



March 28th, 2023

Module 2: Mechanistic and statistical modelling of resilience and feed efficiency

Course description:

Mathematical modelling has become a valuable tool in the analysis of resilience and feed efficiency and to support the development of control strategies. This module will introduce the conceptual ideas and mathematical tools needed for formulating and evaluating mathematical models for resilience and feed efficiency in farmed animals. A hands-on approach will be adopted in form of interactive lectures and tutorials. The module will cover fundamental principles of statistical and mechanistic resilience and feed efficiency models, together with relevant examples including

- General introduction to statistical and mechanistic mathematical models
- Mechanistic models of trade-offs determining variation in resilience and feed efficiency
- Statistical models of resilience trajectories
- Modelling resilience of sheep to gastro-intestinal parasite infections

The course will provide participants with the relevant theory of mathematical modelling of resilience as well as with hands-on experience with relevant modelling techniques. Upon course completion, participants can expect to have a basic understanding of the purpose, essential building-blocks, assumptions and limitations of different types of mathematical models, have the fundamental knowledge to build mathematical models from scratch and analyze the model behavior, and will be able to interpret published results from diverse modelling studies.

The course is aimed at animal scientists (post-graduate level or above) and professionals in the field of livestock production or health with good numeracy skill and an interest in quantitative approaches to study infectious diseases. The course is not aimed at researchers with advanced modelling skills.

Course teachers:

Masoud Ghaderi-Zefreh (UEDIN), Nicolas Friggens (INRAE), Laurence PUILLET (INRAE), Frédéric Douhard (INRAE)

Agenda

Session 1: General introduction to mathematical modelling	
09:00 - 10:00	“General introduction to statistical and mechanistic mathematical models” – Masoud Ghaderi-Zefreh (UEDIN)
Session 2: Statistical models of resilience trajectories	
10:00 – 10:45	“Lecture: Statistical models of resilience trajectories from a biologist’s perspective” - Nicolas Friggens (INRAE)
10:45 – 11:00	Coffee Break
11:00 – 12:00	“Statistical modelling tutorial” - Nicolas Friggens (INRAE)
12:00 – 13:00	Lunch
Session 3: Mechanistic models of trade-offs determining variation in resilience and feed efficiency	
13:00 – 13:30	“Lecture: Allocation theory in farm animals: from concepts to code” – Laurence Pulliet (INRAE)
13:30 – 15:00	“Lecture & Tutorial: Manipulating acquisition and allocation parameters to generate variability in production trajectories” - Laurence Pulliet (INRAE)
15:00 – 15:15	Coffee Break
Session 4: Modelling resilience to infections	
15:15 – 17:00	“Lecture and tutorial: Modelling resilience of sheep to gastr-intestinal parasite infections” – Frédéric Douhard (INRAE)