# Model definition and implementation

The model that was implemented was a predator prey model between humans and mosquitos. Additionally the spread of malaria in a human population through mosquito bites was modelled.

For this model several assumptions were made. The first being that humans won’t be able to flee or move away from the mosquitos. As humans usually live in houses not suited for fleeing from or shutting out the plentyfull mosquito individuals. So only the moquitos will be able to move around in this model, while the humans will remain static. The mosquitos will wander around randomly along the map. Though moquitos would be able to find humans in the vicinity we assumed that the map would be big enough they would use those senses only when on the same location as the human to find its prey. Thus before then they will randomly walk around the map.To prevent our mosquitos randomly move out of the simulation, we have them bounce of the side instead of crossing it.

Additionally we assume that mosquitos only have a chance to bite humans that are in the same location as themselves. Not all bites would be succesfull and not every bite would transmit malaria [[1]](#footnote-2). Mosquitos only bite when hungry, so we also modelled a chance for mosquitos to become hungry after having eaten. So we implemented a chance of malaria transmission should a succesfull bite take place. As prevention measure that will be modelled, a insecticed net was chosen. This will make it more difficult for moquitos to reach the sleeping humans and bite them. It will be modelled by reducing the bitingsuccessrate to 20%[[2]](#footnote-3).

Finally, A population is never constant. Individuals die and as disease transmission is simulated sick individuals have a bigger chance to pass. And ofcourse sick people have a chance to recover and become immune. Once immune the human won’t spread nor be affected by the disease.

The parameters used are the following:

Initial parameters

* Width
* Height
* nHuman
* nMosquito
* initMosquitoHungry chance to be hungry when population is created
* initHumanInfected chance to be infected when population is created
* biteProb

Human parameters

* humanInfectionProb chance to get infected when bitten
* humanCureProb chance to cure and then become resistant
* humanSickDieProb chance to die from malaria
* humanDieProb chance to die in general
* Human state
  + S Susceptible
  + I Infected (and thus ill)
  + R Resistant
  + D Dead

Mosquito parameters

* mosquitoInfectionProb chance to get infected when an infected human is bitten
* mosquitoHungryProb chance to get hungry
* mosquitoHungryDieProb chance to die when hungry

for each step in time

1. move every mosquito random
2. if mosquito and human have the same location, and the mosquito is hungry, the mosquito has a chance of biteProb to bite the human.
   * For every bite ( if the malarianetsimulation is enabled, after the time set time the bite has a succesrate of 0.2, since 80% of the population is protected!)
     + When the Human is infected, the mosquito has a chance of mosquitoInfectionProb to get infected as well
     + When the mosquito is infected, the human has a chance of humanInfectionProb to get infected
     + The mosquito is not hungry anymore
3. Each mosquito has a chance of mosquitoHungryDieProb to die when hungry
4. Each mosquito has a chance of mosquitoHungryProb to get hungry
5. Every human
   * If a human is dead, respawn the human
   * has a chance of humanDieProb to die
   * If a human is infected
     + The human has a chance of humanCureProb to cure and thus become resistant
     + The human has a chance of humanSickDieProb to become dead

# Fitting the model parameters

Suggestion: 1 figure showing how one simulation proceeds over time in terms of fractions of infected/healthy/death over time, and how it settles to the real (target) value eventually. Also: a table with all parameter names and their values.

# Experiments and analysis

1-3 insightful figures.

It is important to note that your experiments and analyses should be summarized in 1-3 insightful figures. Each figure should have a caption which describes what it shows and how it is computed, such that it is more or less stand-alone and can be understood by itself. Your report’s job is to logically connect the figures and motivate them, and draw a main conclusion from them. Each plot may be a combination of subplots which are logically connected. Please keep your report concise, meaning to-the-point, and preferably limited to about 4 pages.

“between 2010 and 2015, there was an 80% increase in the use of insecticide treated nets for all population risk of malaria in sub-Saharan Africa by 80%”

Done: implement a function where 1 - 0.8 = 0.2 of the bites occur after a period of time! This corresponds with the usage of anti-mosquito nets.

1. <https://www.imperial.ac.uk/news/176909/malaria-infection-depends-number-parasites-number/> [↑](#footnote-ref-2)
2. <http://www.who.int/features/factfiles/malaria/en/> [↑](#footnote-ref-3)