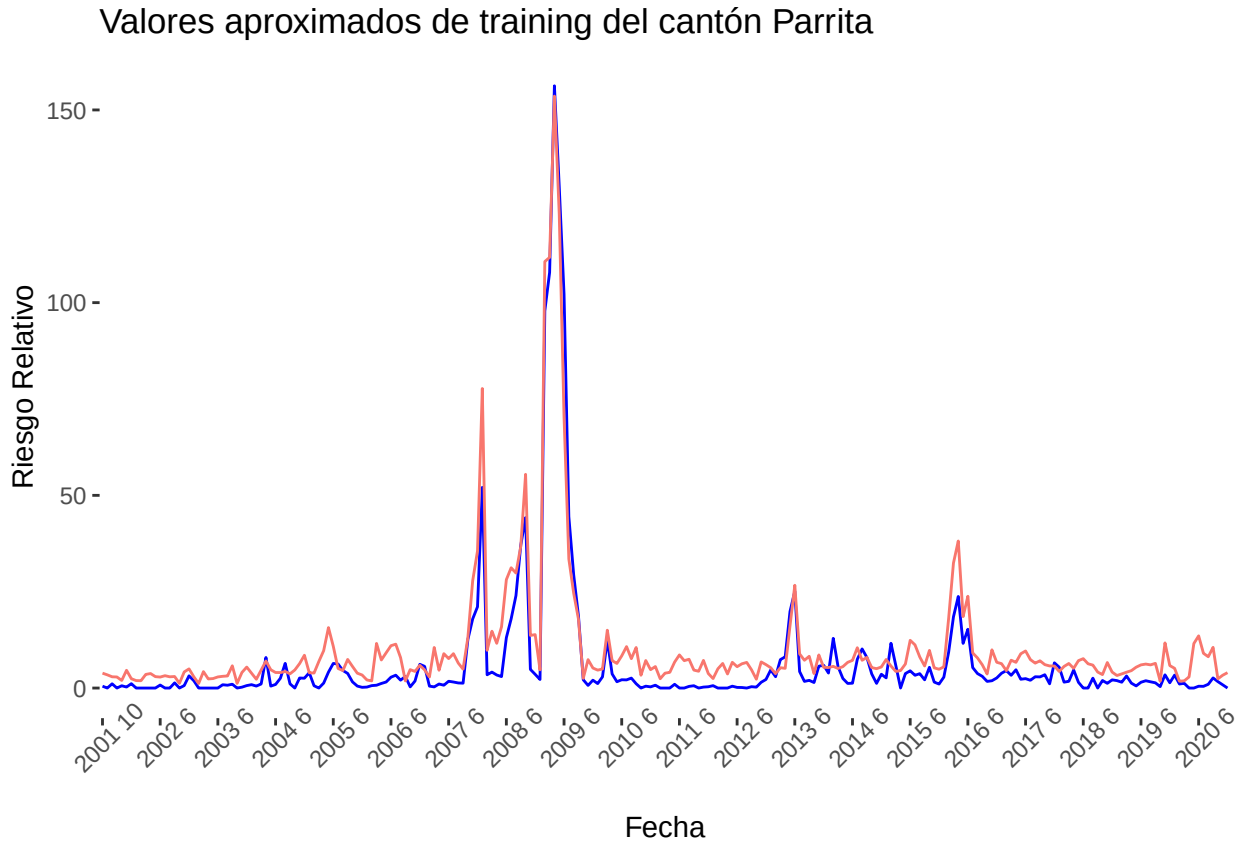
```
##
## [[18]]
```


Valores aproximados de training del cantón Orotina
Riesgo Relativo
40
20
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

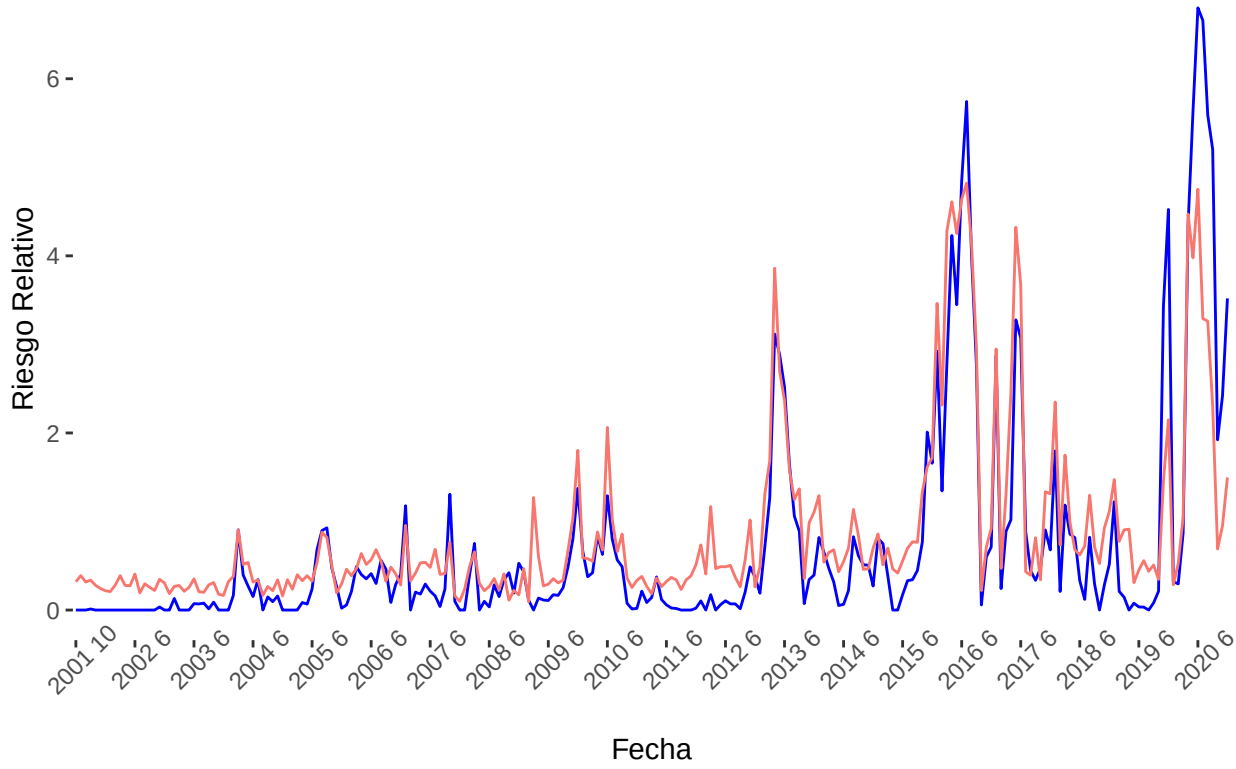
```
##
## [[19]]
```


Valores aproximados de training del cantón Osa
Riesgo Relativo
0
5
10
15
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

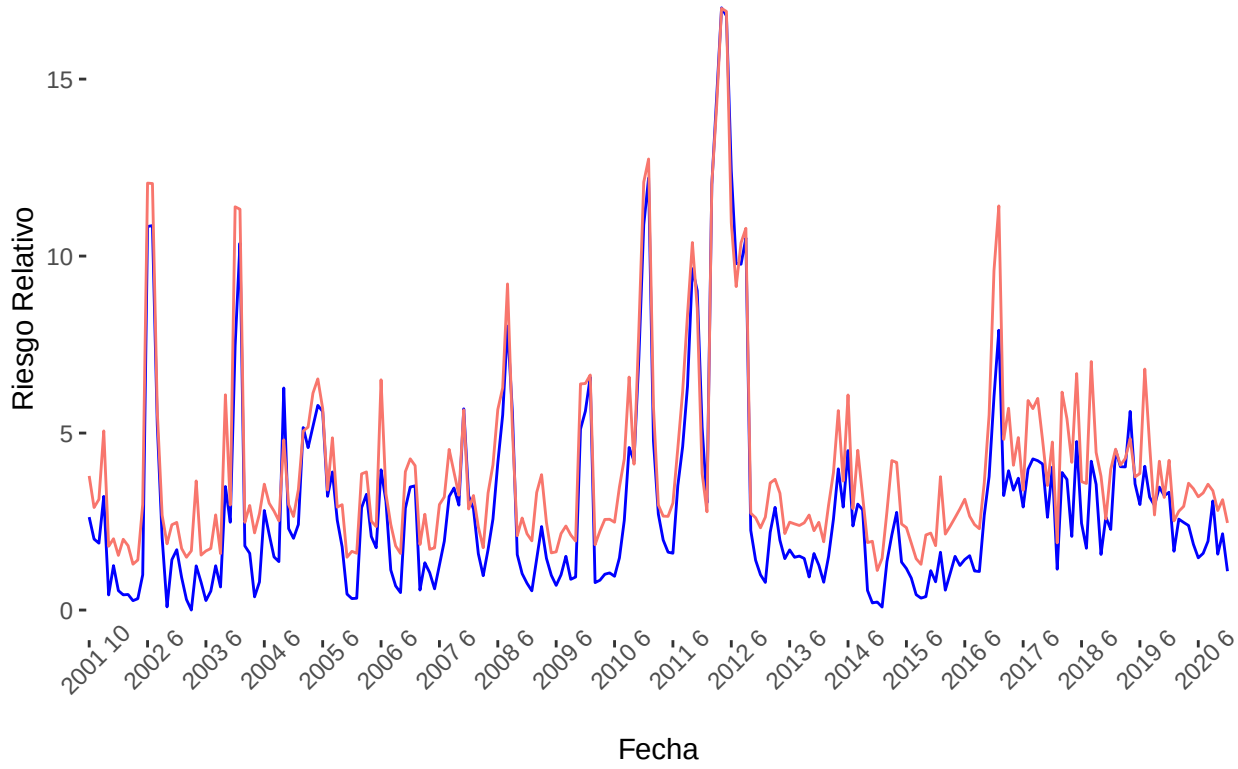
```
##
## [[20]]
```


Valores aproximados de training del cantón Parrita
Riesgo Relativo
150
100
50
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

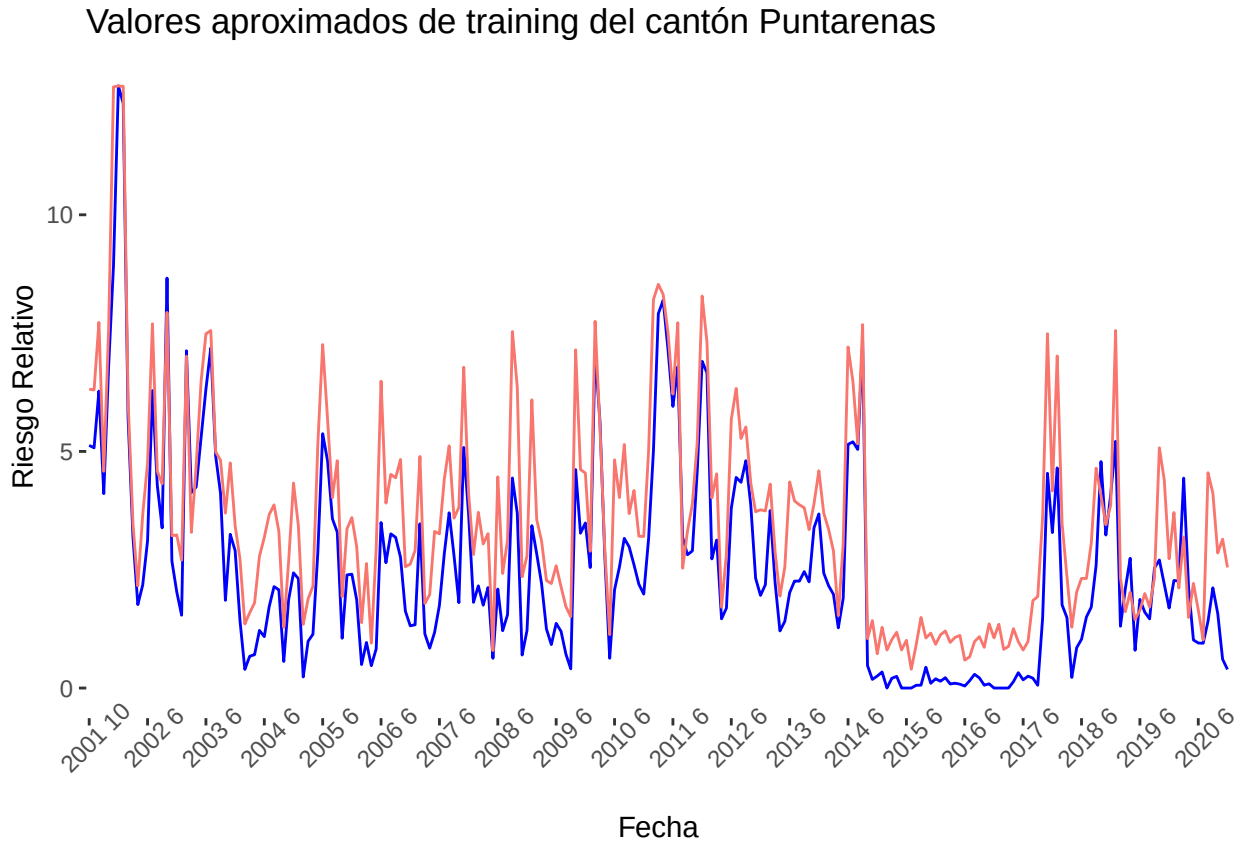
```
##
## [[21]]
```


Valores aproximados de training del cantón Perez Zeledón
Riesgo Relativo
0
2
4
6
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

```
##
## [[22]]
```


Valores aproximados de training del cantón Pococí
Riesgo Relativo
0
5
10
15
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

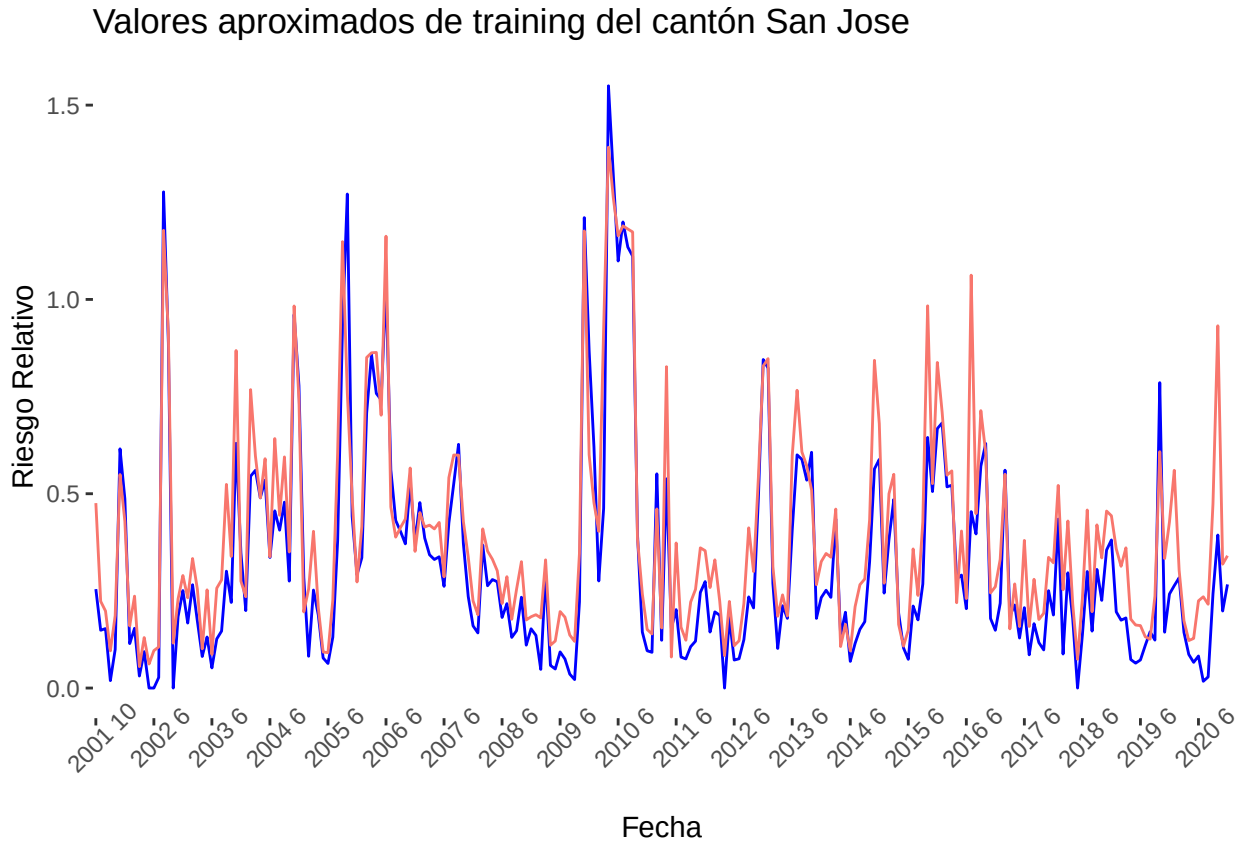
```
##
## [[23]]
```


Valores aproximados de training del cantón Puntarenas
Riesgo Relativo
10
5
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

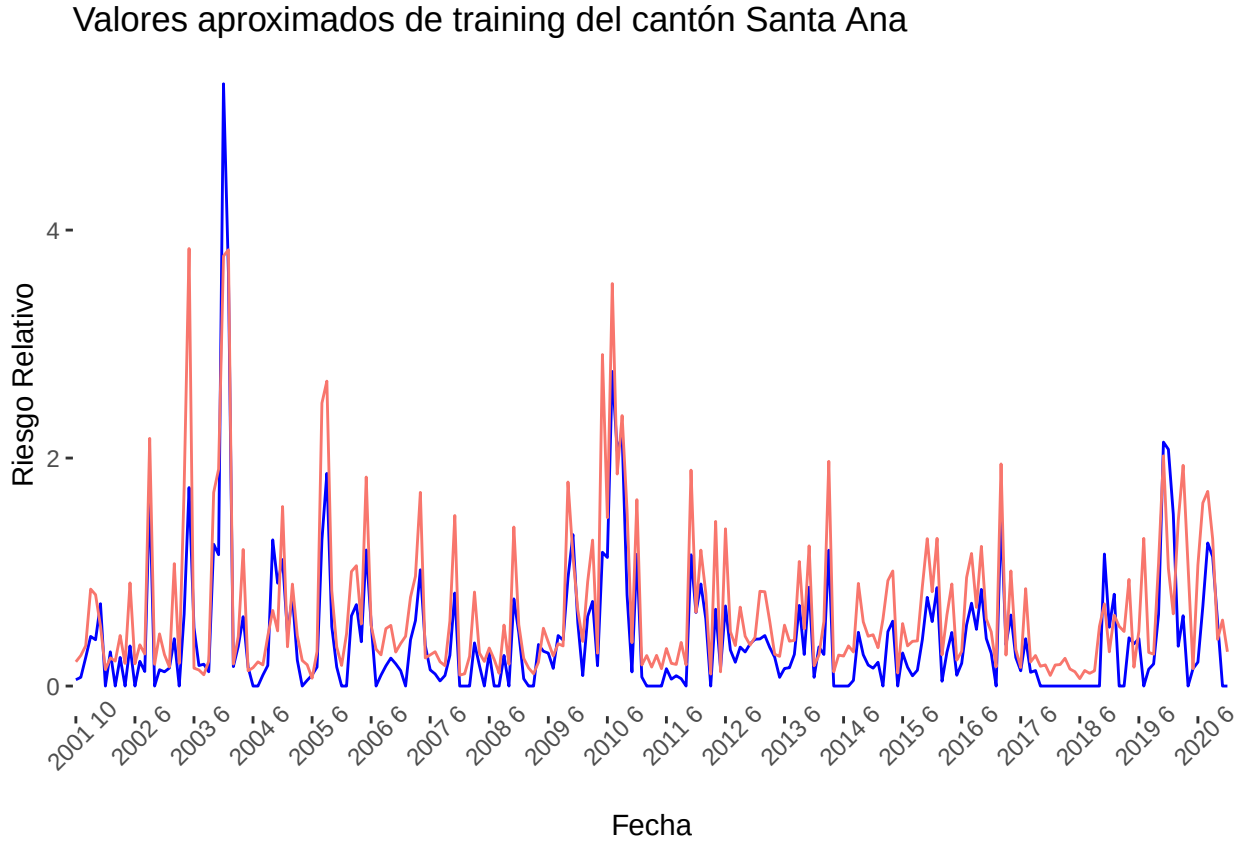
```
##
## [[24]]
```


Valores aproximados de training del cantón Quepos
Riesgo Relativo
0
20
40
60
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

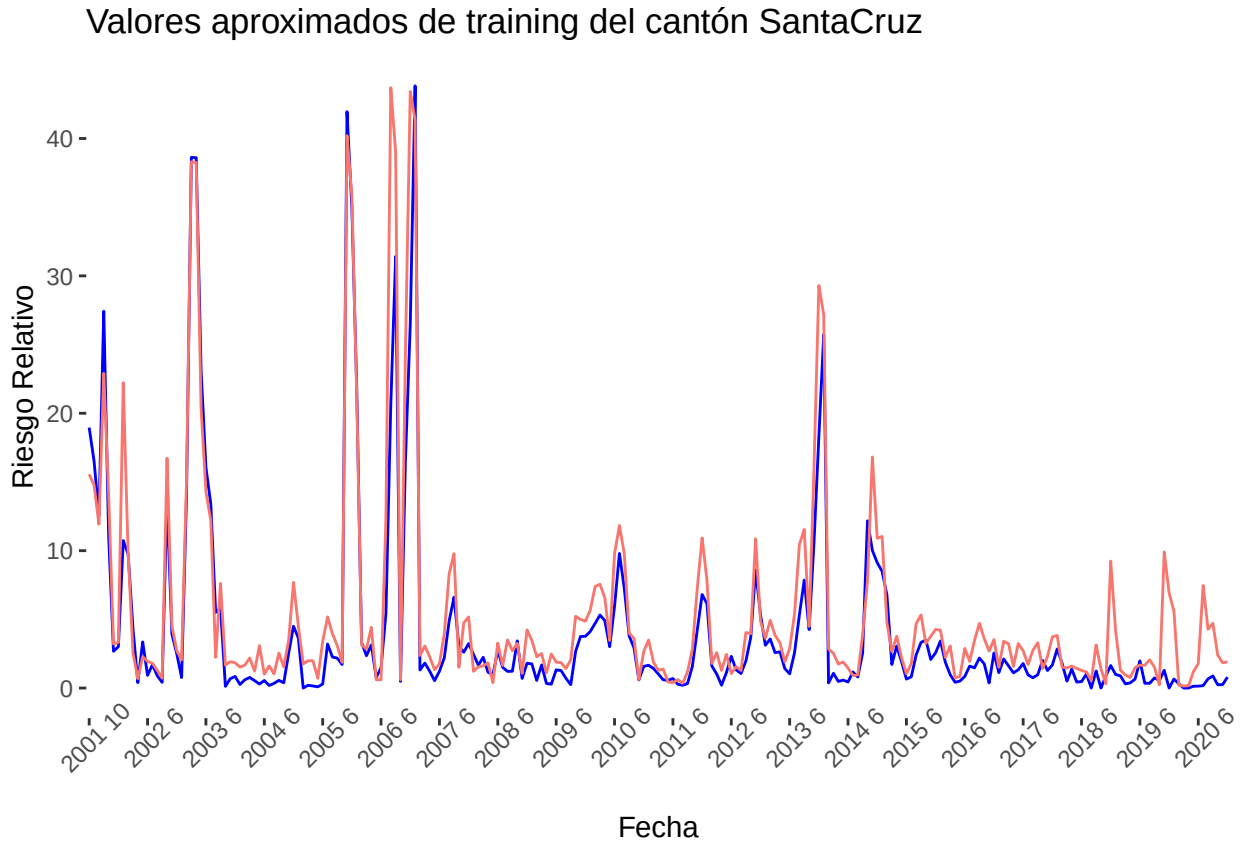
```
##
## [[25]]
```


Valores aproximados de training del cantón San Jose
Riesgo Relativo
1.5
1.0
0.5
0.0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

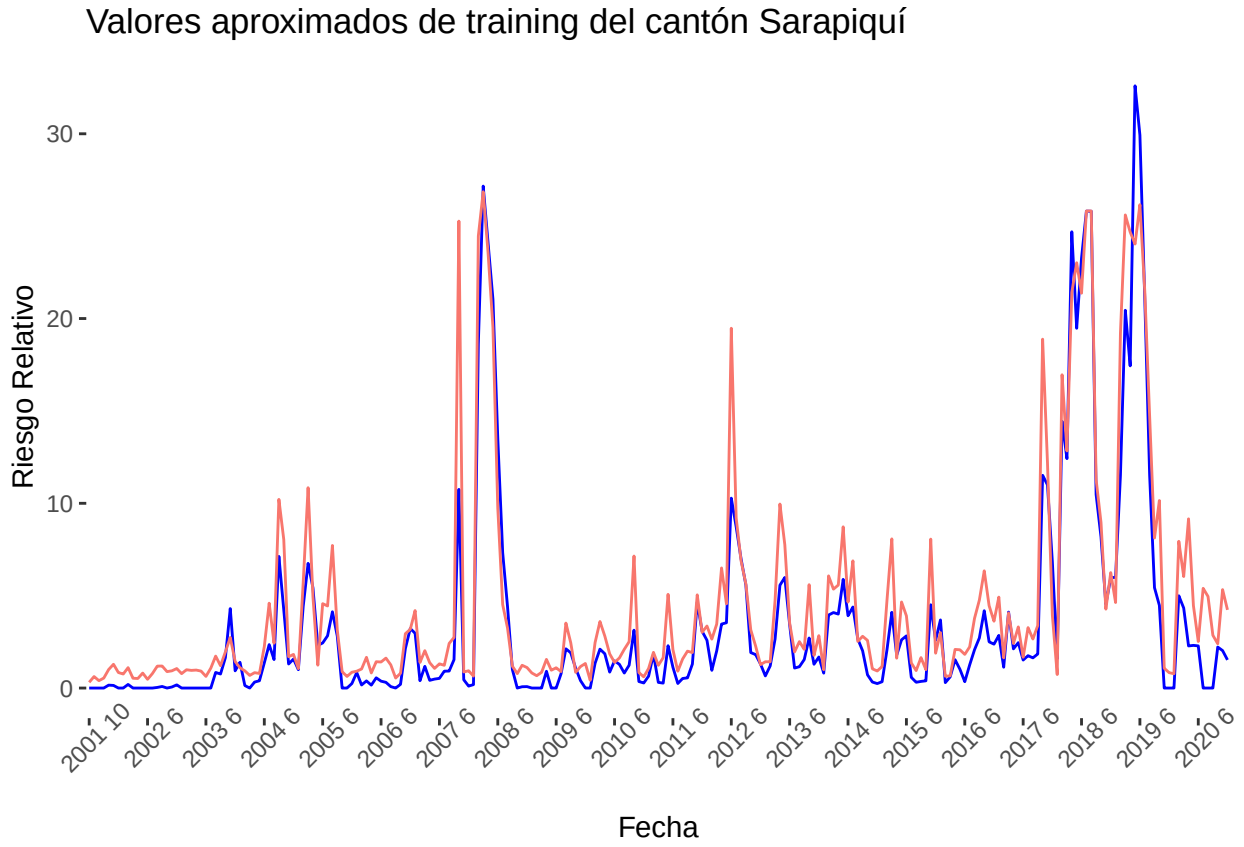
```
##
## [[26]]
```


Valores aproximados de training del cantón Santa Ana
Riesgo Relativo
0
2
4
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

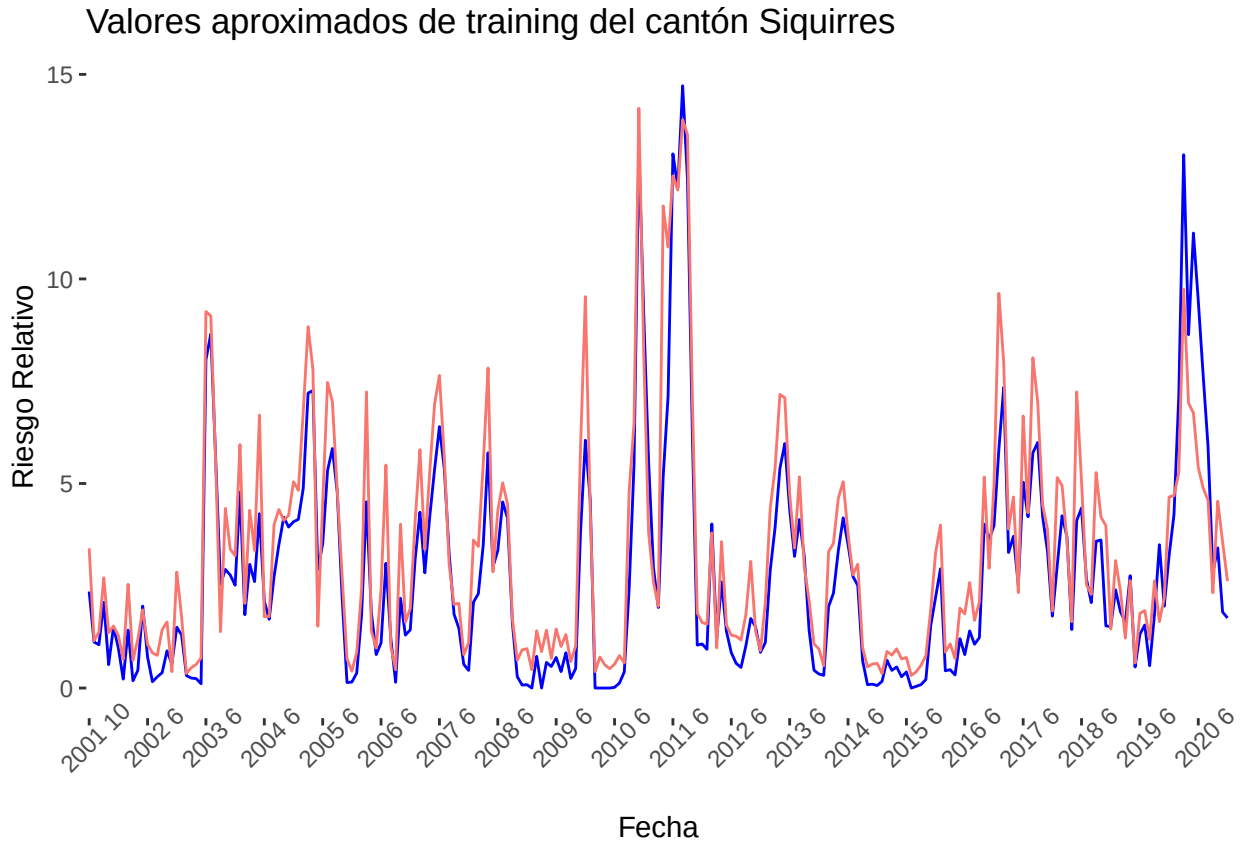
```
##
## [[27]]
```


Valores aproximados de training del cantón SantaCruz
Riesgo Relativo
0
10
20
30
40
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

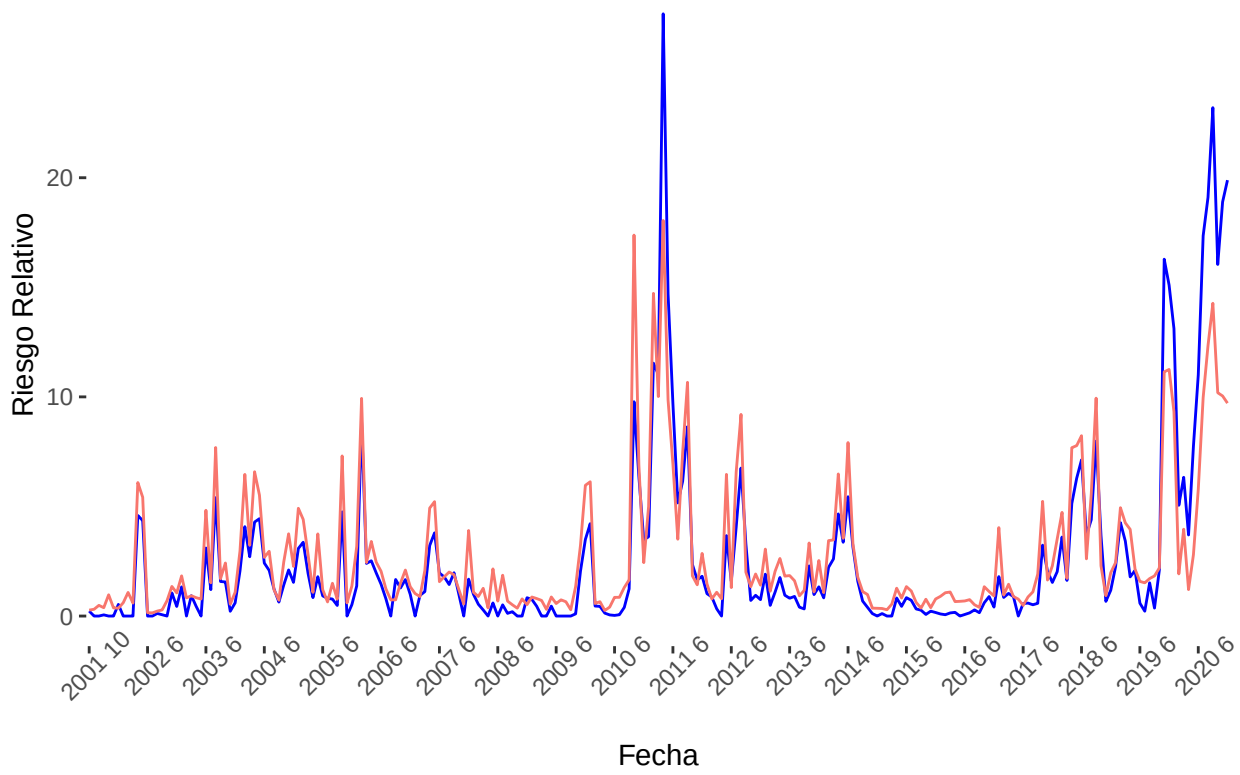
```
##
## [[28]]
```


Valores aproximados de training del cantón Sarapiquí
Riesgo Relativo
30
20
10
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

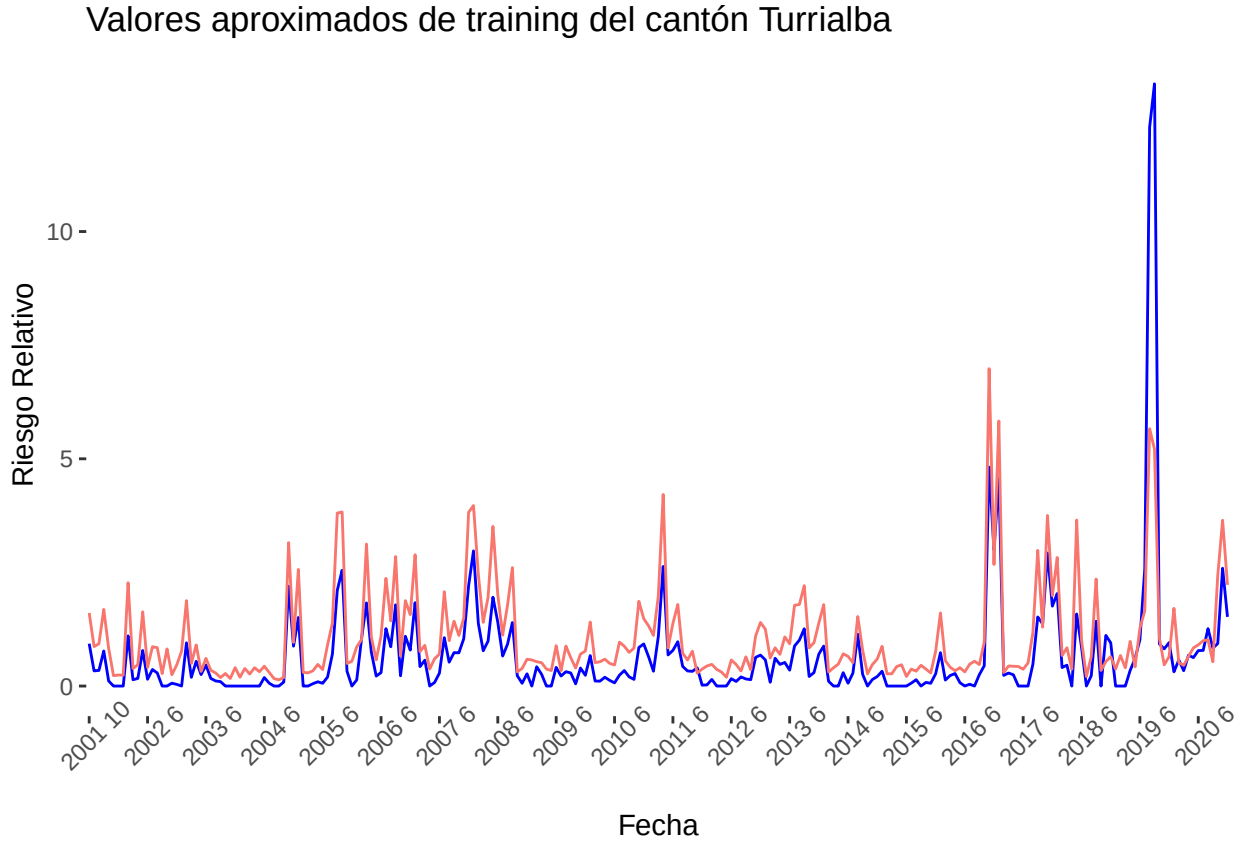
```
##
## [[29]]
```


Valores aproximados de training del cantón Siquirres
Riesgo Relativo
15
10
5
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

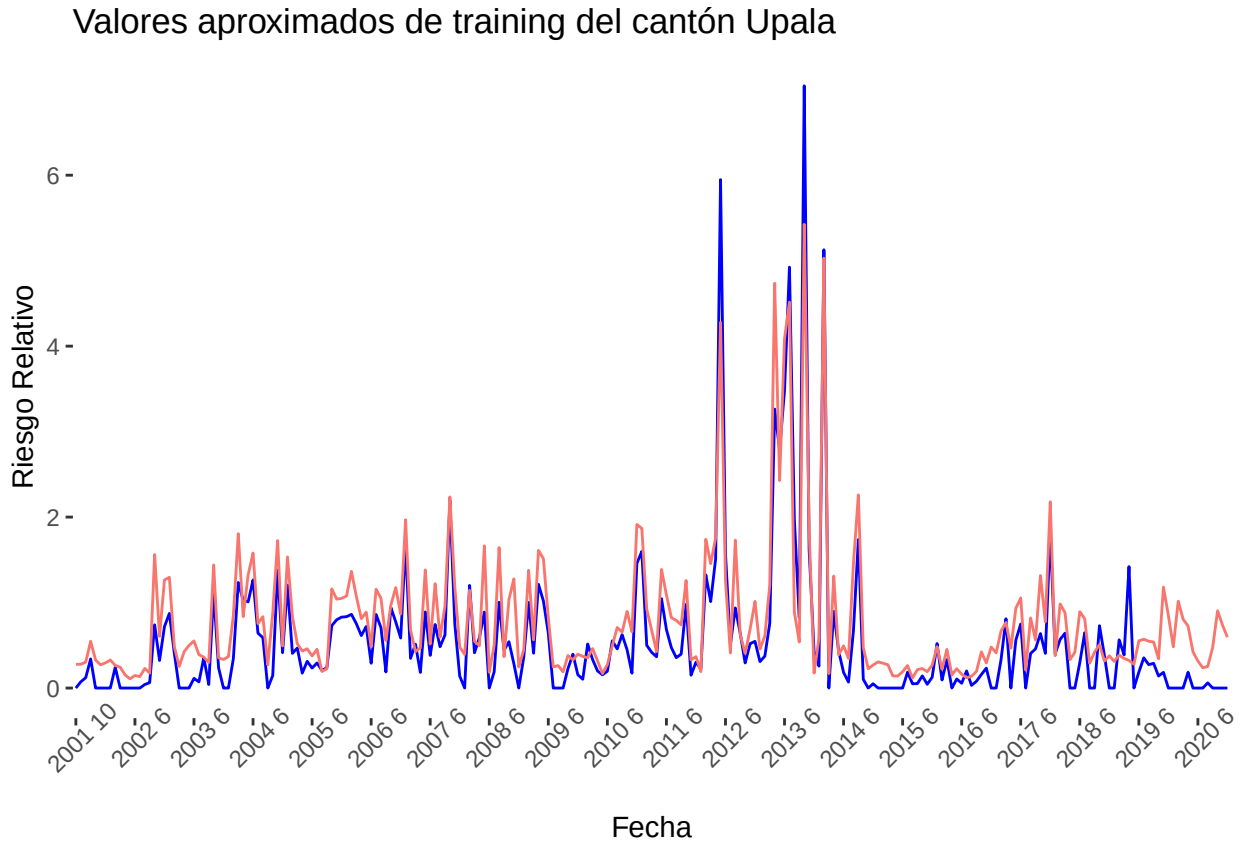
```
##
## [[30]]
```


Valores aproximados de training del cantón Talamanca
Riesgo Relativo
20
10
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

```
##
## [[31]]
```


Valores aproximados de training del cantón Turrialba
Riesgo Relativo
10
5
0
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha

```
##
## [[32]]
```


Valores aproximados de training del cantón Upala
Riesgo Relativo
0
2
4
6
2001 10
2002 6
2003 6
2004 6
2005 6
2006 6
2007 6
2008 6
2009 6
2010 6
2011 6
2012 6
2013 6
2014 6
2015 6
2016 6
2017 6
2018 6
2019 6
2020 6
Fecha