PLANNING

Make decisions about:

* What is the purpose of the project
* What is the goal of the project (how the output will look like)?
* What are the inputs that I need for the model?
* Classification of life stages (will use it when I make the model more realistic) (literature search)
* Model
* Assumptions of the model

R-CODING

* Generate a dummy community at year 0 with 4 species and 4 life stages (seed, seedling, sapling, adult) each species has 100 individuals in each life stage
* Generate array of matrices of parameters for each species
* Matrix multiplication
* Generate a function that takes the input and calculate the output
* Generate a function that look through the output and report a community structure at a specific time

“BELLS & WHISTLES”

* Make it more realistic
* More detail when I get here

**DETAIL**

PLANNING

Purpose of the project: To develop a model projecting the forest community structure in the future

Output that I am aiming for: an array with matrices of populations structure of different species as components

For example: If the community has s species, the output will be an array with s matrices, each matrix has t rows (t = time (year)) with four columns reporting number of individuals in each stage (seed, seedling, sapling, adult). Below is the first component of the array: the population structure of species 1

[ , , 1]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | seed | seedling | sapling | adult |
| 1 | Ns11 | Nsl11 | Nsa11 | Na11 |
| 2 | Ns12 | Nsl12 | Nsa12 | Na12 |
| … | … | … | … | … |
| T | Ns1t | Nsl1t | Nsa1t | Na1t |

Ns11 = Number of seeds of species 1 at year 1

Nsl12 = Number of seedling of species 1 at year 2

Inputs for the model

1. Matrix of community structure at time 0, columns are life stages and rows are species

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | seed | seedling | sapling | adult |
| 1 | Ns10 | Nsl10 | Nsa10 | Na10 |
| 2 | Ns20 | Nsl20 | Nsa20 | Na20 |
| … | … | … | … | … |
| s | Nss0 | Nsls0 | Nsat0 | Nat0 |

1. Matrix of transition rates of each species in the community

Seed : germination rate (Gs) \*\*(1-Gs = mortality rate(Ms))

Seedling : mortality (Msl), transition rate (Gsl) \*\*

Sapling : mortality (Msa), transition rate (Gsa)

Adult : mortality (Ma), Reproduction rate (Ra), Maximum size

Ns1 = Na0\*Ra

Nsl1 = Nsl0 - Nsl0\*Msl + Ns0\*Gs

Nsa1 = Nsa0 – Nsa0\*Msa – Nsa0\*Gsa + Nsl0\*Gsl

Na1 = Na0 – Na0\*Ma + Nsa\*Gsa

The matrix will have 7 columns for 7 parameters and n rows for n species

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Ra | Gs | Msl | Gsl | Msa | Gsa | Ma |
| sp1 | Ra1 | Gs1 | Msl1 | Gls1 | Msa1 | Gsa1 | Ma1 |
| Sp2 | .. | .. | .. | .. | .. | .. | .. |
| spn | Ran | Gsn | Msln | Gsln | Msan | Gsan | Man |

1. Time (t)

Model

Community at time t+1 = community at time t \* transition matrix

Assumptions

There is no dormancy

Only adult produces seeds

R-CODING

1. Generate dummy community matrix at time 0 with 4 species as rows and 4 life stages as columns each species has 100 individuals in each life stages

t0.com = matrix(data=100,nrow=4, ncol=4)

1. Generate dummy transition rate matrix with 7 rates as columns (Ra, Gs, Msl, Gsl, Msa, Gsa, Ma) and 4 species as rows (4x7)

Ra

Each trees produce between 100 seeds to 1000 seeds

sample(100:1000, )

Msl, Msa, Ma

As survival curve of trees is type III then 1-Gs (Ms rate) >>>Msl>>Msa>Ma

Gs, Gsl, Gsa

1. Create function that takes given transition rate of each species and turn it into a 4x4 matrix (transition matrix)

|  |  |  |  |
| --- | --- | --- | --- |
| 0 | Gs | 0 | 0 |
| 0 | 1-Msl | Gsl | 0 |
| 0 | 0 | 1-Msa-Gsa | Gsa |
| Ra | 0 | 0 | 1-Ma |

2. Create the function that takes the 4x7 matrix containing transition rates and produce an array containing transition matrix (4x4) of each species

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Ra | Gs | Msl | Gsl | Msa | Gsa | Ma |
| sp1 | Ra1 | Gs1 | Msl1 | Gls1 | Msa1 | Gsa1 | Ma1 |
| Sp2 | .. | .. | .. | .. | .. | .. | .. |
| spn | Ran | Gsn | Msln | Gsln | Msan | Gsan | Man |