microstegium_elymus_competition_summary

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Contents

1 Set-up

```
# clear
rm(list = ls())

# load libraries
library(tidyverse)

# import data
parms <- read_csv("../data/mv_ev_model_parameters_experiment_021720.csv")
parms_dis <- read_csv("../data/mv_ev_model_disease_parameters_experiment_021720.csv")
```

2 Interference competition

We assume that the effect of interference competition comes from the annual species through production of litter and both species respond to it.
- Effect: per capita biomass production
- Response: mu(1-s)/(1 - s(1-g)) [mu is the germination sensitivity from G(t) = g/(1 + mu x L(t))]

```
# extract parameters
v.A <- parms %>% filter(symbol == "v.A") %>% select(value)
v.A_dis <- parms_dis %>% filter(symbol == "v.A") %>% select(value)

# interference competition effect from annual
(int_eff.A <- v.A)
```

```
## # A tibble: 1 x 1
##   value
##   <dbl>
## 1  413.
```

```
(int_eff_dis.A <- v.A_dis)
```

```
## # A tibble: 1 x 1
##   value
```

```
##   <dbl>
## 1  36.4
```

```
# extract parameters
beta.A <- parms %>% filter(symbol == "beta.A") %>% select(value)
s.A <- parms %>% filter(symbol == "s.A") %>% select(value)
g.A <- parms %>% filter(symbol == "g.A") %>% select(value)
beta.A_dis <- parms_dis %>% filter(symbol == "beta.A") %>% select(value)
s.A_dis <- parms_dis %>% filter(symbol == "s.A") %>% select(value)
g.A_dis <- parms_dis %>% filter(symbol == "g.A") %>% select(value)

beta.S <- parms %>% filter(symbol == "beta.S") %>% select(value)
s.S <- parms %>% filter(symbol == "s.S") %>% select(value)
g.S <- parms %>% filter(symbol == "g.S") %>% select(value)
beta.S_dis <- parms_dis %>% filter(symbol == "beta.S") %>% select(value)
s.S_dis <- parms_dis %>% filter(symbol == "s.S") %>% select(value)
g.S_dis <- parms_dis %>% filter(symbol == "g.S") %>% select(value)

# interference competition response of annual
(int_res.A <- beta.A * (1 - s.A)/(1 - s.A * (1 - g.A)))
```

```
##         value
## 1 0.004579439
```

```
(int_res_dis.A <- beta.A_dis * (1 - s.A_dis)/(1 - s.A_dis * (1 - g.A_dis)))
```

```
##         value
## 1 0.008044914
```

```
# interference competition response of perennial
(int_res.P <- beta.S * (1 - s.S)/(1 - s.S * (1 - g.S)))
```

```
##        value
## 1 0.02276215
```

```
(int_res_dis.P <- beta.S_dis * (1 - s.S_dis)/(1 - s.S_dis * (1 - g.S_dis)))
```

```
##        value
## 1 0.02276215
```

3 Resource competition

Resources are not explicit in the model but changes in density result in changes in biomass production or seed production, which we assume reflects resource competition, among other processes.
- Effect: g x v x y x alpha (annual) and g x y x [s_{sp} x s_{ps}/(1-s_p) + f] x alpha (perennial) [alpha is species-specific - I'm using the means, some are 0, so the geometric mean comes out to 0, f = y1/y]
- Response: 1 - s(1 - g) times the reduction in size/reproduction with changes in plant density

```
# extract parameters
y.A <- parms %>% filter(symbol == "y.A") %>% select(value)
alpha.AA <- parms %>% filter(symbol == "alpha.AA") %>% select(value) %>%
    as.numeric()
alpha.SA <- parms %>% filter(symbol == "alpha.SA") %>% select(value) %>%
    as.numeric()
alpha.PA <- parms %>% filter(symbol == "alpha.PA") %>% select(value) %>%
    as.numeric()
```

```
y.A_dis <- parms_dis %>% filter(symbol == "y.A") %>% select(value)
alpha.AA_dis <- parms_dis %>% filter(symbol == "alpha.AA") %>% select(value) %>%
    as.numeric()
alpha.SA_dis <- parms_dis %>% filter(symbol == "alpha.SA") %>% select(value) %>%
    as.numeric()
alpha.PA_dis <- parms_dis %>% filter(symbol == "alpha.PA") %>% select(value) %>%
    as.numeric()

f.1 <- parms %>% filter(symbol == "f.1") %>% select(value)
f.P <- parms %>% filter(symbol == "f.P") %>% select(value)
s.1 <- parms %>% filter(symbol == "s.1") %>% select(value)
s.P <- parms %>% filter(symbol == "s.P") %>% select(value)
alpha.SS <- parms %>% filter(symbol == "alpha.SS") %>% select(value) %>%
    as.numeric()
alpha.AS <- parms %>% filter(symbol == "alpha.AS") %>% select(value) %>%
    as.numeric()
alpha.PS <- parms %>% filter(symbol == "alpha.PS") %>% select(value) %>%
    as.numeric()
alpha.PP <- parms %>% filter(symbol == "alpha.PP") %>% select(value) %>%
    as.numeric()
alpha.AP <- parms %>% filter(symbol == "alpha.AP") %>% select(value) %>%
    as.numeric()
alpha.SP <- parms %>% filter(symbol == "alpha.SP") %>% select(value) %>%
    as.numeric()
f.1_dis <- parms_dis %>% filter(symbol == "f.1") %>% select(value)
f.P_dis <- parms_dis %>% filter(symbol == "f.P") %>% select(value)
s.1_dis <- parms_dis %>% filter(symbol == "s.1") %>% select(value)
s.P_dis <- parms_dis %>% filter(symbol == "s.P") %>% select(value)
alpha.SS_dis <- parms_dis %>% filter(symbol == "alpha.SS") %>% select(value) %>%
    as.numeric()
alpha.AS_dis <- parms_dis %>% filter(symbol == "alpha.AS") %>% select(value) %>%
    as.numeric()
alpha.PS_dis <- parms_dis %>% filter(symbol == "alpha.PS") %>% select(value) %>%
    as.numeric()
alpha.PP_dis <- parms_dis %>% filter(symbol == "alpha.PP") %>% select(value) %>%
    as.numeric()
alpha.AP_dis <- parms_dis %>% filter(symbol == "alpha.AP") %>% select(value) %>%
    as.numeric()
alpha.SP_dis <- parms_dis %>% filter(symbol == "alpha.SP") %>% select(value) %>%
    as.numeric()

# resource competition effect of annual
(res_eff.A <- g.A * v.A * y.A * mean(c(alpha.AA, alpha.SA, alpha.PA)))
```

```
##      value
## 1 1321.968
```

```
(res_eff_dis.A <- g.A_dis * v.A_dis * y.A_dis * mean(c(alpha.AA_dis, alpha.SA_dis,
    alpha.PA_dis)))
```

```
##    value
## 1 6.7279
```

```
# resource competition effect of perennial
(res_eff.P <- g.S * f.P * (s.1 * s.S/(1 - s.P) + f.1/f.P) * mean(c(alpha.SS,
```

```
    alpha.AS, alpha.PS, alpha.PP, alpha.AP, alpha.SP)))
```

```
##       value
## 1 0.6895967
```

```
(res_eff_dis.P <- g.S_dis * f.P_dis * (s.1_dis * s.S_dis/(1 - (s.P_dis -
    0.01)) + f.1_dis/f.P_dis) * mean(c(alpha.SS_dis, alpha.AS_dis, alpha.PS_dis,
    alpha.PP_dis, alpha.AP_dis, alpha.SP_dis)))
```

```
##      value
## 1 1.263182
```

```
# resource competition response of annual
(res_res.A <- 1 - s.A * (1 - g.A) * mean(c(alpha.AA, alpha.AS, alpha.AP)))
```

```
##       value
## 1 0.9610062
```

```
(res_res_dis.A <- 1 - s.A_dis * (1 - g.A_dis) * mean(c(alpha.AA_dis, alpha.AS_dis,
    alpha.AP_dis)))
```

```
##       value
## 1 0.9964167
```

```
# resource competition response of perennial
(res_res.P <- 1 - s.S * (1 - g.S) * mean(c(alpha.SS, alpha.SA, alpha.SP,
    alpha.PP, alpha.PA, alpha.PS)))
```

```
##       value
## 1 0.9951336
```

```
(res_res_dis.P <- 1 - s.S_dis * (1 - g.S_dis) * mean(c(alpha.SS_dis, alpha.SA_dis,
    alpha.SP_dis, alpha.PP_dis, alpha.PA, alpha.PS_dis)))
```

```
##       value
## 1 0.9987847
```

```
# resource competition annual
res_eff.A/res_res.A
```

```
##      value
## 1 1375.608
```

```
res_eff_dis.A/res_res_dis.A
```

```
##      value
## 1 6.752095
```

```
# resource competition perennial
res_eff.P/res_res.P
```

```
##       value
## 1 0.6929689
```

```
res_eff_dis.P/res_res_dis.P
```

```
##      value
## 1 1.264719
```

4 Competition coefficients

```
# intraspecific competition annual
alpha.AA
```

```
## [1] 1.78
```

```
alpha.AA_dis
```

```
## [1] 0.08
```

```
# interspecific competition annual
mean(c(alpha.AS, alpha.AP))
```

```
## [1] 0.0275
```

```
mean(c(alpha.AS_dis, alpha.AP_dis))
```

```
## [1] 0.06
```

```
# intraspecific competition perennial
mean(c(alpha.SS, alpha.PP, alpha.SP, alpha.PS))
```

```
## [1] 0.0945
```

```
mean(c(alpha.SS_dis, alpha.PP_dis, alpha.SP_dis, alpha.PS_dis))
```

```
## [1] 0.0119925
```

```
# interspecific competition perennial
mean(c(alpha.SA, alpha.PA))
```

```
## [1] 0.048
```

```
mean(c(alpha.SA_dis, alpha.PA_dis))
```

```
## [1] 0.0018
```