

# Some traits make farming systems more vulnerable to uncertain climate than others

Gus Rose, Han Mulder, Johan van Arendonk and Andrew Thompson



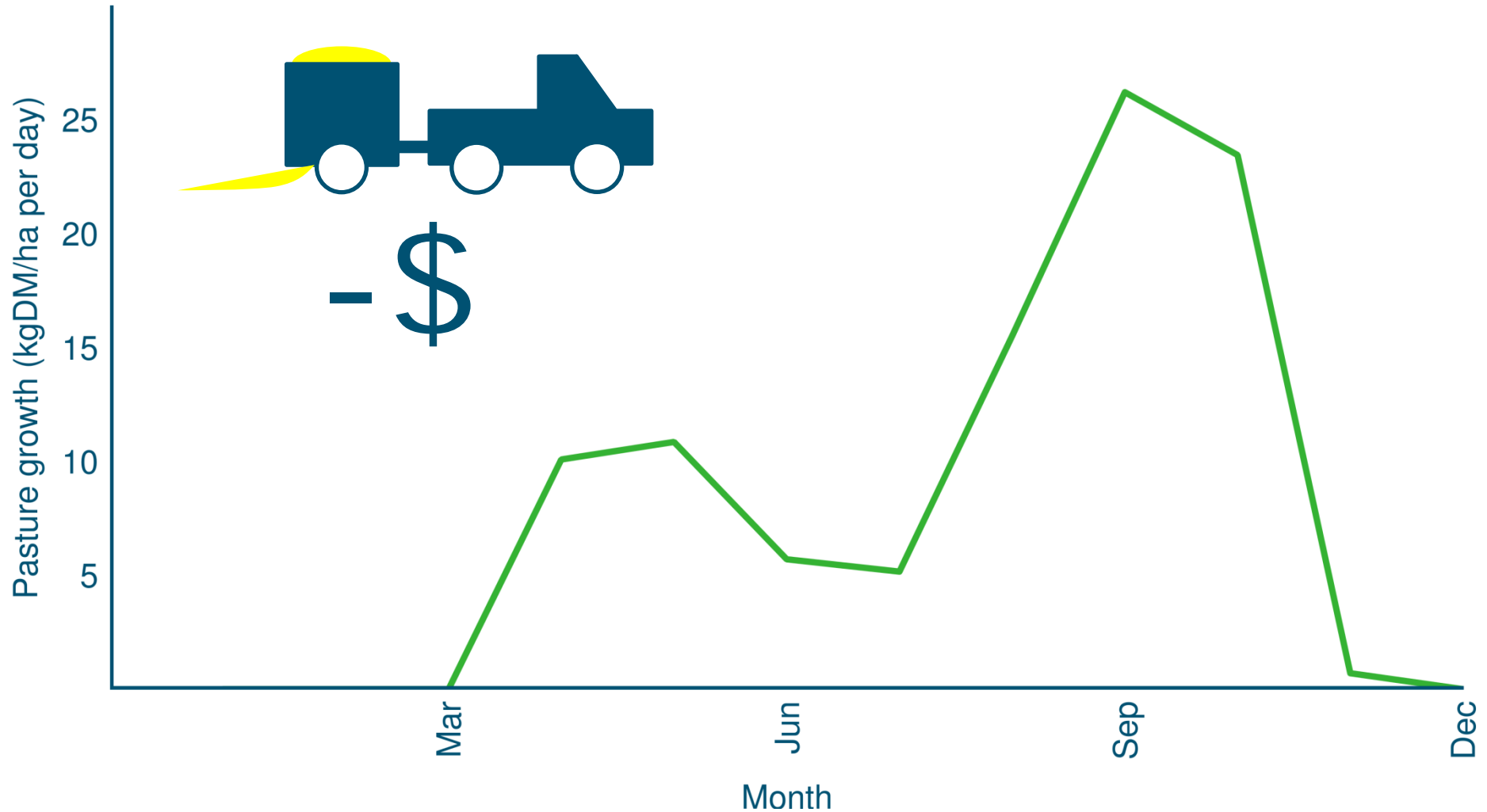
# Sheep farming is not easy



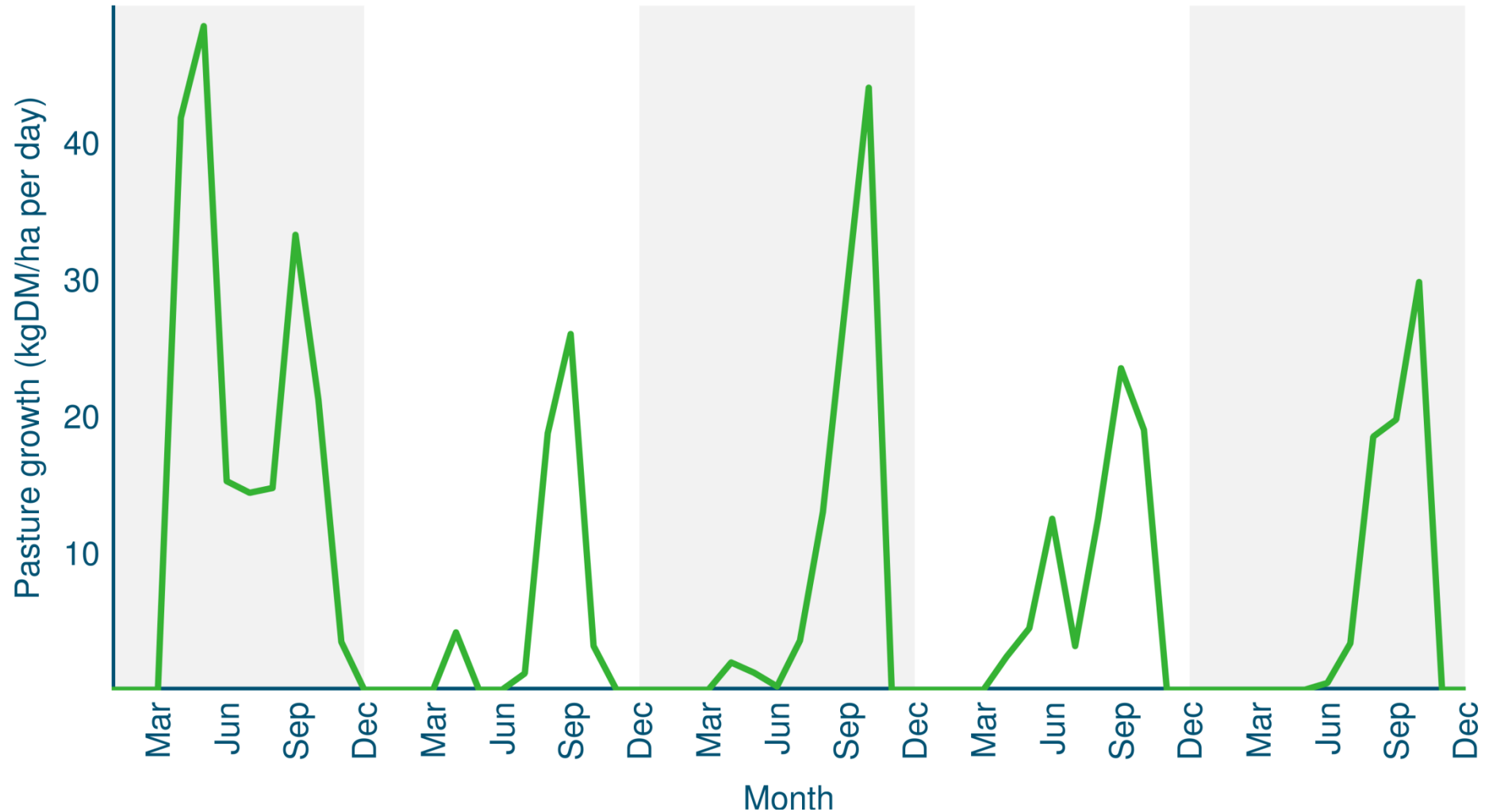
# Mediterranean – uncertain climate



# Variation within year



# Pasture growth varies across years



# Objective

- Does variation of pasture and across years affect profit?
- What traits should we breed for?



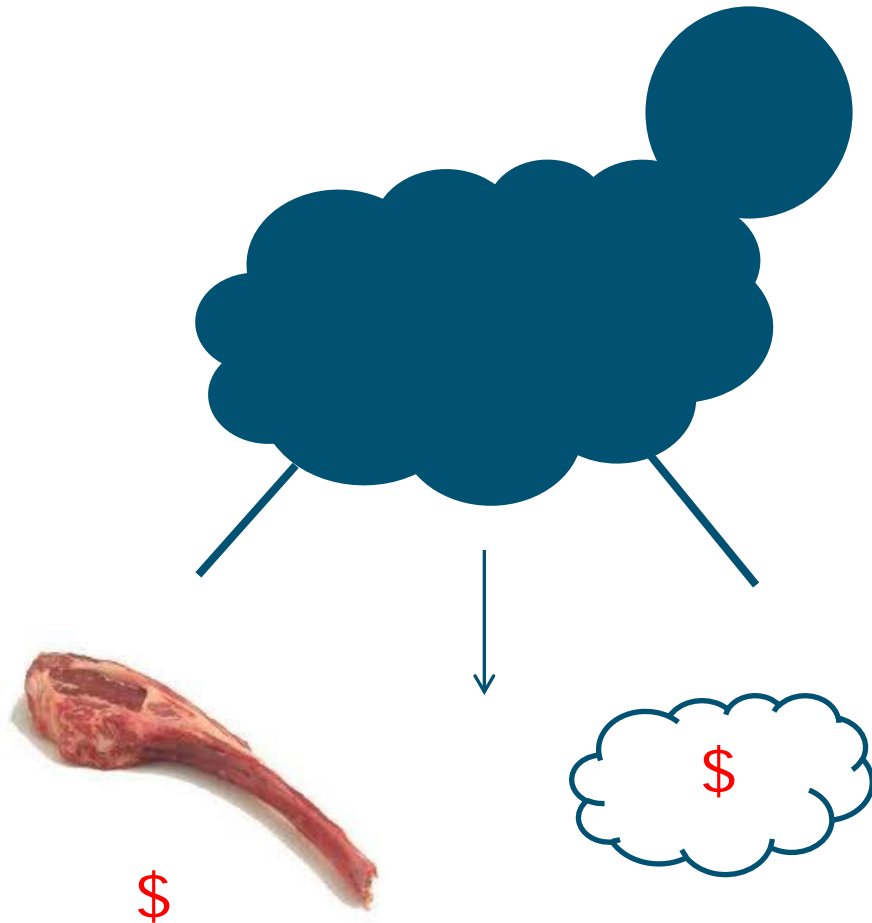
# Optimising profit

Brooke, Drud, and  
Meeraus linear  
program  
(BDMLP in GAMs)

=



# Model of a sheep



Energy

Maintenance

Growth

Wool

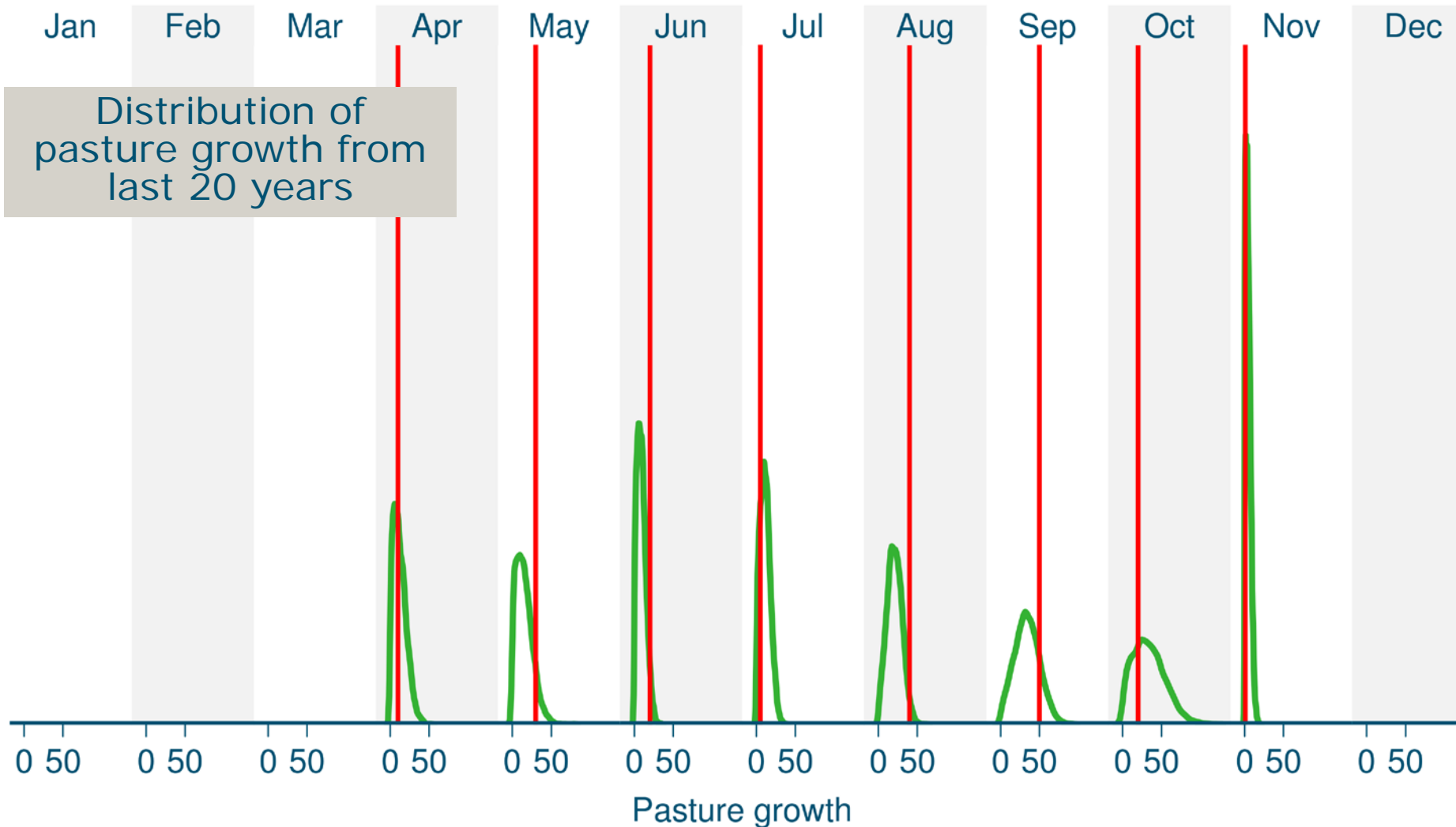
Pregnancy

Lactation

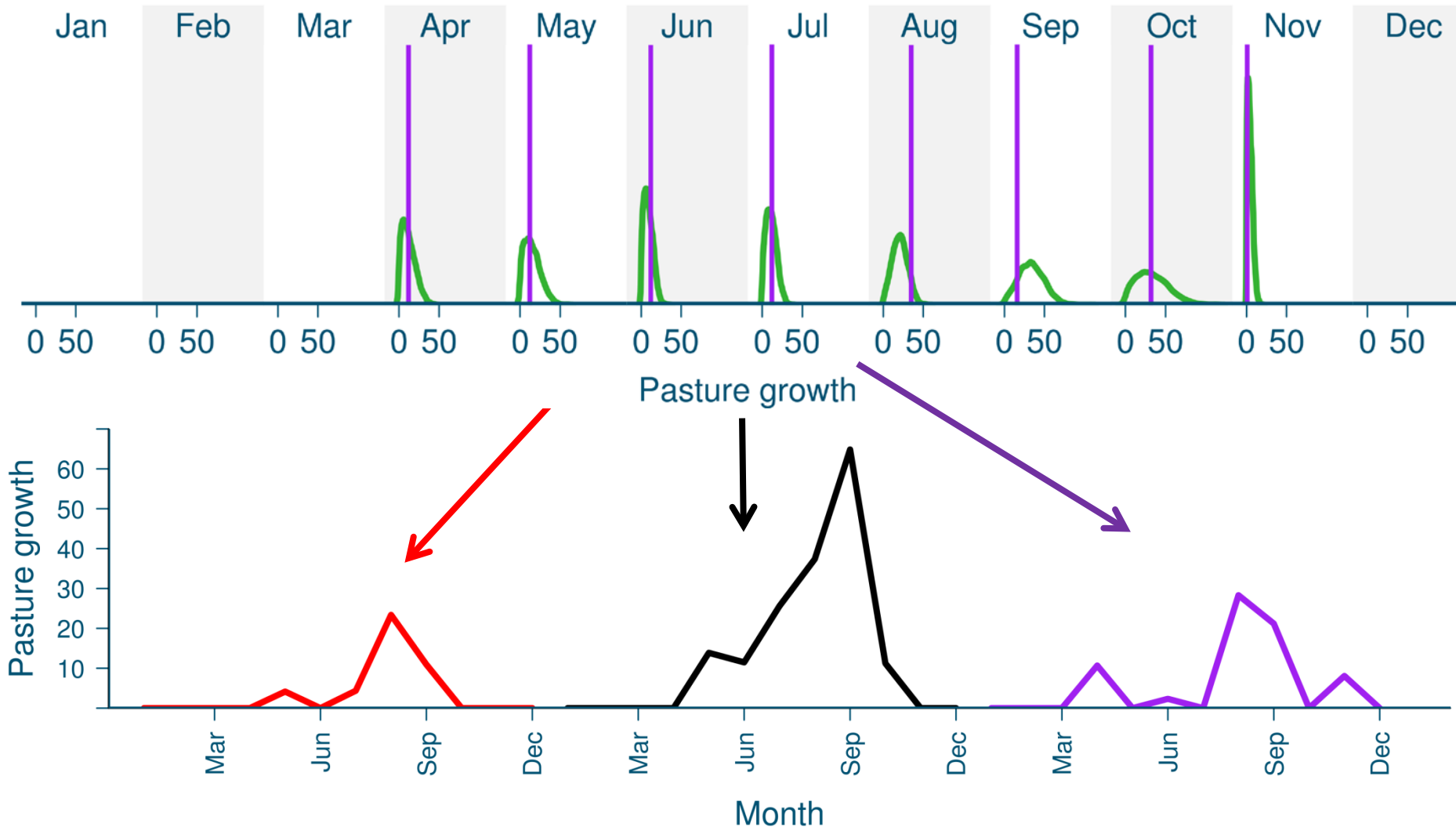




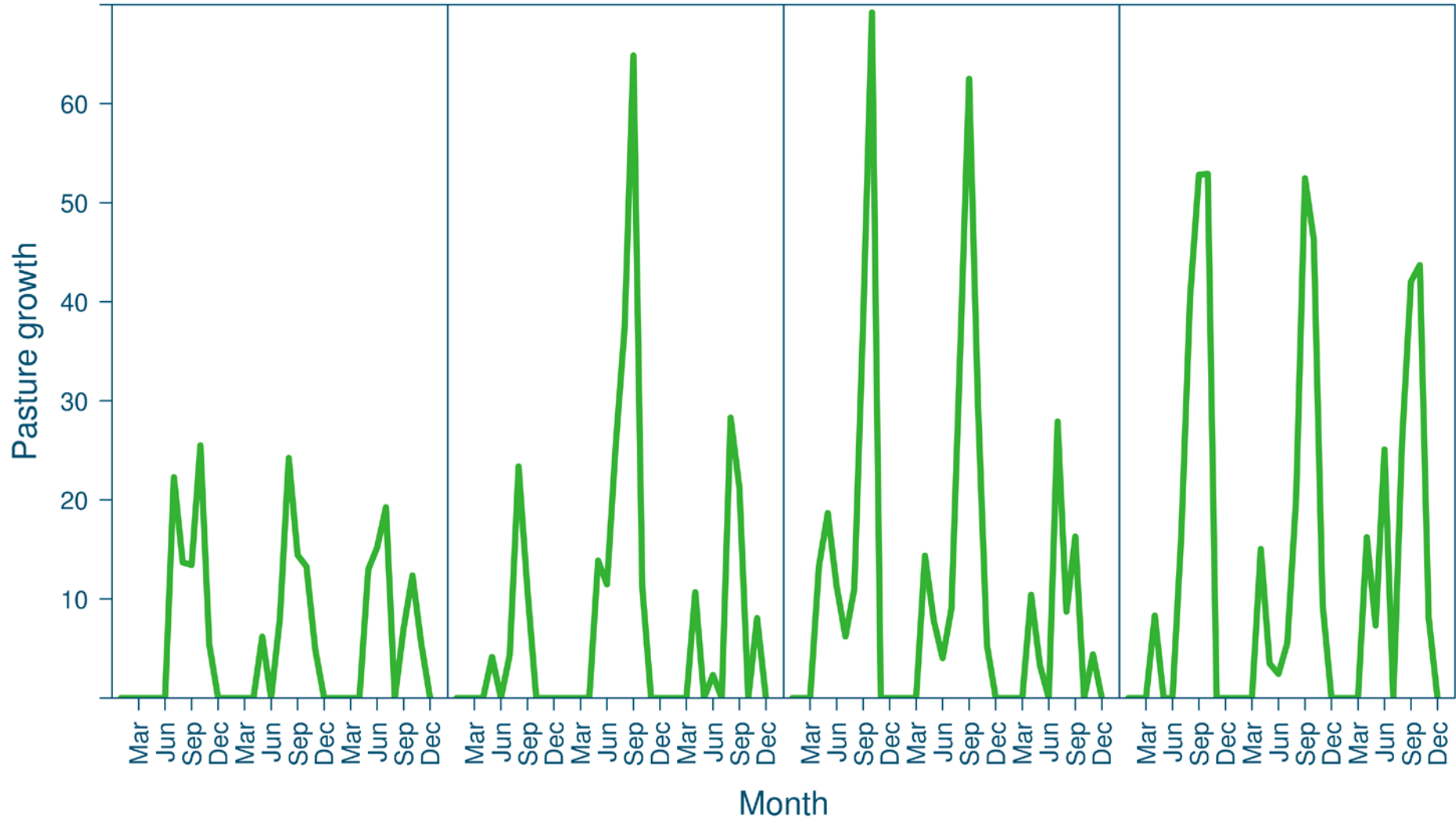
# Sampling pasture growth across years



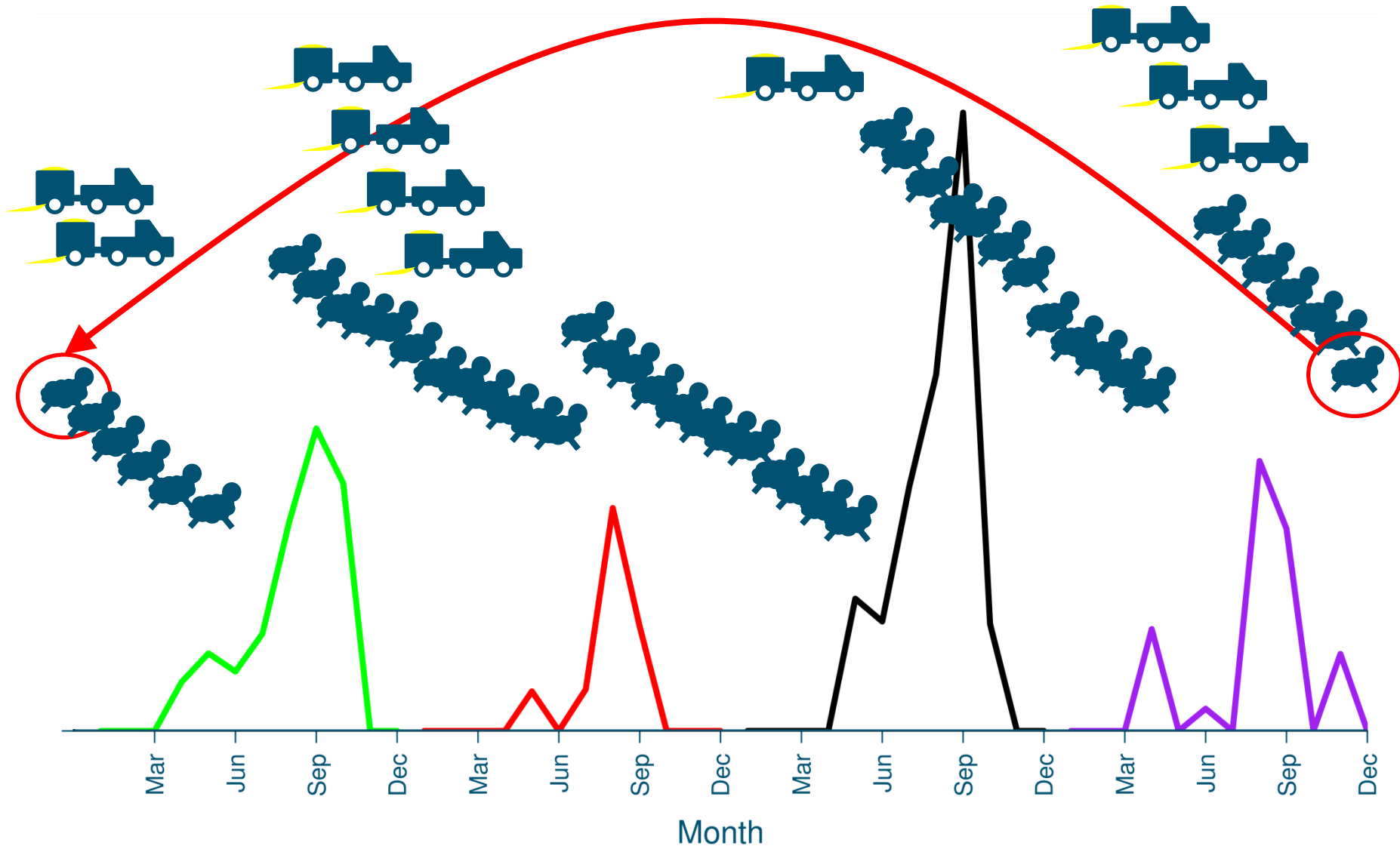
# Sampling pasture growth across years



# Many different combinations

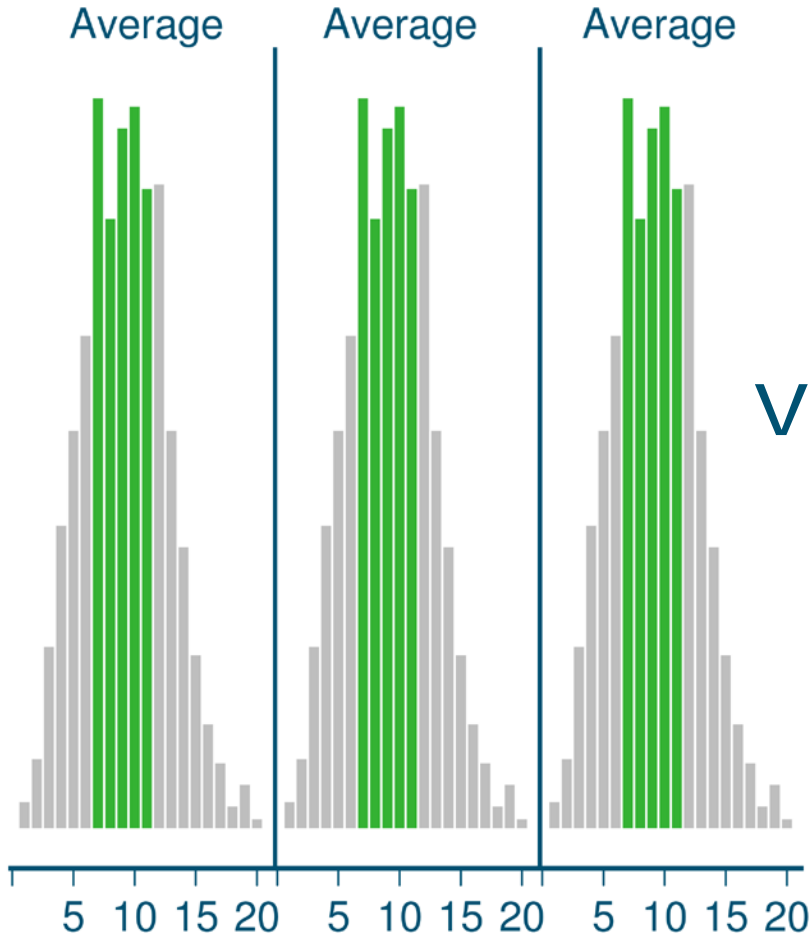


# Looping through years



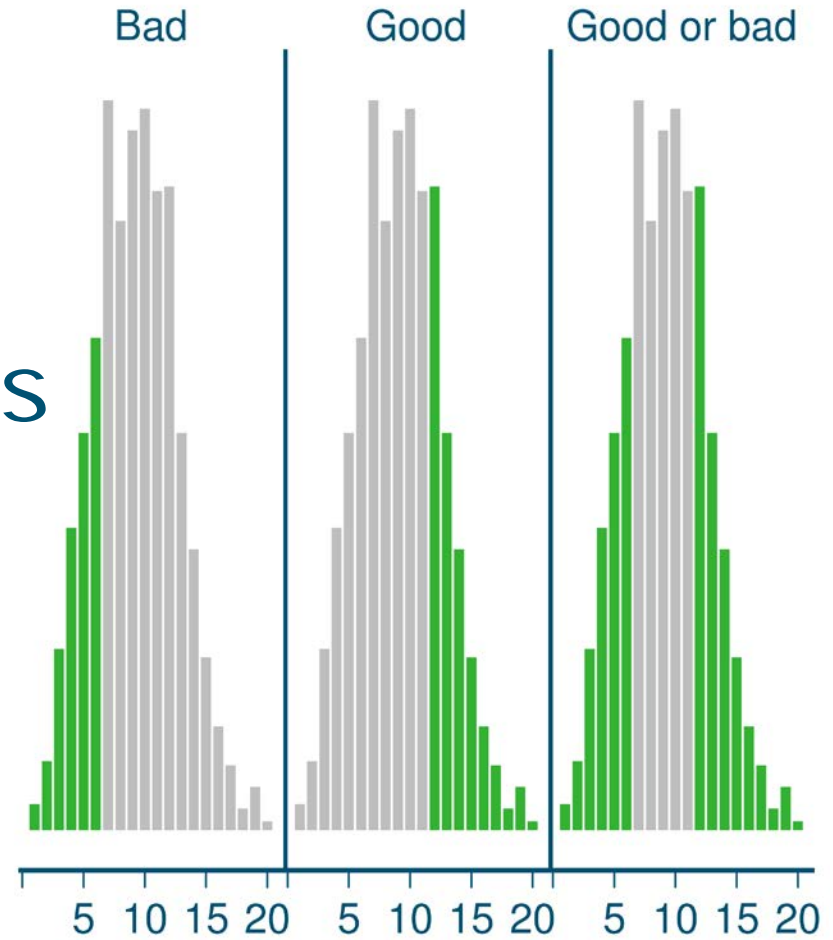
# Filtering average and extreme years

## Average consistent years



versus

## Extreme years

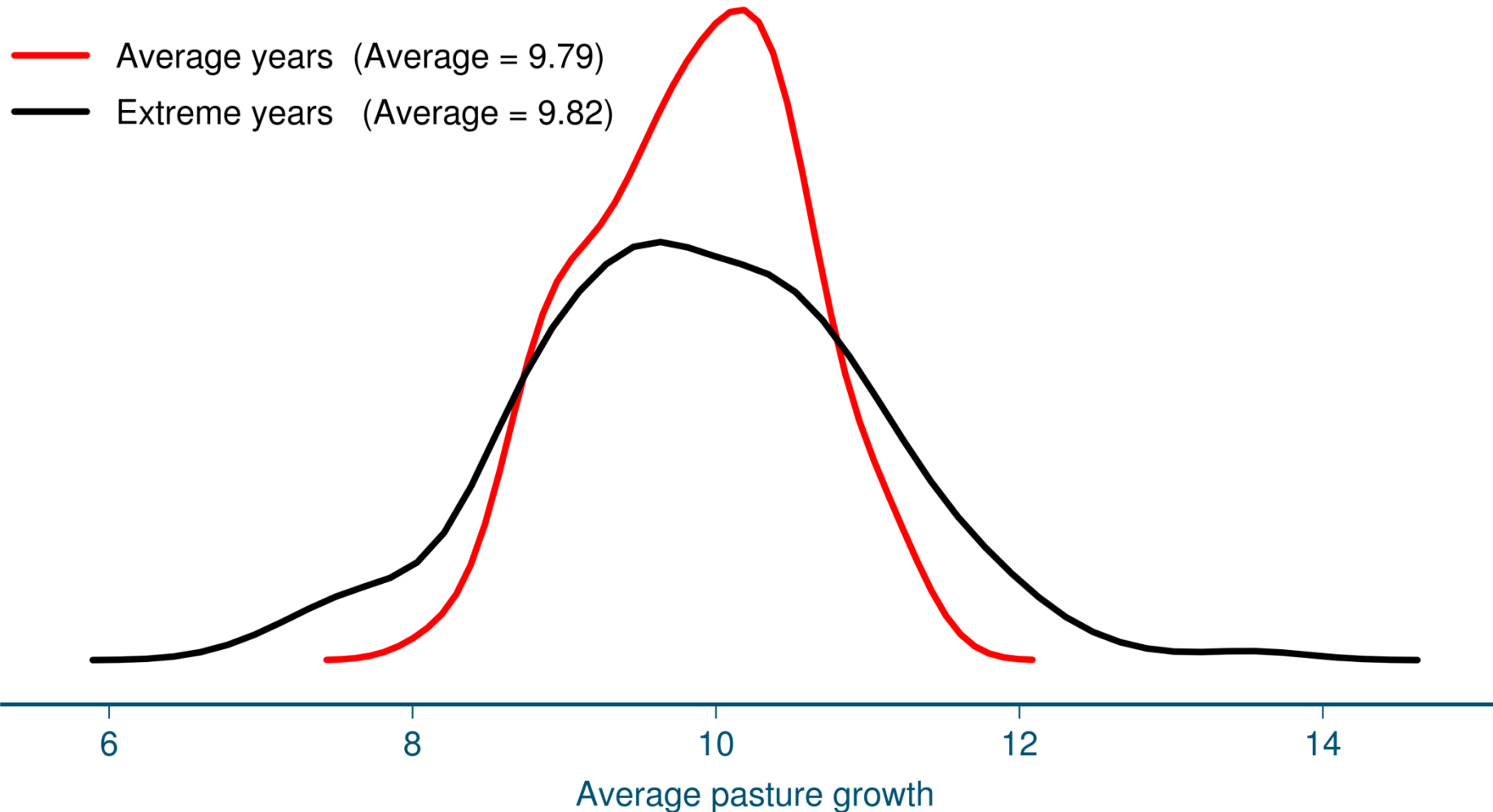


Average pasture growth

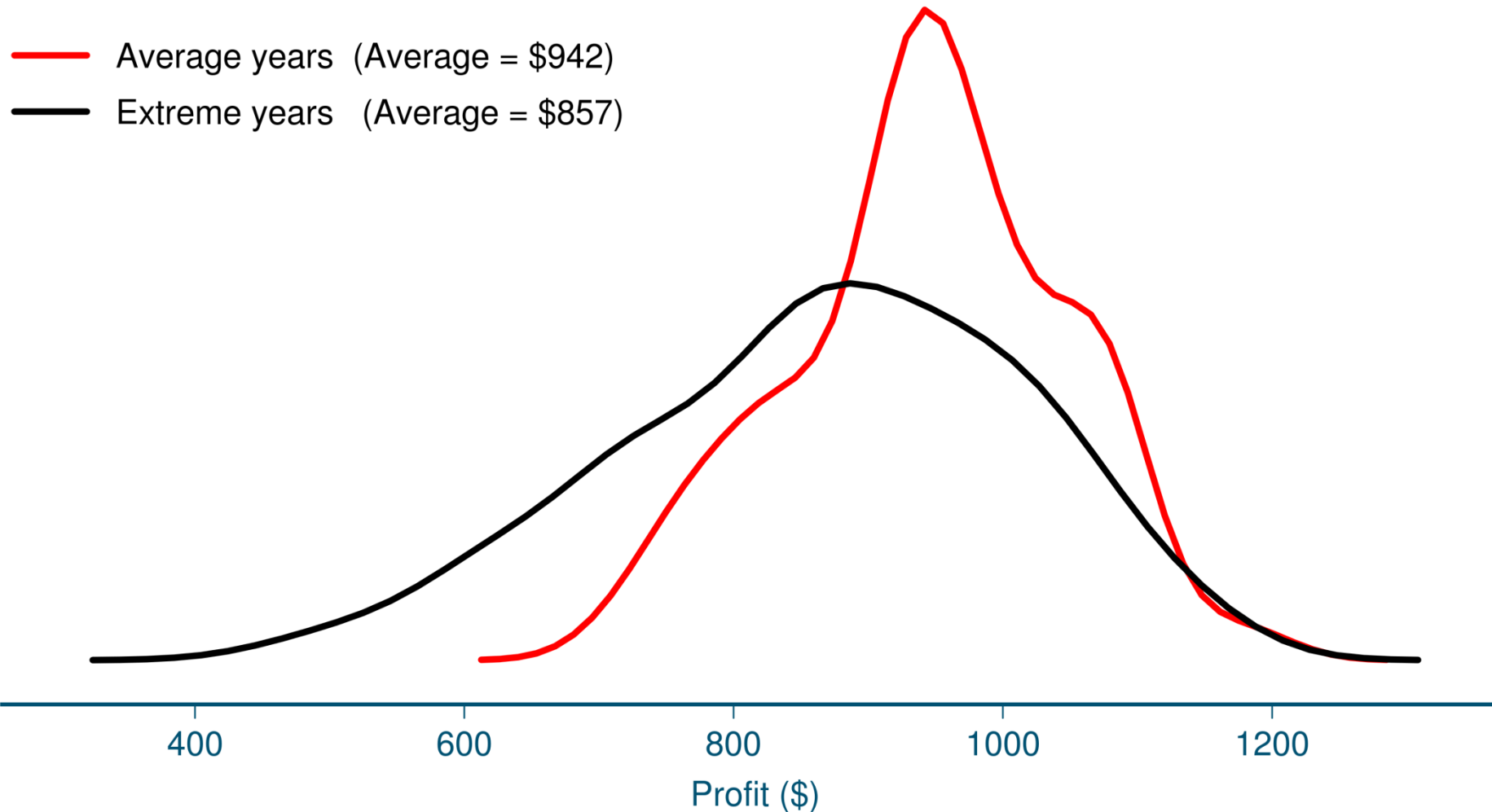
Average pasture growth



# Average pasture growth over three years



# Extreme years change profit



# Traits

**Live weight** - energy, intake, meat income

**Longevity** – flock structure

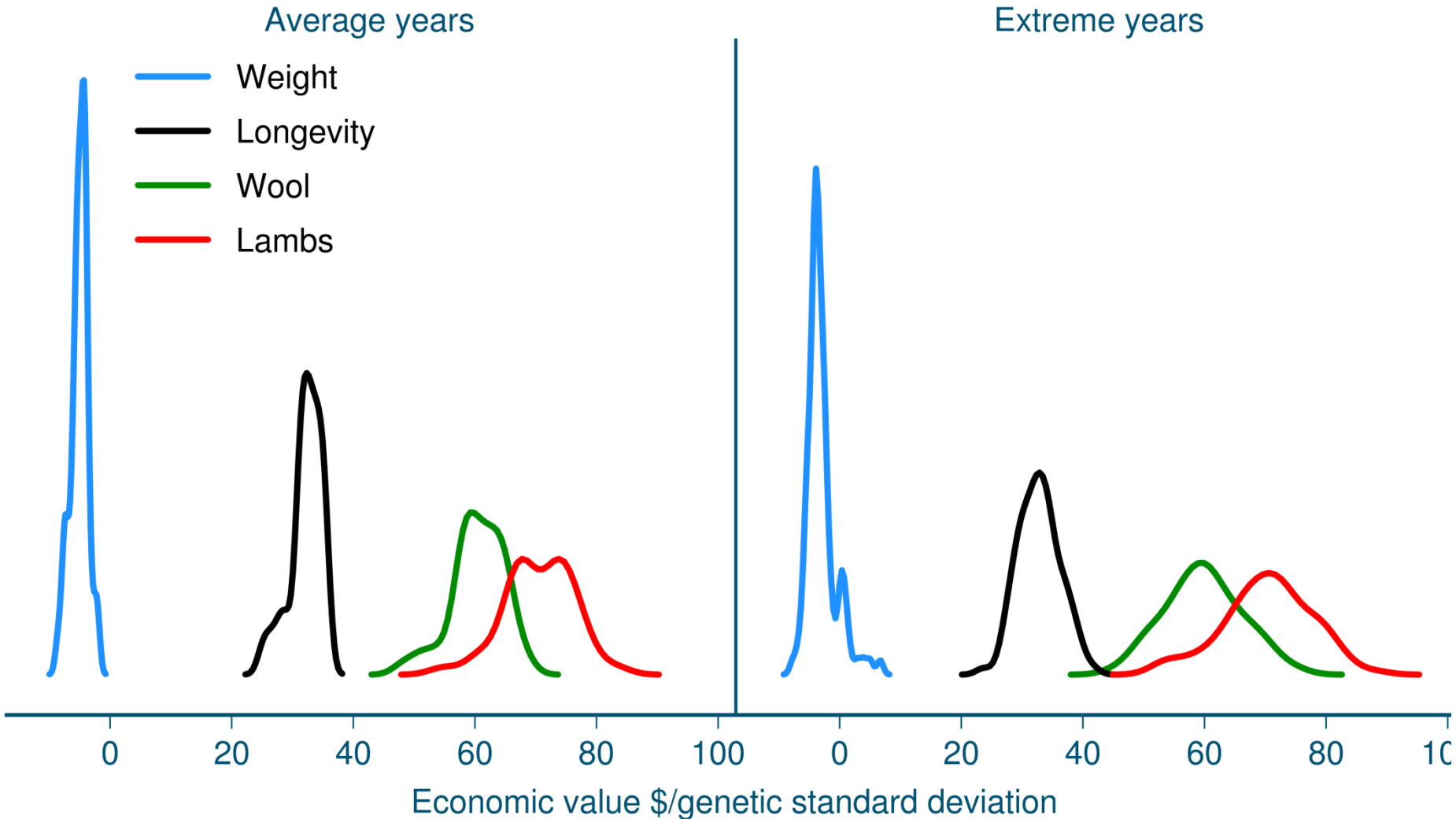
**Wool weight** – energy, wool income

**Lambs weaned** – flock structure, energy





# Relative importance the same

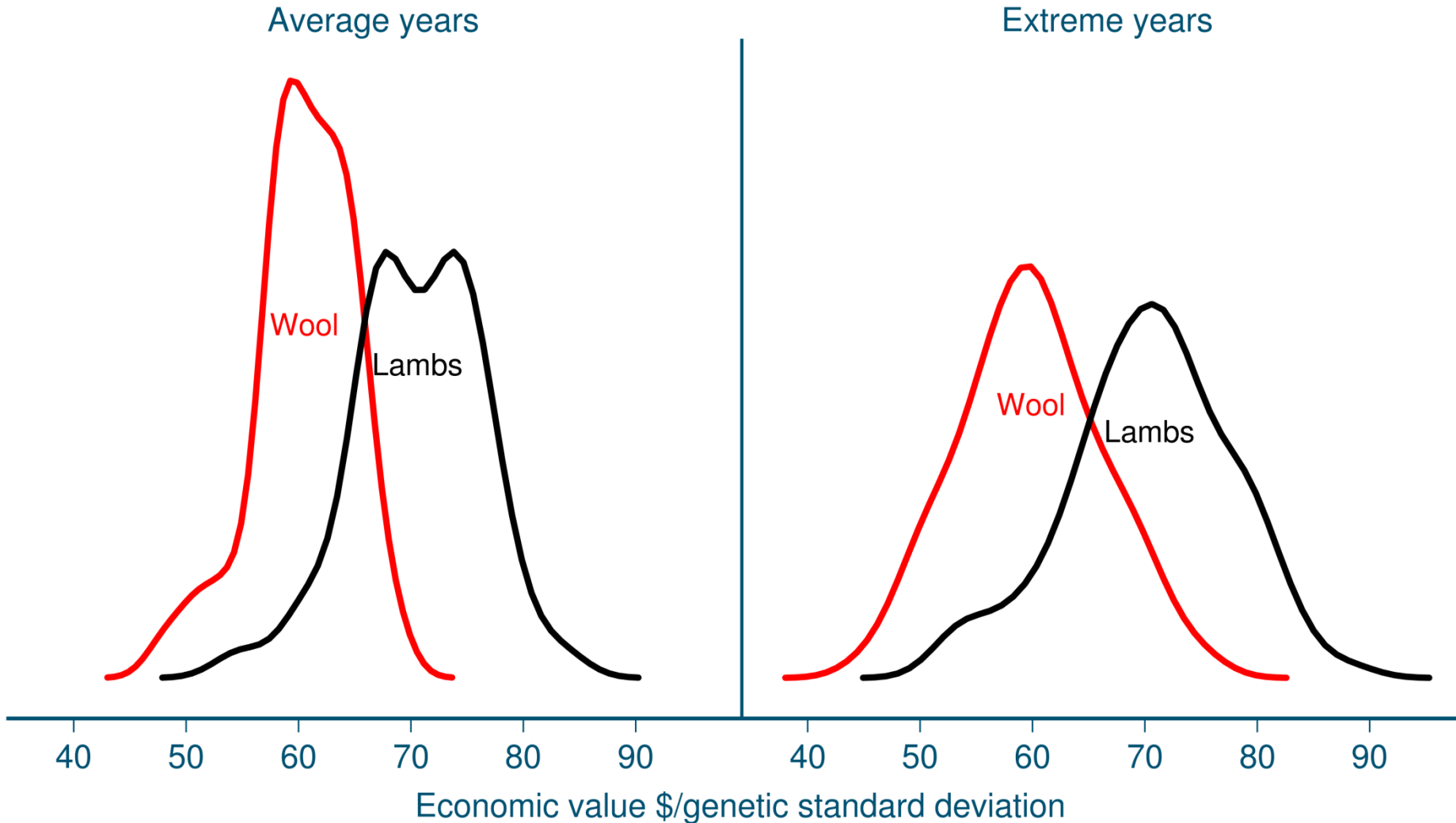


# Take home messages

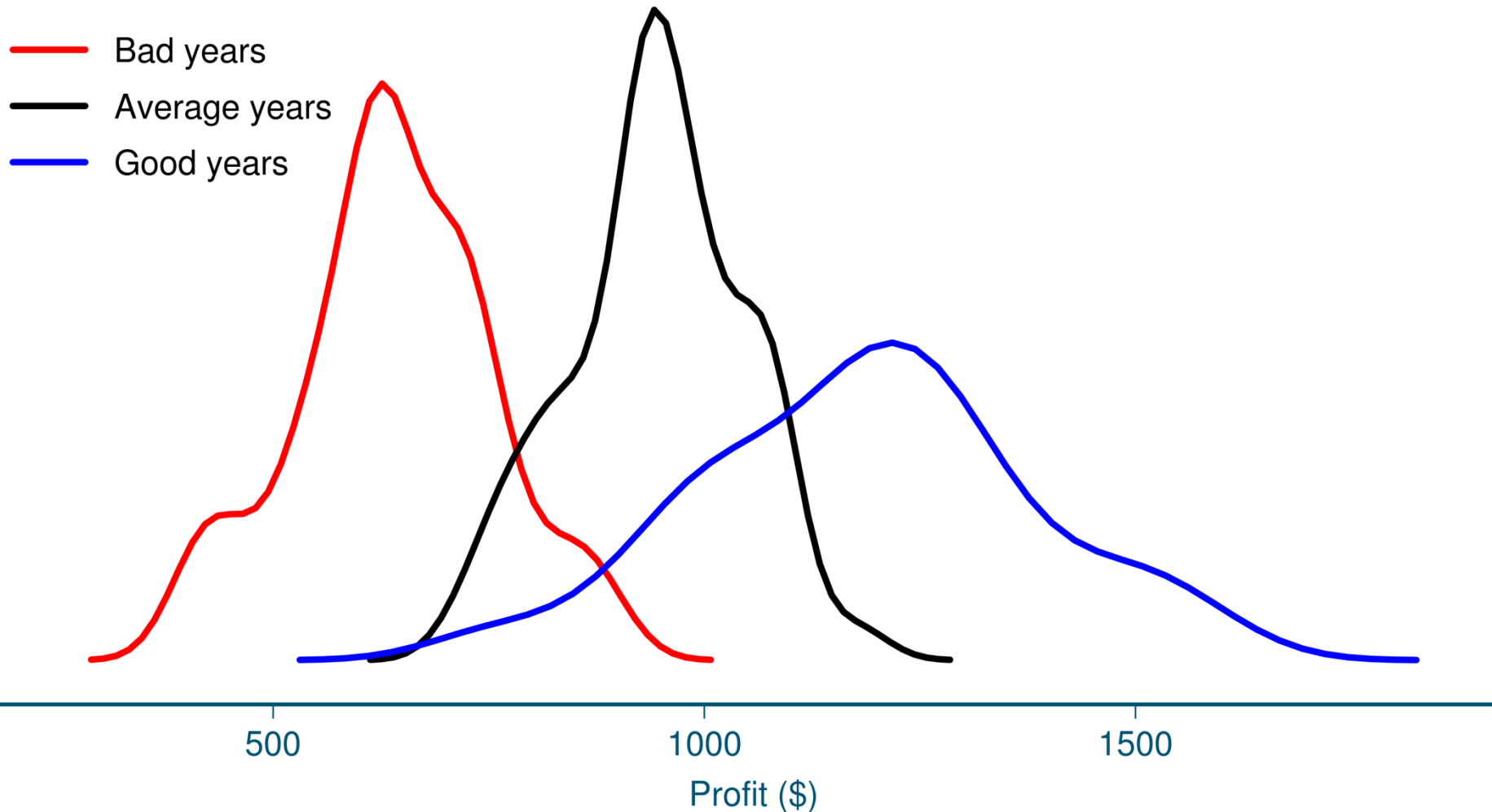
- Varying pasture growth across years affects profit
- Average relative value of traits not affected by varying pasture
- Economic values vary when pasture growth varies
  - Potential to change economic values?



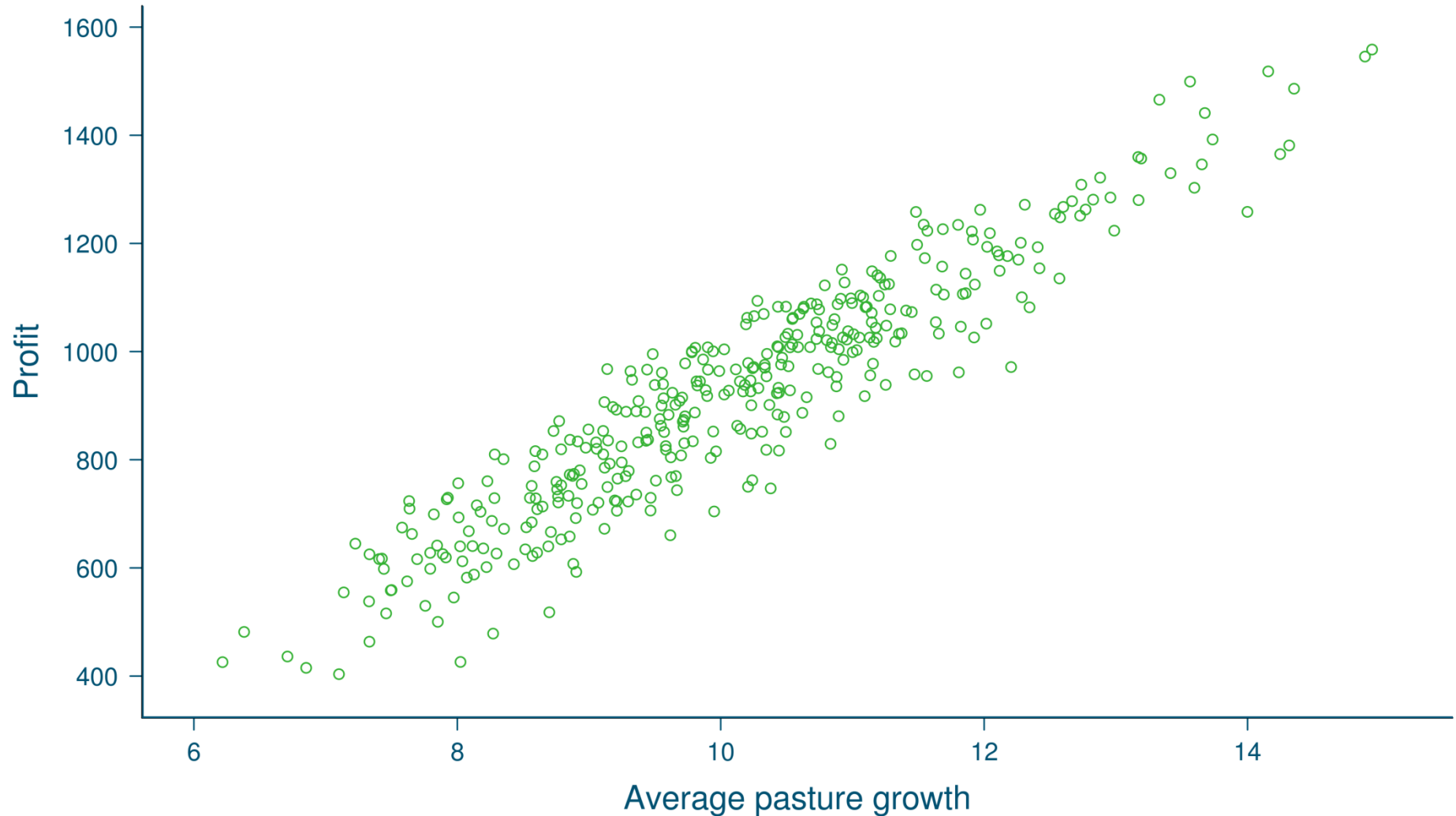
# Relative importance does not change



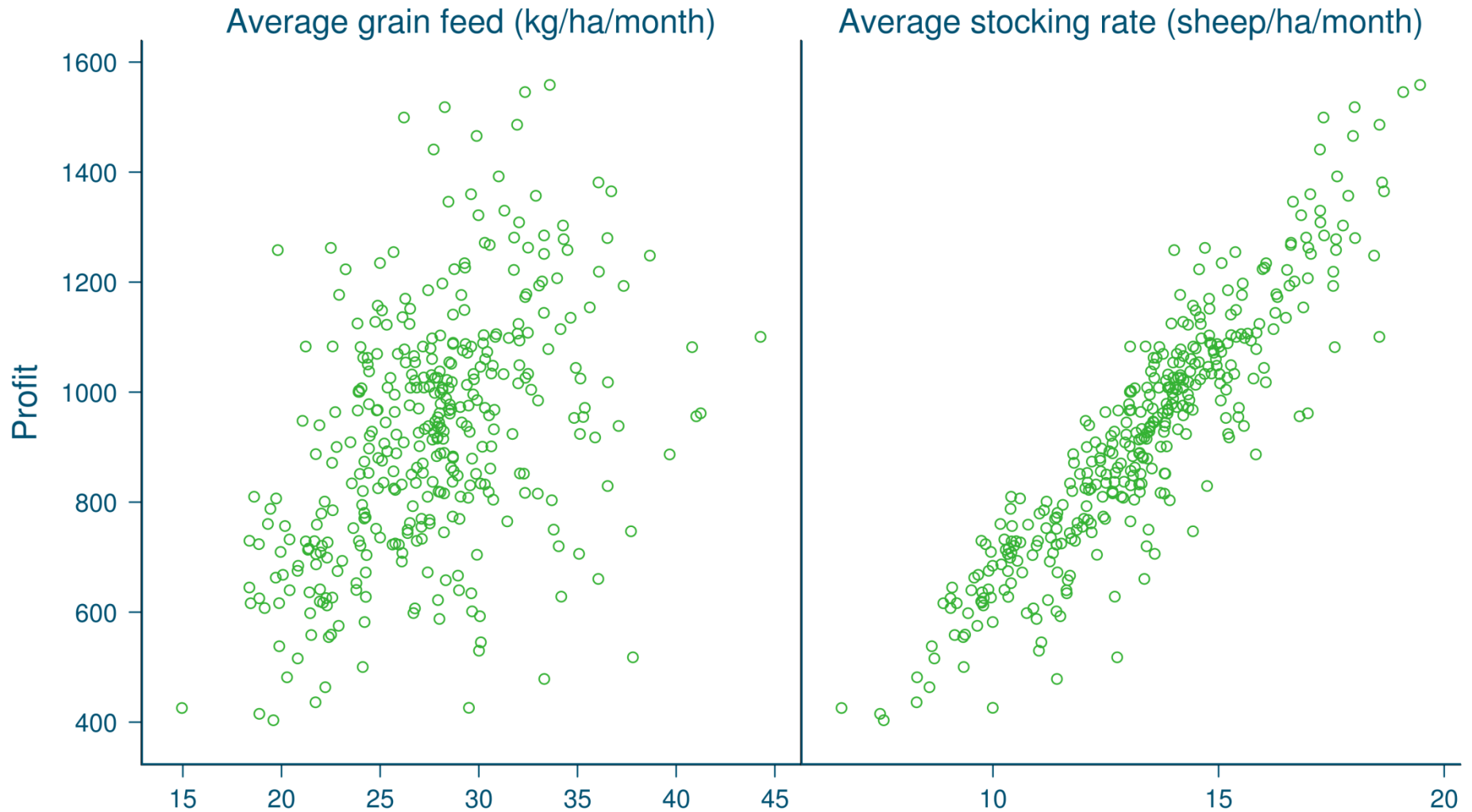
# Low medium and high rainfall



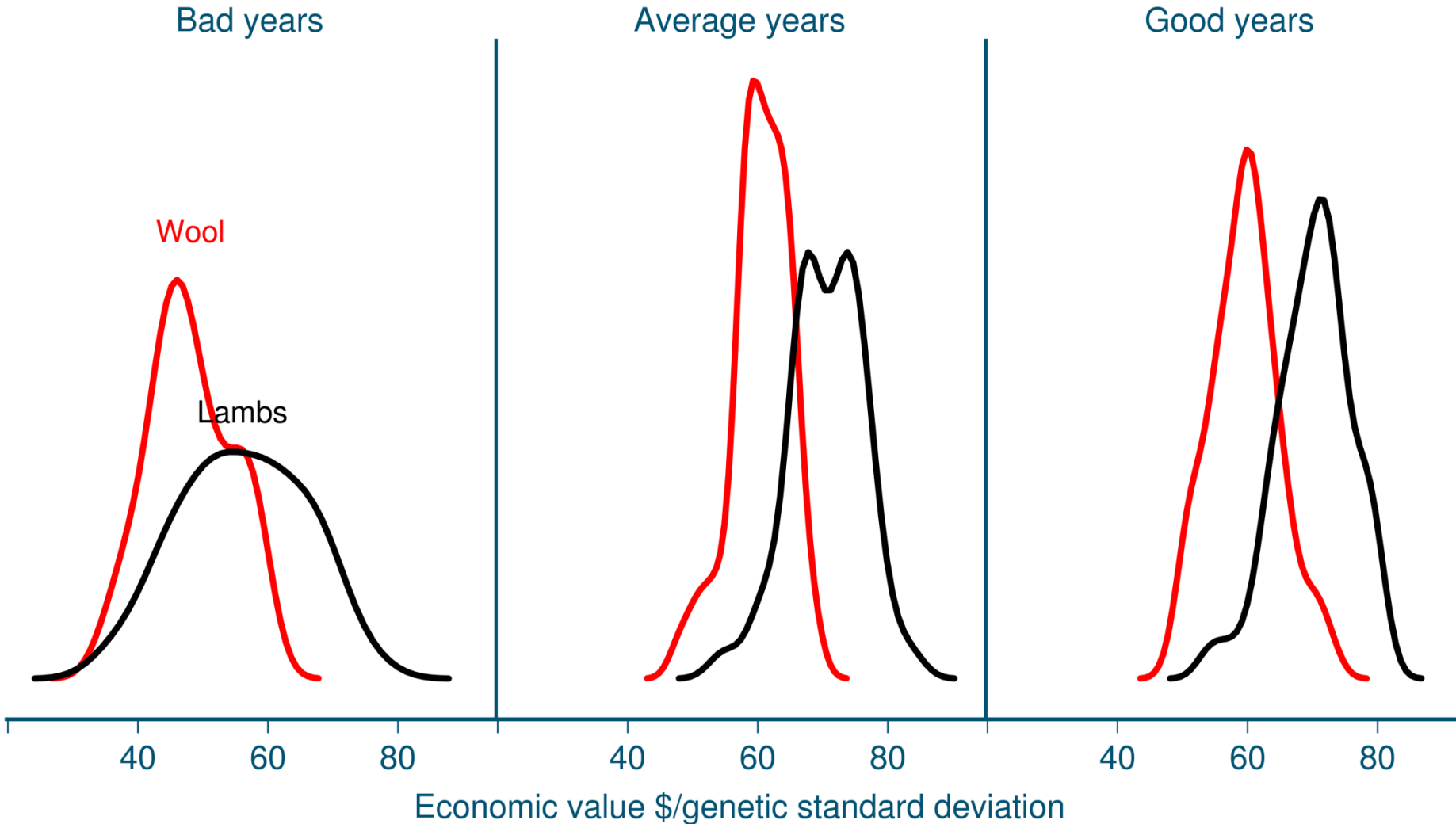
# Profit affected by pasture growth



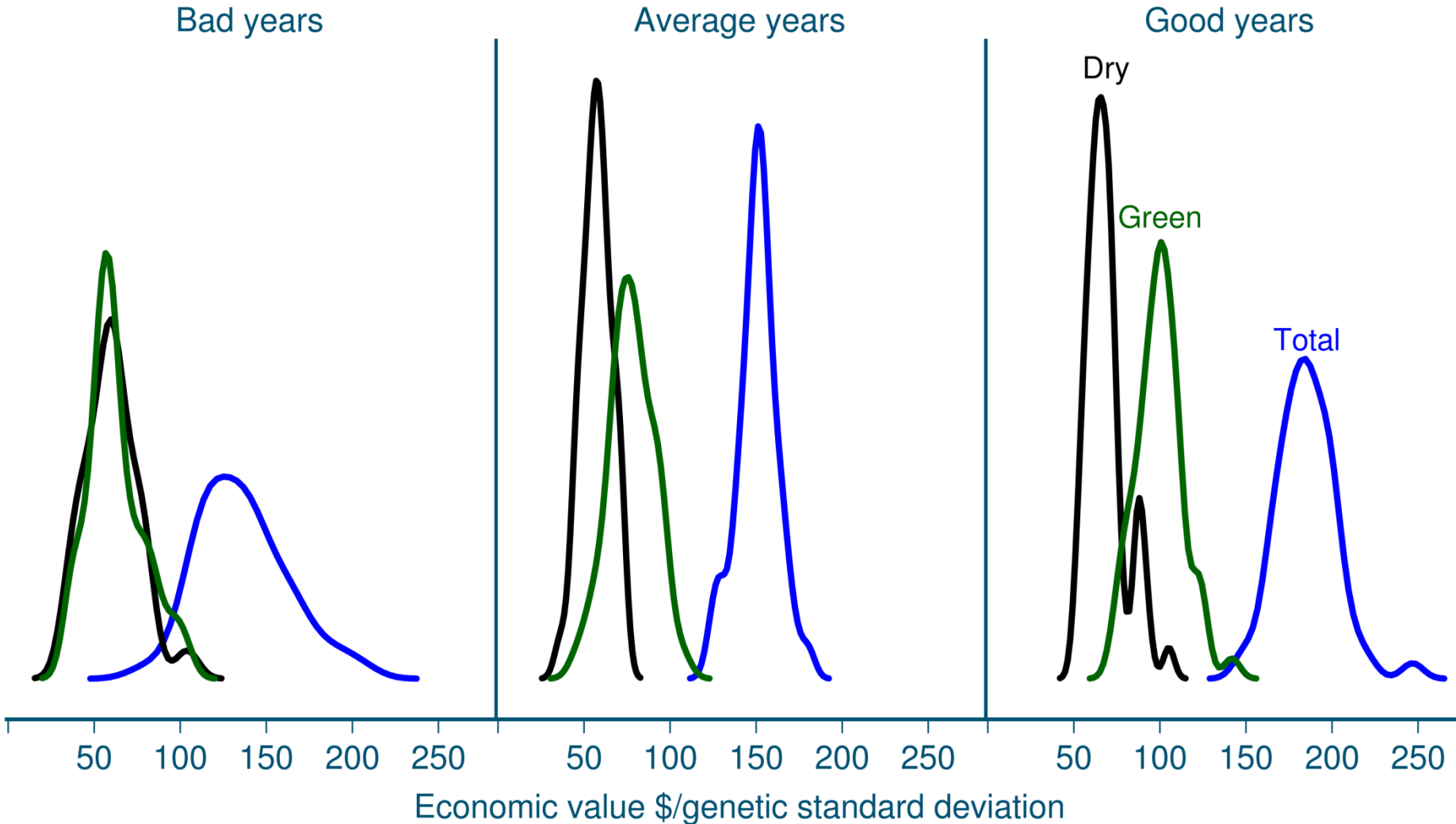
# Stocking rate more important than grain



# Economic values affected change

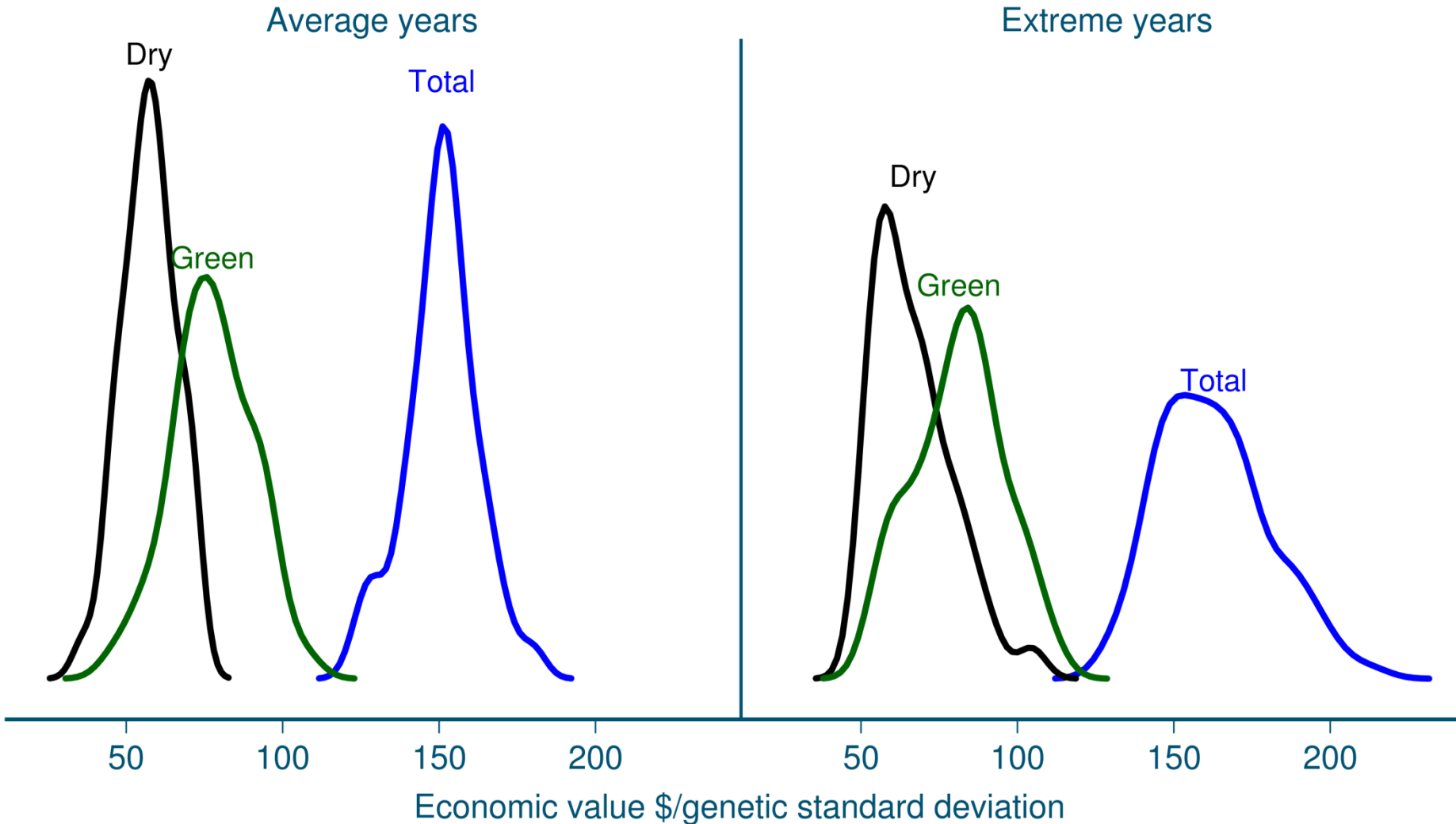


# Variation also changes





# Variation of traits does change



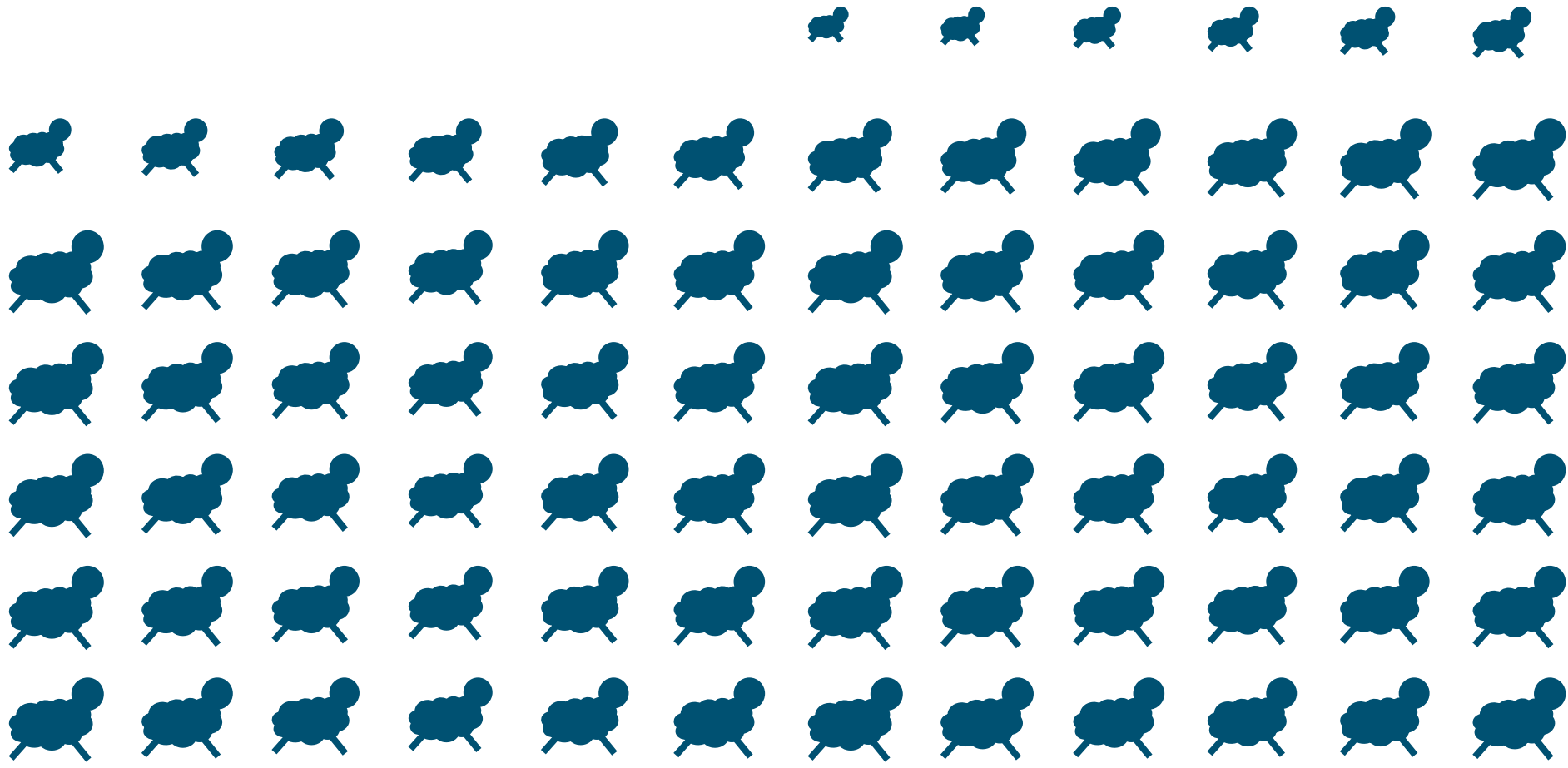
# Model stats

---

- Iterations 159000
- Time 27 minutes
  
- Blocks of equations 19
- Single equations 71,549
- Blocks of variables 12
- Single variables 172,289
- Non zero elements 502,785



# 82 age groups

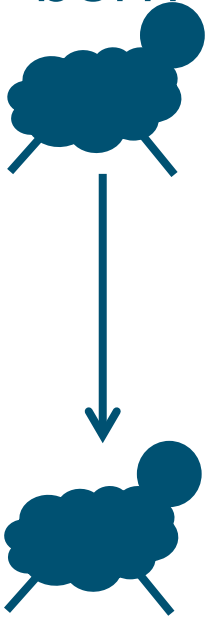


Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec



# 6 categories for reproduction

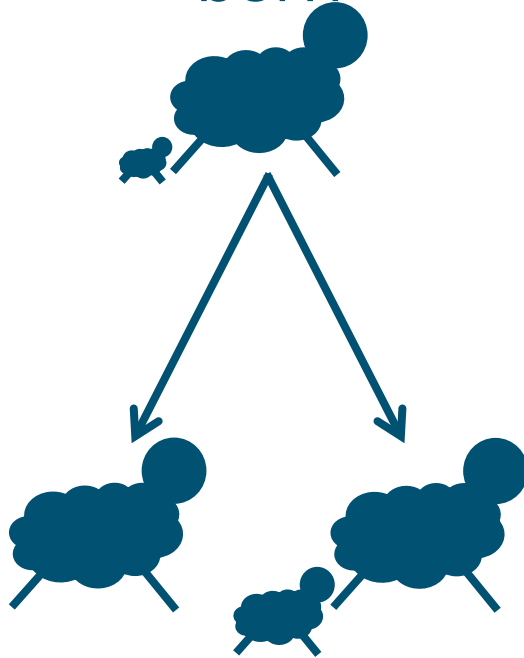
0 lambs  
born



0 lambs  
weaned

1

1 lamb  
born



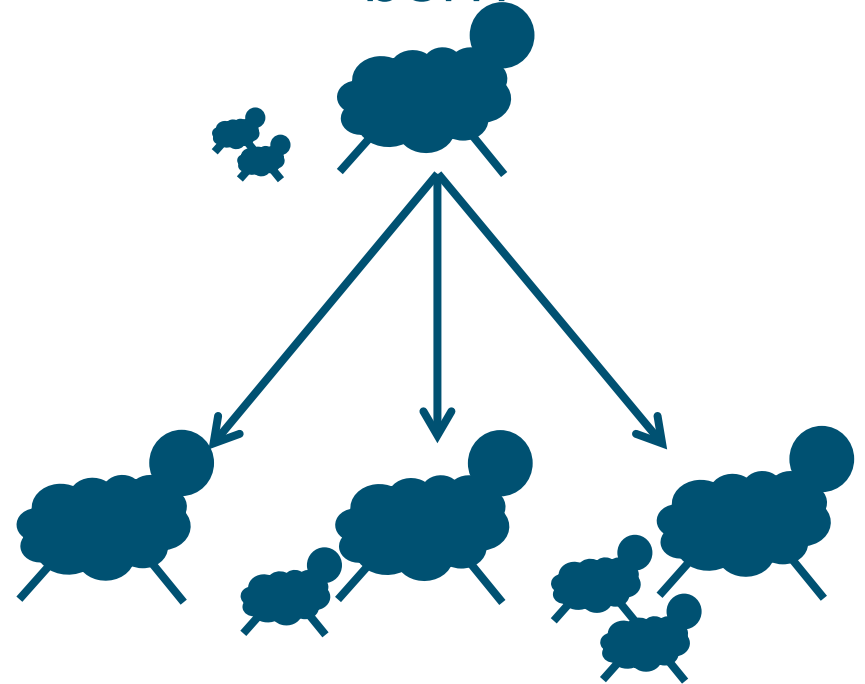
0 lambs  
weaned

2

1 lamb  
weaned

3

2 lambs  
born



0 lambs  
weaned

4

1 lamb  
weaned

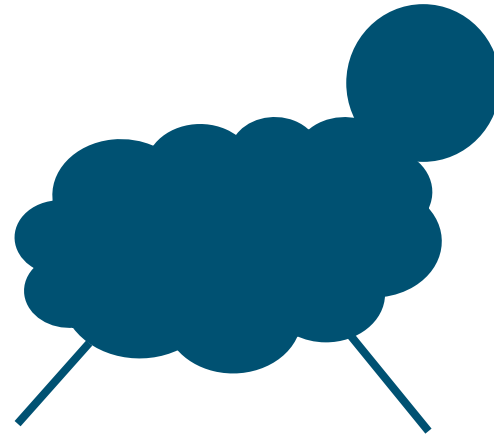
5

2 lambs  
weaned

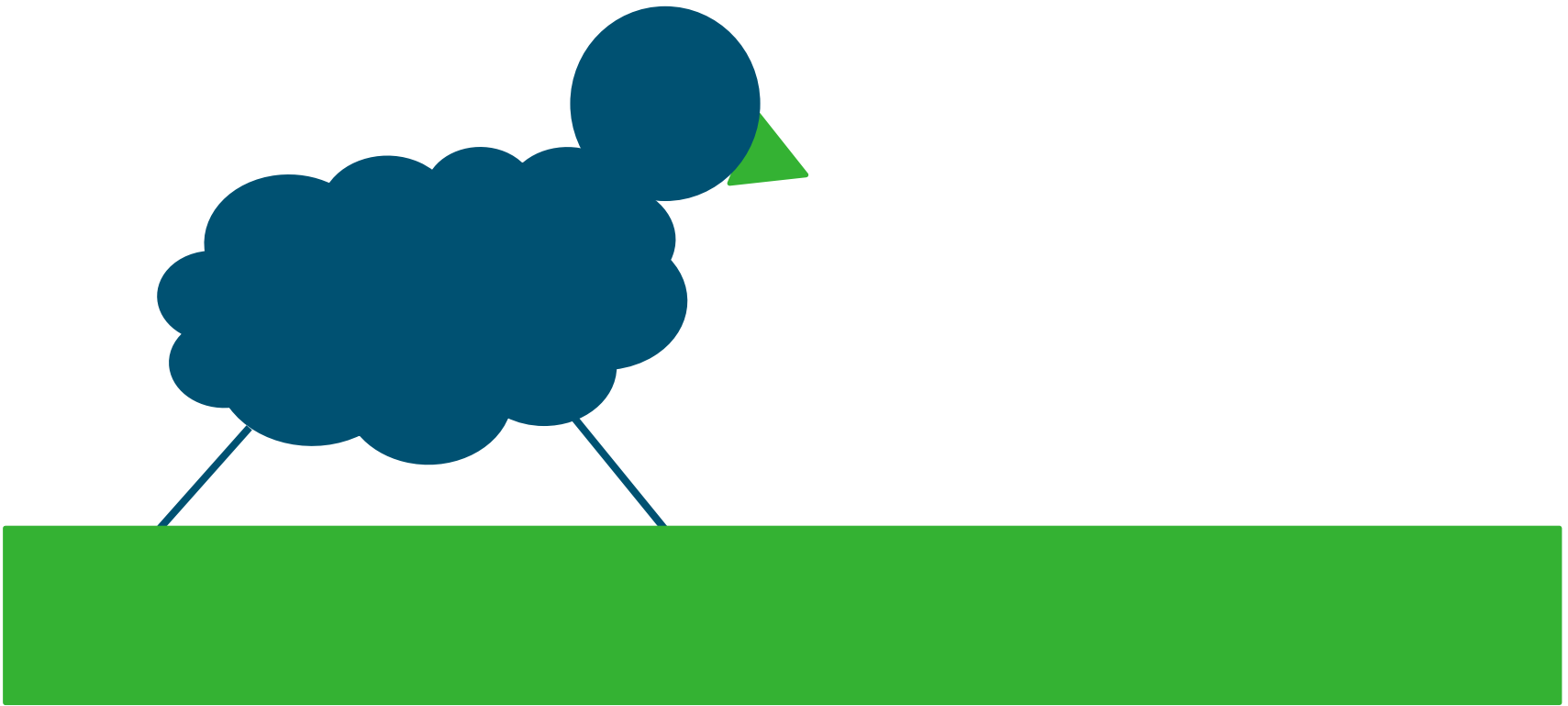
6



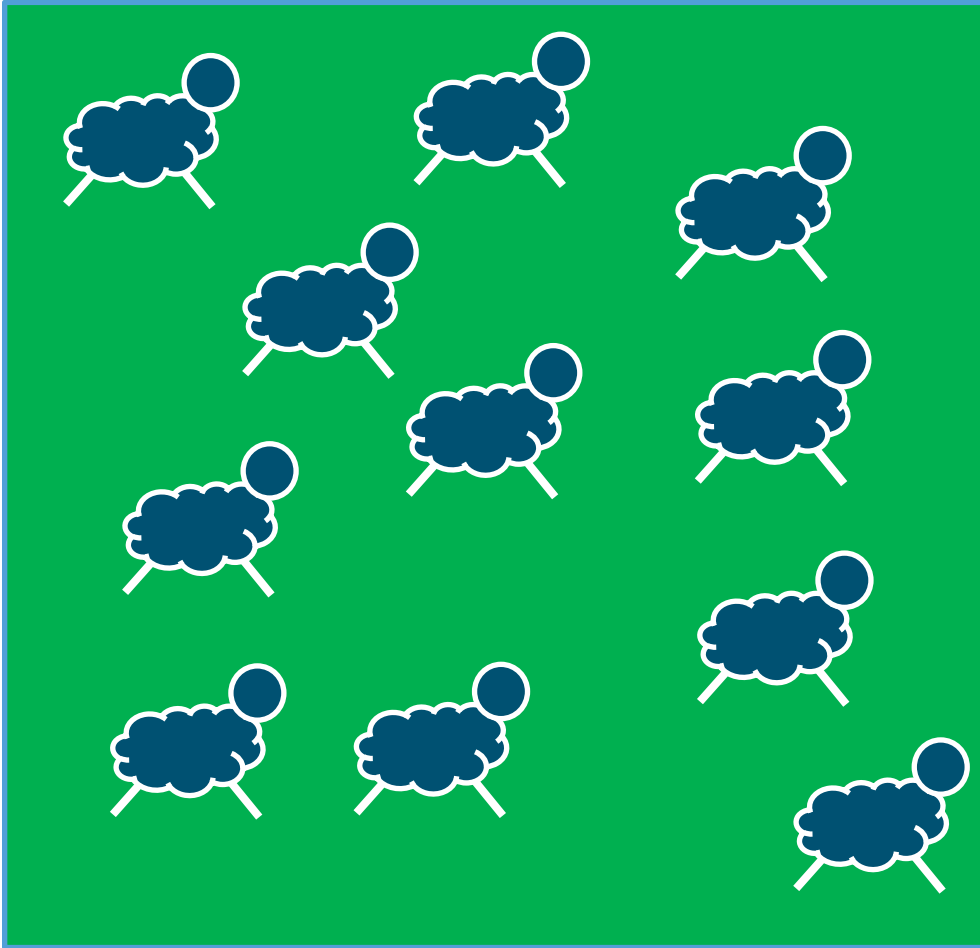
# Two sexes



# Sheep eats grass and grain



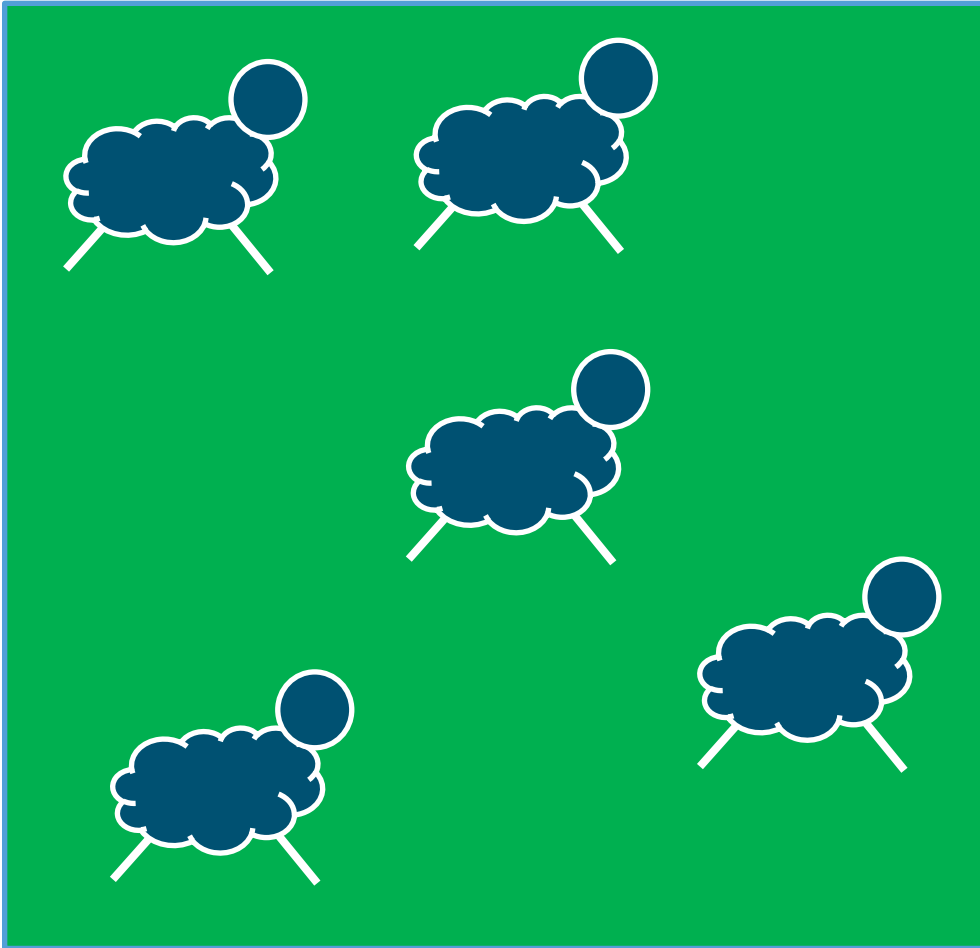
# Model sheep farm



Number of sheep limited by the amount of grass on the farm



# Model sheep farm



Increase feed intake  
or decrease pasture

=

Less sheep or more  
grain

=

Less profit





# Always included average pasture growth

