Group 2 - Mathematica Models

Exponential population growth

$$N_t = N_0 e^{rt}$$

Where:

N = population size

N_0 = population size at start

N_t = population size at desired time

t = time

e = base of natural logarithm (2,718)

r = rate of increase

r is calculated by: r = b – d

where b is birth rate (births / N)

d is death rate (deaths / N)

r dictates the growth in population. If r>0 population will grow, if r=0 population will stall, if r<0 population will decrease

- L.V. Competition Model is necessary as well. And maybe gender (ch. 3?)
- Math mainly with Koos

Pg 4 in th TB Read!

Source?

Explanations?

Group 2 – App Feature List V3

1. Herbivores in each category can be shown or hidden/Competitors in each category can be shown or hidden. → function
2. Select what prediction to display, and the time frame to display, in the graph. → too small; function
3. Add/Edit/Remove data/parameters. → vague
4. Setting all parameters for the application.
5. Displaying a table with predictions.
6. Using alternative models.
7. Showing the ~~output~~ prediction in a graph.
8. Making the app maintainable for updates/improvements. → wish, intention. QA.

1. Introduction

Mathematical engineering is based on developing application models for making predictions and find desirable solutions to real-life problematic situations. While working towards the development of an application, one comes across several challenges which fluctuates the approach of development. Challenges can be encountered when determining the model of the application, due to the observation and collection of data which is relevant to use as variables in a mathematical formula. Thus, parameters are going to be divided into categories such as the essential and trivial factors, then later implemented to improve the model. Therefore, due to the level of complexity that the model may hold it is mandatory to not only implement an application which gives as an output statistical numbers but visuals as well, such as graphs.

1.1. Context

Oostvaardersplassen, a persevered ecological system, which has many animals living there including the main three large herbivores: wild horses, wild cattle, and deer; and other foremost species such as geese and birds of prey. Conjecting that no major predators are present in the ecological system and the herbivores prohibited migration, unbalance has been settled in the Oostvaardersplassen preservation.

Complicating the situation is the fact that there are a lot of geese, particularly during winter, and they consume the same type of food as the large herbivores do. The competition and interact between the herbivores and the geese for food can be quite severe, leading some to extreme situations such as death.

Extremly short

1.2. Purpose

The purpose of this project is to work towards a possible solution of a problem taken from an existing ecological system, Oostvaardersplassen. Based on a mathematical model for the system and an application doing the number crunching to graphically illustrate the predicted effects of the proposed measures on the ecosystem.

2. Project planning

Planning not in report!

2.1. Role division

Project Lead: Stephen Adu

Documentation/Archivist: Tal Buaron

Research Lead: Jens Domela Nieuwenhuis

Coding Lead: Andrej Cholodov

All team members will help with all aspects within the project, but the names mentioned above will be in charge of ensuring that the work is being done correctly and in a timely manner.

2.2. Work Division

Name	Position
Adu, Stephen	UML[1] modeling
Andreicha, Semida	Coding
Buaron, Tal	Coding
Cholodov, Andrej	Research mathematical equations
Domela Nieuwenhuis, Jens	Data collection

2.3. Contact information

Not repat

- Development version control
  - GIT;
- Communication between members:
  - Skype;
  - If necessary, meeting on any day of the week, to discuss the agenda for the next meeting with the project coach on Friday.
- Communication with project coach:
  - Each class meeting on Friday;
  - If necessary, meeting by appointment.

In this part the details of parties involved in the project are listed, as well as the ways of communication and meeting schedule.

Name: Harald Drillenburg
E-mail: harald.drillenburg@inholland.nl
Meeting Schedule: Every Friday face to face.

Name: Koos van Tubergen
E-mail: koos.vantubergen@inholland.nl
Meeting Schedule: Every Friday face to face.

Name: Adu, Stephen
E-mail: E-mail: 572481@student.inholland.nl
Skype: reall.blue
Meeting Schedule: Every Friday face to face, and on social media any time.

Name: Andreicha, Semida
Contact: E-mail: 570027@student.inholland.nl
Skype: semida.andreicha
Meeting Schedule: Every Friday face to face, and on social media any time.

[1] UML - Unified Modeling Language (**UML**) is a general-purpose, developmental, modeling language in the field of software engineering, which intends to provide a standard way to visualize the design of a system.

Name:	Buaron, Tal
Contact:	E-mail: 572481@student.inholland.nl Skype: flika205
Meeting Schedule:	Every Friday face to face, and on social media any time.
Name:	Cholodov, Andrej
Contact:	E-mail: 572481@student.inholland.nl Skype: kashmir25i
Meeting Schedule:	Every Friday face to face, and on social media any time.
Name:	Domela Nieuwenhuis, Jens
Contact:	E-mail: 566536@student.inholland.nl Skype: ojdomela
Meeting Schedule:	Every Friday face to face, and on social media any time.

3. Central research question and sub-questions

3.1. Research question

Main Research Question of the project:

> What will happen to the populations of deer, cattle, horse and geese if releasing a number of foxes in the preserve (with the number of foxes being the free variable).

Main Research Question for this research paper:

> How do the herbivores and the geese compete for the grass in an enclosed area?

3.2. Research sub-questions

Sub-Research Questions for this research paper:

1. What is the rate of grass consumption of each animal?
2. How do animal populations change as a result of grass availability?
3. What are the populations of each animal?
4. What is the start data and what do we know from historical data?
5. Which existing mathematical models can fit to our problem?
6. How can we implement what is being asked?

have model ↓ design #6

4. Project Plan (Iterations)

4.1. Feature list

Features
1. "Print friendly" option
2. Multi-browser compatible
3. Herbivores in each category can be shown or hidden/Competitors in each category can be shown or hidden
4. Select what prediction to display, and the time frame to display, in the graph
5. Add/Edit/Remove data/parameters
6. This is what he suggested
7. Setting all parameters for the application
8. Displaying a table with predictions
9. Using alternative models
10. Showing the output in a graph (not in a graphical interface, it could be printed!)
11. Making the app maintainable for updates/improvements

4.2. Iterations

This section describes the scope of the project, the expectations of the tasks and the parties involves. The MoSCoW[1.1] is a business requirements technique that is used to describe in this sections with following contexts:

MUST (M)

Defines a requirement that has to satisfy for the final solution to be accepted.

SHOULD (S)

This is a high priority requirement that should be included if possible within the delivery time box. Workarounds may be available for such a requirements and they are not usually considered time-critical or must-haves.

COULD (C)

This is desirable or nice-to-have requirement but the main solution is still accepted even if this functionality is not included in the final project.

WOULD (W)

This represents requirement that the stakeholders want to have implemented but agreed that it will not be implemented in the current version.

Iteration	MoSCoW
Find the amount of grass the herbivores eat.	MUST
Find the aggregate of grass eaten by geese.	MUST
Convert fauna to quantity.	MUST
Determine the interaction between herbivores when it comes to food.	SHOULD
Encounter the interaction of herbivores with geese when it comes to food.	SHOULD
Figure how food consumption change during winter/summer.	COULD

5. Research Methodology

This research paper explores the competition for food, taking place between herbivores and geese, in an enclosed ecosystem, Oostvaardersplassen. By means of collecting data and modeling equation based on the data, the research will then attempt to provide an accurate prediction based on fluctuating data. The **Data collection** is based on the information found on the Website of Oostvaardersplassen[2.2], which is related to the numbers of herbivores and geese during different seasons, the amount of grass they eat, death rate and any other related data.

The **Equation research** part, is mostly focused on the equations of the grass growth, transforming grass amount into actual weight so comparison can be made to the amount of food the herbivores and geese are eating. Literature add a sentence

Once the data collection process and equation research will be finalized, the creation of the application model will begin. By creating class models of UML will help to visualize how the application will look like and what it should do. As soon as, the UML model for the application will be completed the focus then

Methodology per subquestion

turns to the back-end work, implemented using Java. After having the engine and the whole map of the Oostvaardersplassen in program, the application will then display in a GUI, by JavaFX.

During the project development several limitations may occur, that could harm the final result of the application. Some of those **Limitations** for this research are the time frame which project needs to be finished. The information availability constraints which might be lacking data or not accurate at all. Another challenge is the interdependence on the other group that is investigating relating variable .This research is limited scope to Oostvaardersplassen.

6. Results

7. Conclusion

8. Recommendations

9. Bibliographies

1.1 MoSCoW Analysis (6.1.5.2)". A Guide to the Business Analysis Body of Knowledge (2 ed.). International Institute of Business Analysis. 2009.

2.2 Startpagina Staatsbosbeheer. Het zit in onze natuur. (n.d.). Retrieved November 23, 2016, from https://www.staatsbosbeheer.nl/

10. Appendices

↑ add the Book ←