

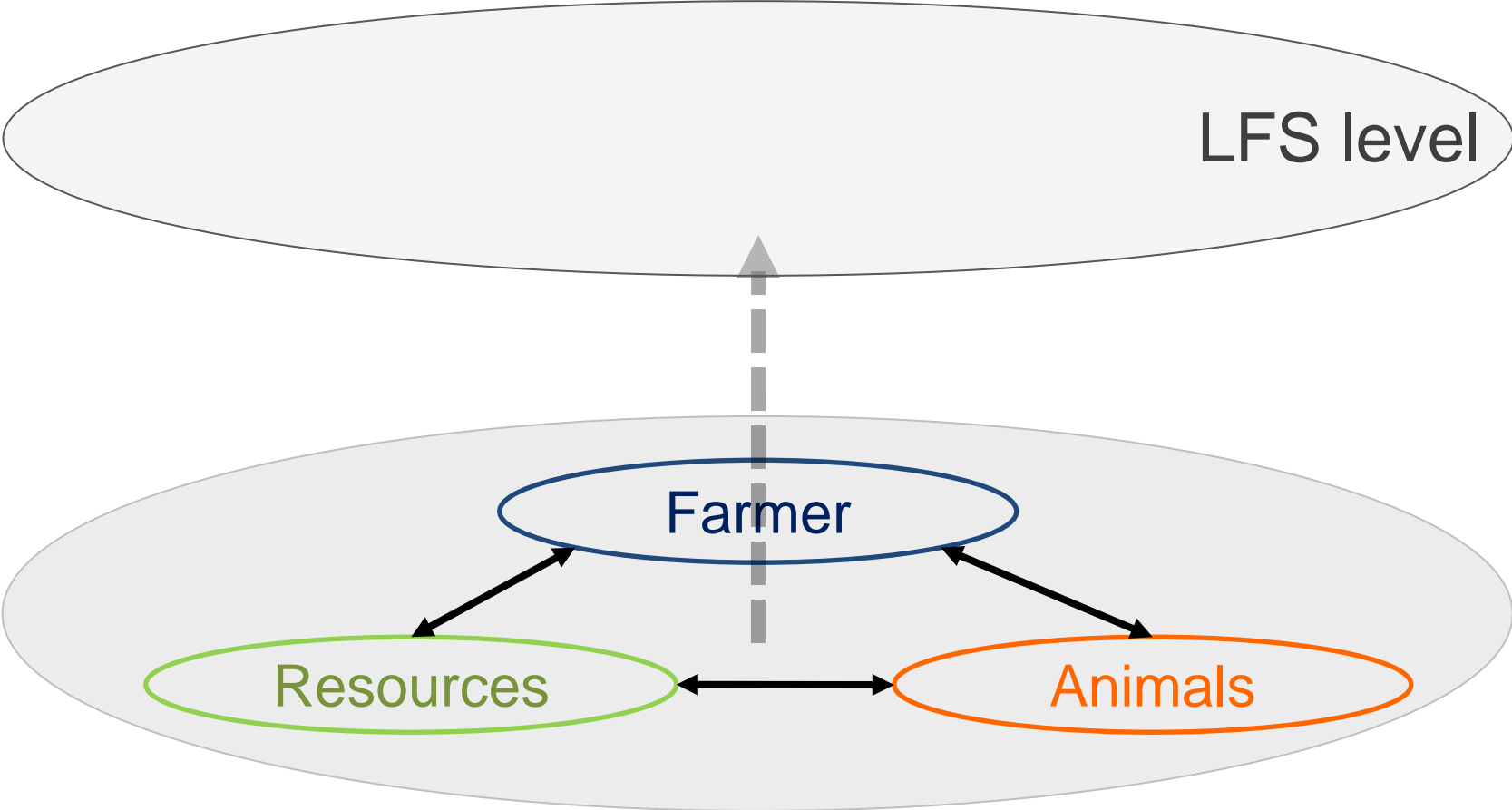
# A modelling framework to evaluate benefits of animal adaptive capacity for livestock farming systems

Puillet L., Martin O., Tichit M., Réale D.



# Levers for robust and resilient LFS

*Robustness & resilience*



*Adaptive capacities*

# Role of the animal biological component

*Using animal adaptive capacities to cope with perturbations*

Where do we come from ?



Benefits of animal robustness

*Low control of environment*

*Gibon, 1994; Blanc et al., 2006; Nozières et al., 2011*

Costs of lack of animal robustness

*High control of environment*

*Rauw et al., 1998; Knaus, 2009; Web & Casey 2010*



# Role of the animal biological component

## Where are we going ?

Producing & transferring knowledge in the field...

→ Toward a tool for analysing and quantifying the effects of management, selection and environmental conditions on the expression of animal adaptive capacities

# Role of the animal biological component

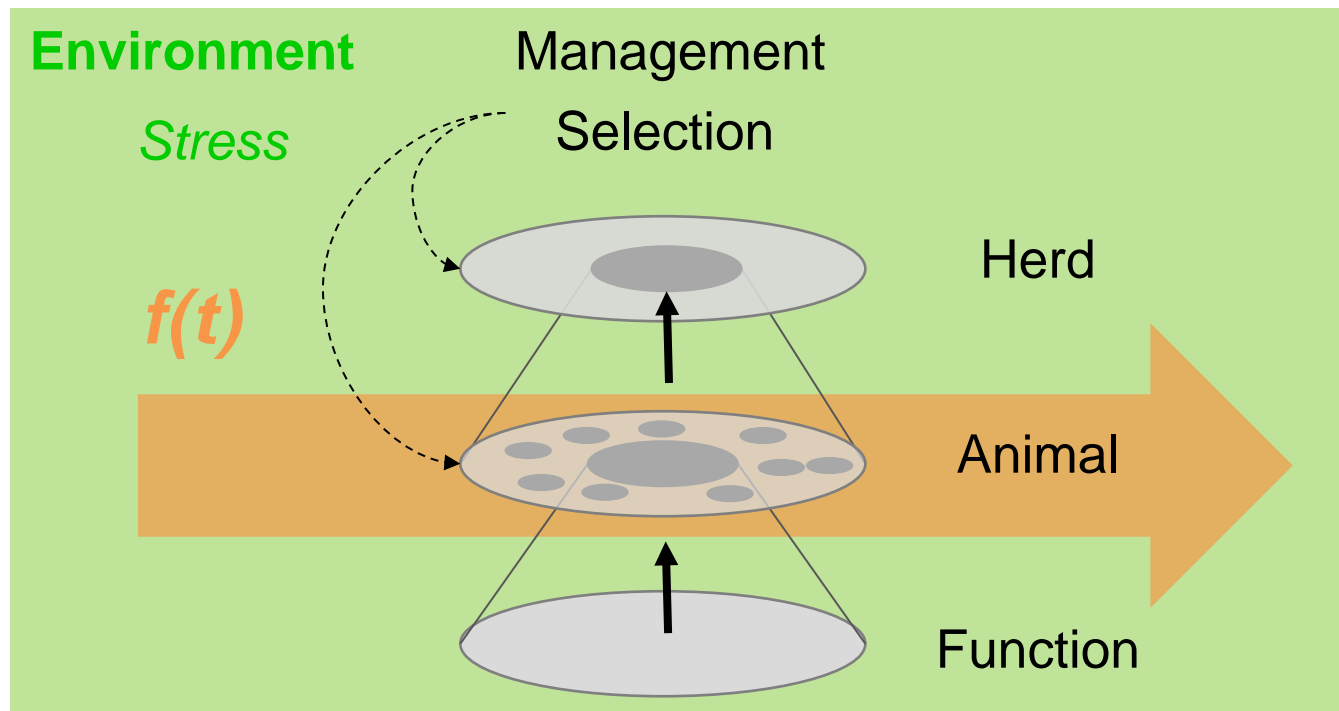
Which strategy ? → Using models



Formalising  
Integrating K

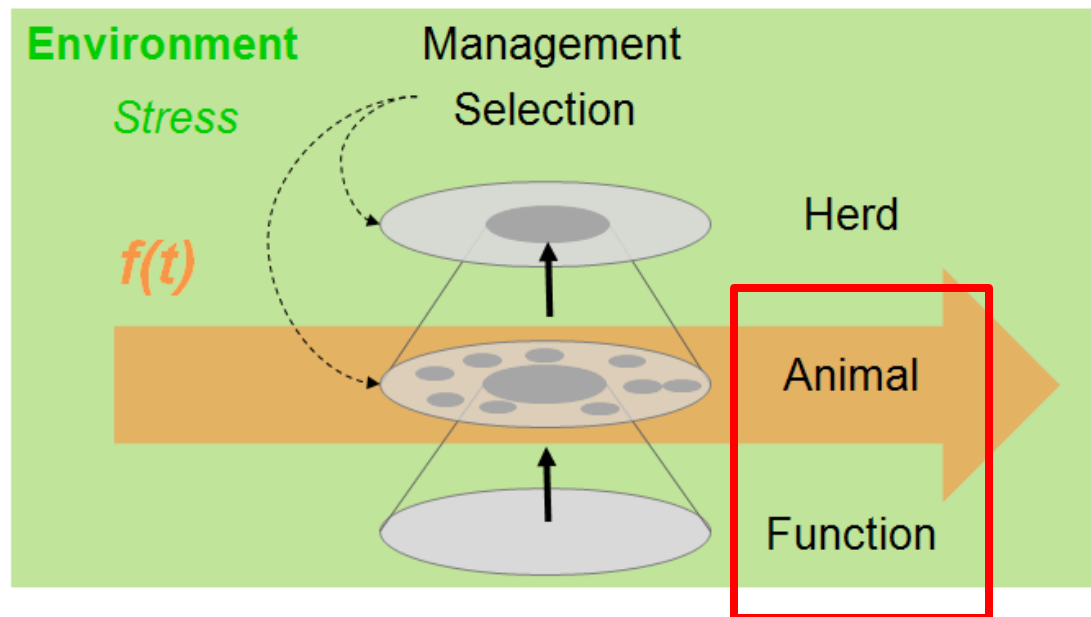


Predicting  
Quantifying



# Objective

An animal model representing different types of robustness

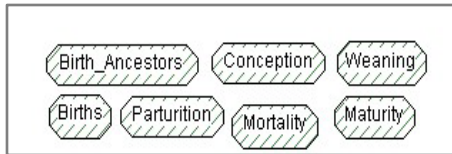


# Modelling diversity of robust animals

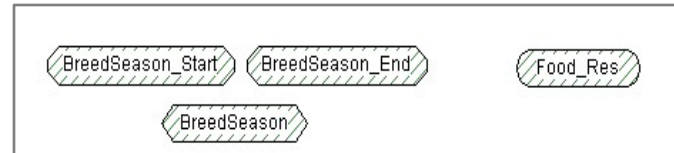
- Robustness & adaptive capacities
  - Trade-offs among biological functions
  - Acquisition and allocation of resource
- Trade-offs → key concept in ecology
- Enrich animal representation by adopting ecology point of view
  - Differences in the drivers of phenotypic traits
    - = Natural selection and adaptation
    - ≠ Production potential
  - Similarities with animal sciences
    - Nutrient partitioning
    - Phenotype as expression of genotype in an environment

# Modelling diversity of robust animals

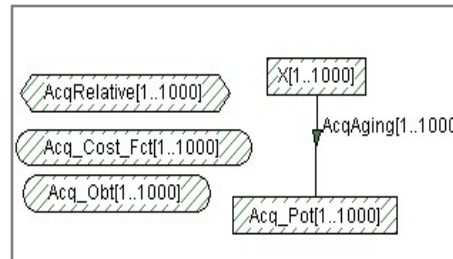
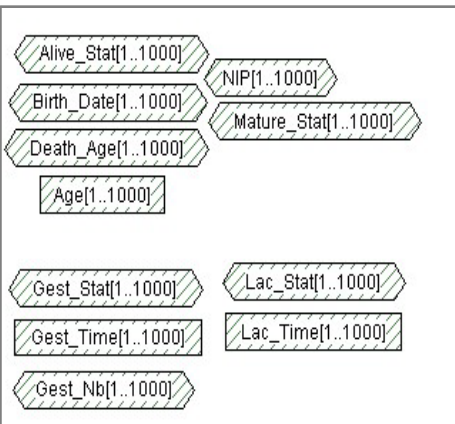
## Biological events



## Environment

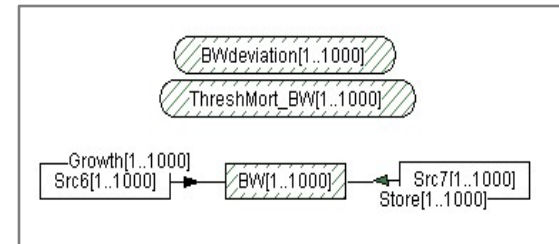


## Life records

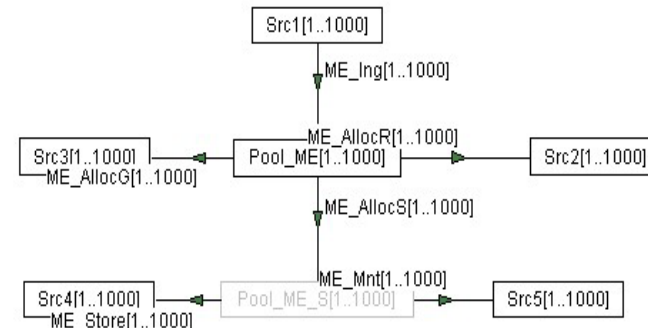
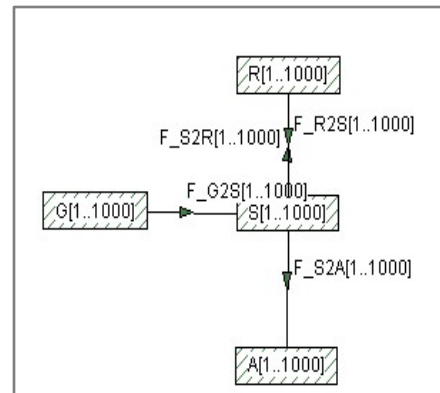


## Acquisition

## BW



## Progeny



## Allocation coefficients

## Energy utilization

## Genetic parameters



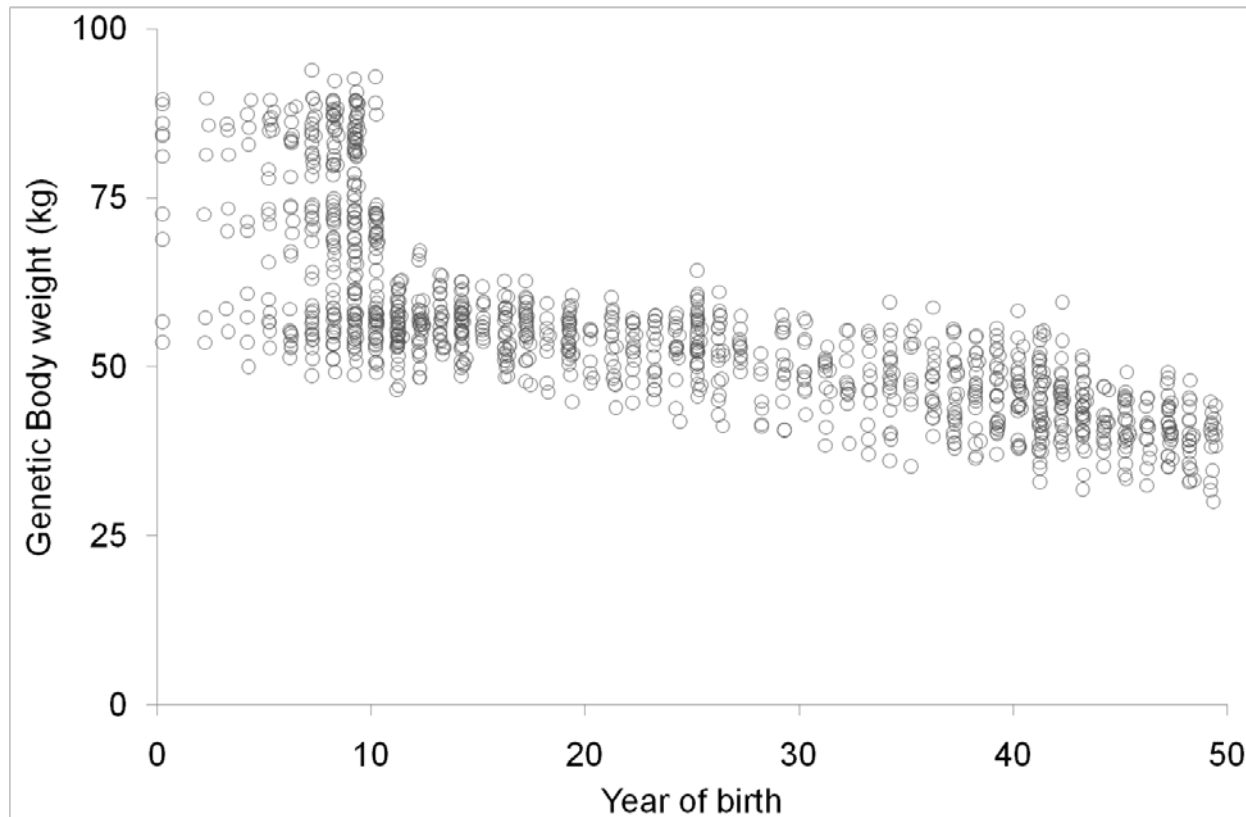


# Modelling diversity of robust animals

- Utilization of energy: core of the animal model
  - Fuel biological functions
  - Result of energy acquisition (environment & cost) & allocation (priorities among functions)
- Conversion of energy into BW
  - Growth, storage and depletion
- Feedback of BW on survival and reproductive success
- Maternal energy investment → progeny survival
- Genetic parameters (BW, allocation & acquisition) transmitted throughout generations

# Modelling diversity of robust animals

- Simulation of an ungulate population
  - How selection shapes the allocation and acquisition parameters ?
  - Which types of animals are the fittest ?



# Modelling diversity of robust animals

- Disappointing results .... Importance of the concept of costs !
  - Acquisition: energy for organs and metabolism
  - Fitness: individual and progeny survival
- Next step → working on costs

*Challenge to merge concepts from ecology and animal sciences...at least at the scale of a post doc!*

# Conclusion

- Thinking concepts with simple models to gain insights on complex issues (robustness, resilience, phenotypic plasticity, ....)
- Benefits from interdisciplinarity : reconsidering animal representation

Passive material  
convertor



Organism with its  
own agenda



Organism interacting  
with its environment

# Thanks for your attention

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