What internal mechanisms make sheep farms more resilient to technical and economic hazards?

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The sustainability of livestock systems can be assessed through their productive and environmental performances, including the ecosystem services they provide and their resilience to hazards. We used a modelling approach to assess how key performance indicators respond to technical and market hazards in five contrasted meat-sheep farms in France and Ireland. Hazards were associated to three key technical (ewe fertility, prolificacy, lamb mortality) and four economic variables (prices of two types of lambs, concentrate use, energy use). We used a mechanistic model to simulate farm functioning and calculate farm performance over 3,000 iterations (simultaneous random draws with hazards on previously-mentioned seven variables), which allowed us to quantify: (1) the compensatory effects of different types of technical and economic mechanisms that lead to more stable economic performance; and (2) the probability of economic collapse of meat-sheep farms through a diachronic analysis. We showed that the most resilient systems in terms of net income coefficient of variation are those combining low level of inputs with at least two lambing periods per year. The most stable income per worker were observed in the accelerated reproduction system with three lambing periods per year, but its high demand in inputs (concentrates) reduced farm net income, increasing in the same time its coefficient of variation. Overall, variations in technical variables have the larger effects on income variability than those of economic prices. This was related to the specific characteristics of sheep production, with a very high potential prolificacy and highly variable lamb mortality. The short gestation duration of the species is quite compatible with the possibility to implement multi periods lambing systems which buffers the variability of the three technical variables, and enhances farmer's adaptive capability to adjust to fluctuations in ewe fertility. The diachronic analysis confirms the results of income sensitivity to hazards with a 18% probability of succession of 3 years with an average loss of income higher than 3,700 € for the one lambing a year farming system vs a 4% probability for the accelerated farming system (three lambing periods).

A thirty-year analysis of trajectories of evolution of cattle farming systems in Central Pyrenees

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Mountain regions are characterised by their complex interrelations between human and environmental systems. In this coupled system, changes induced by political or socioeconomic transformations at different levels generate consequences for mountain livestock systems functioning, resulting in changes in their structure, management and economic performance which may alter their resilience. The analysis of the diversity of current states and past trajectories helps understanding how socioeconomic drivers at different scales affect mountain farm resilience which informs the development of optimal agricultural strategies for future changes. In this study we aimed to determine: (1) the main changes occurred during the last three decades in cattle farming systems in Central Pyrenees in Spain; (2) the main trajectories followed by farms during this period; (3) the socioeconomic drivers of such evolution paths. A constant sample of 50 beef cattle farms of three valleys with different economic development pathways was surveyed in 1990, 2004 and 2018. Trajectories of evolution were analysed using multivariate statistical. Globally, main production orientation in the area changed from mixed dairy-weaned calves to specialised beef systems with on-farm fattening in the first period, and to sucker cattle farms in the second period. Other changes were related to: increase of herd size and grazing period and dependence of subsidies, decrease of the labour input and increase of gross margin per work unit. Besides this general trend, four different trajectories of evolution were identified: three of them specific to each valley and one that was common to all of them. A preliminary discriminant analysis showed that farm trajectories were driven by household size, farmer age and education level, farm dynamism and dependence of subsidies. Our results show that farm resilience is influenced both by internal social drivers at the farm scale and external policy drivers at the EU level.

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Book of Abstracts of the 71st Annual Meeting of the European Federation of Animal Science

Book of abstracts No. 26 (2020)
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Book of Abstracts of the 71st Annual Meeting of the European Federation of Animal Science

Virtual Meeting, 1st–4th December, 2020

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