SIR model with demography

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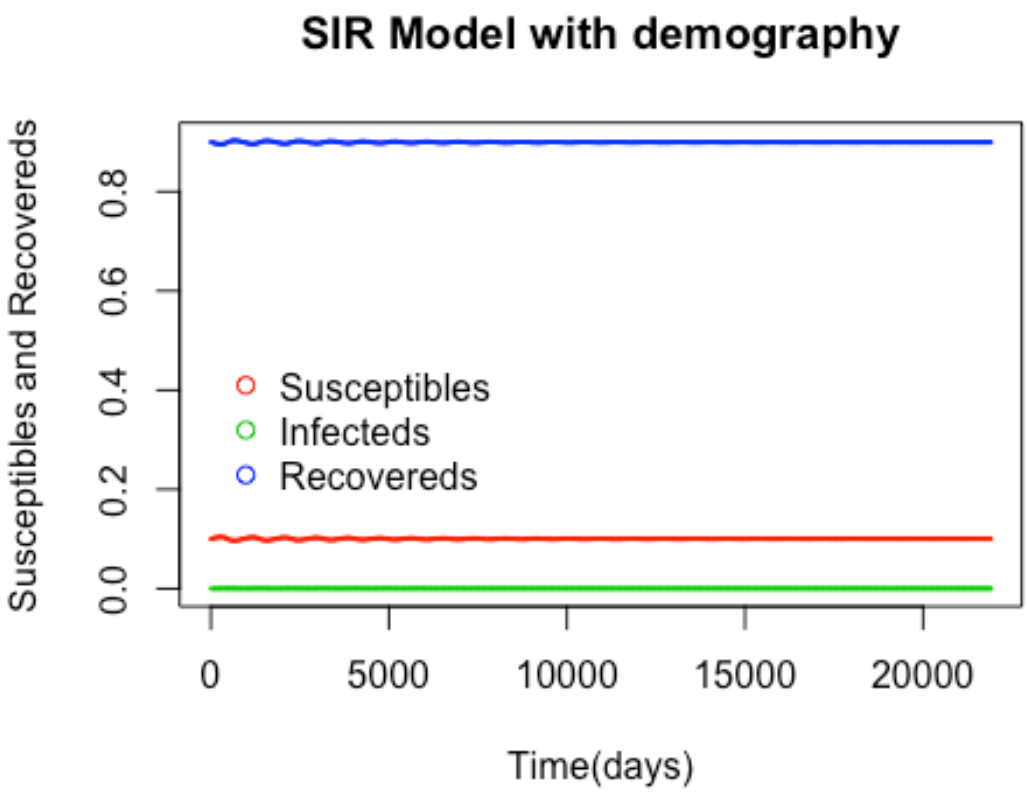
## SIR model with demography
## It is the simple SIR epidemic without births or deaths

## Parameters:
# miu: Per captia death rate, and the population level birth rate;
# beta: Product of contact rates and transmission probability;
# gamma: Recovery Rate;
# S: Proportion of the population that are susceptible;
# I: Proportion of the population that are infectious;
# R: Proportion of the population that are recovered.
library(deSolve)

SIR.demo = function(time, state, pars) {
  with(as.list(c(state,pars)), {
    dS = miu - (beta * S0 * I0) - (miu * S0)
    dI = (beta * S0 * I0) - (gamma * I0) - (miu * I0)
    dR = (gamma * I0) - (miu * R0)
    return(list(c(dS,dI,dR)))
  })
}
# condition 1
yini = c(S0 = 0.1,I0 = 1e-4,R0 = 1-0.1-1e-4)
pars = c(miu = 1/(70*365.0),beta = 520/365.0,gamma = 1/7)
times = seq(0,60*365,by = 1)


out = ode(func = SIR.demo, y = yini, parms = pars, times = times)
out = as.data.frame(out)
out$time = NULL

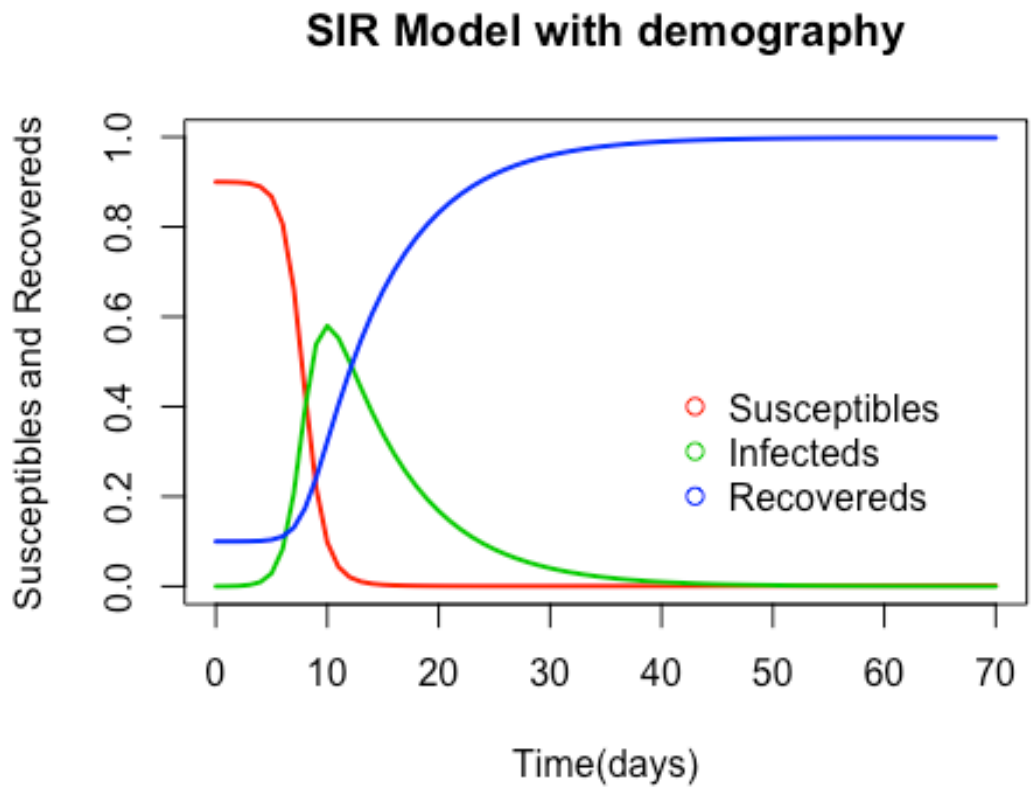
matplot(times,out,type = "l", xlab = "Time(days)", ylab = "Susceptibles and
Recovereds", main = "SIR Model with demography",
        lwd = 2, lty = 1, col = 2:4)
legend(40,0.5,c("Susceptibles","Infecteds","Recovereds"),pch = 1, col = 2:4,
bty = "n")
```


SIR Model with demography
Susceptibles and Recovereds
0.0
0.2
0.4
0.6
0.8
Susceptibles
Infecteds
Recovereds
0
5000
10000
15000
20000
Time(days)

```r
# condition 2
yini = c(S0 = 0.9,I0 = 1e-4,R0 = 1-0.9-1e-4)
pars = c(miu = 1/(70*365.0),beta = 520/365.0,gamma = 1/7)
times = seq(0,70,by = 1)


out = ode(func = SIR.demo, y = yini, parms = pars, times = times)
out = as.data.frame(out)
out$time = NULL

matplot(times,out,type = "l", xlab = "Time(days)", ylab = "Susceptibles and
Recovereds", main = "SIR Model with demography",
        lwd = 2, lty = 1, col = 2:4)
legend(40,0.5,c("Susceptibles","Infecteds","Recovereds"),pch = 1, col = 2:4,
bty = "n")
```



```r
# condition 3
yini = c(S0 = 0.9,I0 = 1e-4,R0 = 1-0.9-1e-4)
pars = c(miu = 1/(70*365.0),beta = 520/365.0,gamma = 1/7)
times = seq(0,60*365,by = 1)


out = ode(func = SIR.demo, y = yini, parms = pars, times = times)
out = as.data.frame(out)
out$time = NULL

matplot(times,out,type = "l", xlab = "Time(days)", ylab = "Susceptibles and
Recovereds", main = "SIR Model with demography",
        lwd = 2, lty = 1, col = 2:4)
legend(15000,0.5,c("Susceptibles","Infecteds","Recovereds"),pch = 1, col =
2:4, bty = "n")
```