Beech forest dynamics

A simulation

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#render this file as follows  
# render(rmarkdown::word\_document("./Davidson\_2019\_Simulation.Rmd"))

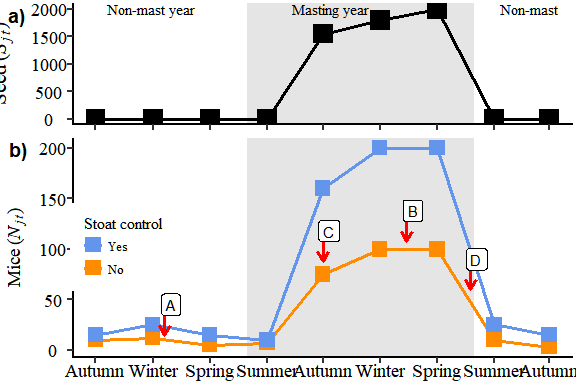
This simple simulation model generates Figure 1 of this publication. This figure explains how I expect population dynamics to ’deterministically work’play-out" given our current understanding of Beech forest dynamics (Choquenot and Ruscoe 2000; Ruscoe, Goldsmith, and Choquenot 2001; Blackwell, Potter, and Minot 2001; Blackwell et al. 2003; Ruscoe et al. 2005; Tompkins and Veltman 2006 @ tompkins2013; Holland et al. 2015; Latham et al. 2017), primarily seed availability (Figure 1).

## Setup

knitr::opts\_chunk$set(comment=NA,  
 fig.path = "../figs/",  
 echo=FALSE,  
 message=FALSE,   
 warning=FALSE)  
  
# how do I do this??  
# ,eval = FALSE,include = FALSE  
  
library(citr)  
# citr::md\_cite("Beech-forest.bib")  
# bib(file = "Beech-forests.bib")

# Overview

New Zealand beech forests exhibit boom-bust dynamics orginally (after many edits looks like this vignette and Figure 1 below.



Each arrow and label represents a prediction we tested (Prediction B to D). Each prediction represents a collection of previous studies that have suggested how mouse populations may respond to seed availability in the presence or absence of stoats. A) during the years when no seed is available (non-mast years; Panel A); B) at the peak of mouse abundance (winter or spring); C) the season when mice populations are responding rapidly to increasing seed abundance (summer to winter in mast years; Panel B); D) when mouse abundance declines (spring to summer; Panel B). The top panel represents the average seed availability cycle in New Zealand Native Beech Forests between non-mast (no shading) and mast years (shaded grey). The bottom panel represents the expected response of mouse abundance () to the variation in seed availability ($Seed\_{j,t}) above where solid yellow symbols represent locations where stoats are un-controlled

Where, beech trees mast in spatial synchronised but annually variable years dependant (Wardle 1991). Mice populations have invaded these systems and studies have shown that populations response numerically to changes in resources (beech seed) and mice have been modelled under a range of both functional and numerical responses (King 1983).

# Introduction

I have made a very simple simulation of the expected relationships from the literature. *For more detail see thesis drafts* [*here*](https://www.ssnhub.com/phd-thesis/)*.*

## Season

## Mouse Abundance

#Abundance  
no.stoats <- c(25,15,25,15,10,160,200,200,25,15,25,20)  
stoats <- c(12,10,12,5,7,75,100,100,10,3,5,4)

## Beech Seed

#seed  
beech.seed <- c(0,0,0,0,0,rnorm(1,1550,1),rnorm(1,1800,1),rnorm(1,2000,1),0,0,0,0)  
lcl.seed <- c(0,0,0,0,rnorm(1,10,2),rnorm(1,1000,50),rnorm(1,3000,100),0,0,0,0,0)  
ucl.seed <- c(0,0,0,0,rnorm(1,190,10),rnorm(1,3000,50),rnorm(1,5000,100),0,0,0,0,0)  
stata <- seq(1,12,1)

## Stoat control

#control <- as.factor(c(rep(c("no.stoats"),4),rep(c("stoats"),4)))  
control <- factor(rep(1,12))  
# kable(table(control))

## Date

#date  
date <- as.Date(as.character(c("1999-02-01","1999-05-01","1999-08-01","1999-11-01",  
 "2000-02-01","2000-05-01","2000-08-01","2000-11-01",  
 "2001-02-01","2001-05-01","2001-08-01","2001-11-01")))

### Labelling

#date  
date <- as.Date(as.character(c("1999-02-01","1999-05-01","1999-08-01","1999-11-01",  
 "2000-02-01","2000-05-01","2000-08-01","2000-11-01",  
 "2001-02-01","2001-05-01","2001-08-01","2001-11-01")))

## Create dataset

It is always nice to export csv data with meaningful labels.

### Labelling

labels1 <- c("Summer", "Autumn", "Winter", "Spring", "Summer", "Autumn", "Winter", "Spring")  
  
labels2 <- c("", "", "Non-mast year", "", "", "", "Mast year", "")

## Build dataset

### Save data

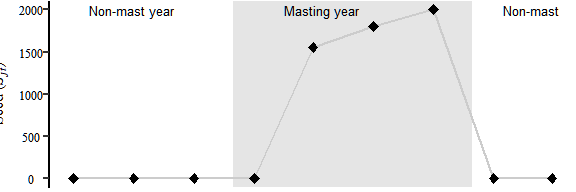
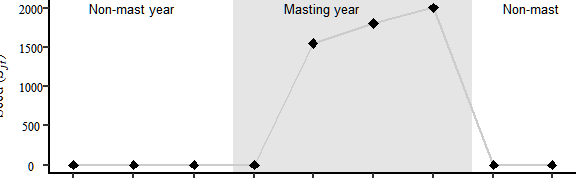
# Results

### Plot data

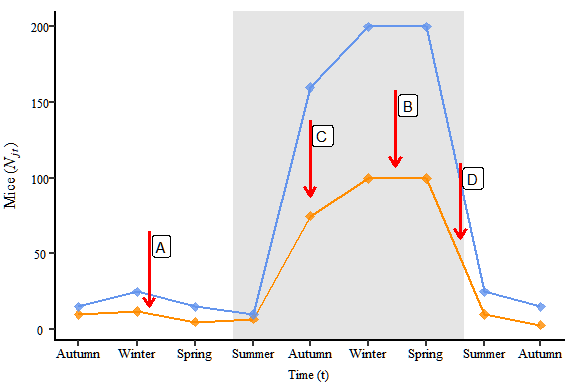
### Plot symbols/labels

# build points data  
# tibble my life  
arrow.length <- 40  
touchoff.distance <- 10 # distance between data and start of arrow  
arrowhead.size <- 3 # in millimeters  
time.loc <- as.character()  
  
# "1999-09-31", "2000-05-31", "2000-07-31", "2000-12-31"  
  
points.dat <- tibble(  
 prediction = as.factor(c("A", "C", "B", "D")),  
 value = as.numeric(c(15, 88, 108, 60)),  
 date = as.Date(c("1999-08-20", "2000-05-01", "2000-09-13", "2000-12-25")))  
  
# c("1999-02-01","1999-05-01","1999-08-01","1999-11-01","2000-02-01","2000-05-01","2000-08-01","2000-11-01", "2001-02-01","2001-05-01","2001-08-01","2001-11-01")

### Seed plot

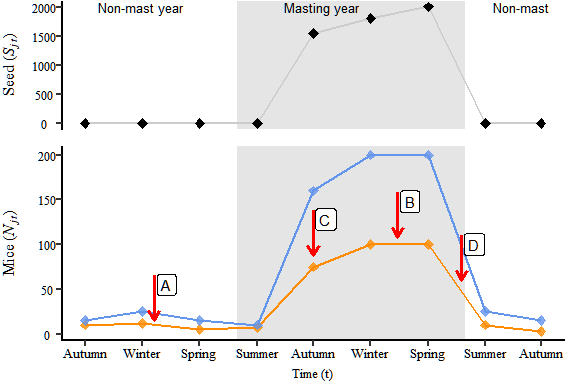


### Mouse plot



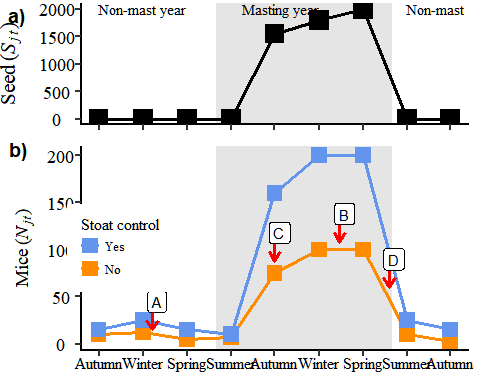
png   
 2

### Joint plot



png   
 2

#### Old plot



png   
 2

# Discussion

### Saving

png   
 2

# Appendix 1

## Old code

# References

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