



March 30th, 2023

Module 4: How can resilience and efficiency traits impact system performances and modify farmers' breeding choices?

Course description:

In the animal breeding process, the system level is very important because different aspects can be modified by the availability of new resilience and efficiency traits: economic results, environmental impacts, farmer choice and farming practices. This course module focuses on two different methods: modelling and surveys, with different approaches.

Redesign of farming systems to switch towards more sustainable and resilient sheep and goat production using modelling.

The first approach is based on the development of a **farm-scale mathematical simulation model**. This linear programming model is implemented for sheep and goat farms and its outcomes will be presented. This whole-farm model simulates economic performance under new resilient and efficient traits that counteract presence of infectious and non-infectious diseases. The model provides scenarios of how changes towards optimizing one farm component (e.g. genetics at animal level) could affect other components of the farm or the overall system (e.g. gross margin, labor, land use, grazing, profit etc.), in terms of sustainability. The model constitutes a very useful tool for policy-makers to identify innovative strategies that can be proposed to re-design sheep and goat farming systems. The structure and the main features of the model as well as the required data for its implementation will be described in detail and the results of the implementation of the model using real-farm data from **Chios sheep breed** will be analyzed.

The second approach uses OSIRIS, a **bio-economic model**, that allows to define an economic breeding goal for ruminants by estimating the economic values of traits for a particular system and breed in today's context. The very detailed description of the functioning of the system (replacement and culling policy, fertility rates, health costs, mortality rates, etc.) allow to model the profit for a typical herd management. The model includes equations of income and costs related to several traits that can be genetically improved for breeding and production and so be part of breeding objectives. Then, the economic values can be defined as the first derivative of the herd profit function regarding each individual trait. The architecture of the model as well as the main parameters required will be described. The results of the modelling for a system in the French **Lacaune milk sheep breed** will also be detailed.

Understand farmers' choice to use new breeding traits for more sustainable livestock production using surveys.

The approach is based on interviews about farmer's practices to identify paragon of livestock farming system. The interviews focus on farm features, breeding practices, and farmers' choice of traits to improve farm genetics. Based on the diversity of the case studies (10 different types of systems/intensification and different breeds), we will explore how farmer choice can be linked to various socio-technical systems and positively enable increased sustainability of agriculture.

Course teachers:

Alexandros Theodoridis (AUTH), Vincent Thénard (INRAE), Stéphanie Coppin (IDELE)

Agenda

Session 1: General introduction of resilience and efficiency traits approach in Sheep & Goat farming system	
09:30 - 10:00	"Presentation of the cases studies Livestock Farming System by countries" – Vincent Thénard (INRAE)
Session 2: Holistic models for designing efficient and resilient Sheep & Goat sector	
10:00 – 11:00	"A farm-scale mathematical model to simulate economic performance under infectious and non-infectious challenges" – Alexandros Theodoridis (AUTH)
11:00 – 11:15	Coffee Break
11:15 – 12:15	"OSIRIS, a bio-economic model, that allows to define an economic breeding goal for ruminants" – Stéphanie Coppin (INRAE)
12:15 – 13:15	Lunch
Session 3: Breeder's choices to use new breeding traits for sustainable livestock production	
13:15 – 14:15	SMARTER Survey - Stéphanie Coppin (INRAE)
14:15 – 15:30	Conduct interviews on farmers' practices to identify paragons of livestock selection management" – Vincent Thénard (INRAE)
15:30 – 15:45	Coffee Break
15:45 – 17:15	"How to imagine new select traits based on participatory approach using LEGO game" – Vincent Thénard (INRAE)
17:15 – 17:30	General discussion