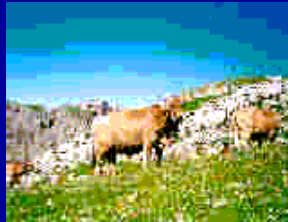


Analyzing trade-offs between production, economics, land use and labour in mountain farming systems through long-term simulation



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Simulation Model: Assessment of LFS dynamics

- Mountain livestock play a number of crucial functions beyond production of food
- New management strategies will need take into account structural, managerial and social changes occurred in recent years
- Simulation models are able to integrate the multiple factors involved in LFS dynamics
 - *Reproduction and nutrition, management, animal physiology, availability of resources,...*
 - *Throughout long periods of time*



Objective

- Compare the long-term performance of mountain beef cattle herds under diverse:
 - Feeding, reproductive and land use management strategies
- Using a herd dynamics simulation model
- Analyzing derived trade-offs between production, economics, land use and labour input

The herd dynamic simulator (*Nodriza*) : An Overview

- Beef cattle model based on an stochastic and dynamic animal sub-model presenting management –nutrition - reproduction interactions
- Parameterized and Validated under conditions of Spanish Pyrenees. Work of “La Garcipollera” research station since 1987
- The equations of the model have been programmed in Visual Basic 2005 express edition ® in order to facilitate its use. The Nodriza software designed had different visual interfaces where diverse scenarios can be defined.

Nodriza: An Overview

Feeding Plan
(Energy, ME)

COW-CALF SUB-MODEL

Individual (stochastic) and daily basis simulation
Compartments: Empty Body Weight → Weight
Total Fat → BCS
Calf Weight

BCS →

Postpartum
Anoestrus (PPA)

Physiological state:
Lactating
Pregnant

Key
Management
Dates

HERD DYNAMIC SUB-MODEL

Individual (stochastic) and daily basis evaluation of:
sexual cyclicity
Mating
Pregnancy
Calving
Lactation, culling and mortality



Nodriza: User Interfaces- MAIN

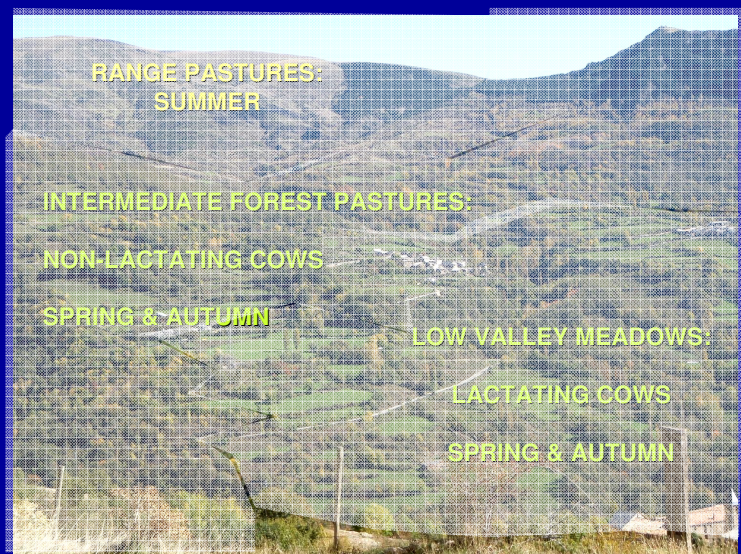


Simulated herd

- 100-cows herd of 650 ± 15 kg (mean $\pm$ s.d.) of LW and BCS of 2.5 ± 0.1 .
- The period of time simulated was 15 years (steady state at year 6).
- Culling, replacement and random mortality and abortion assumed common for all the strategies



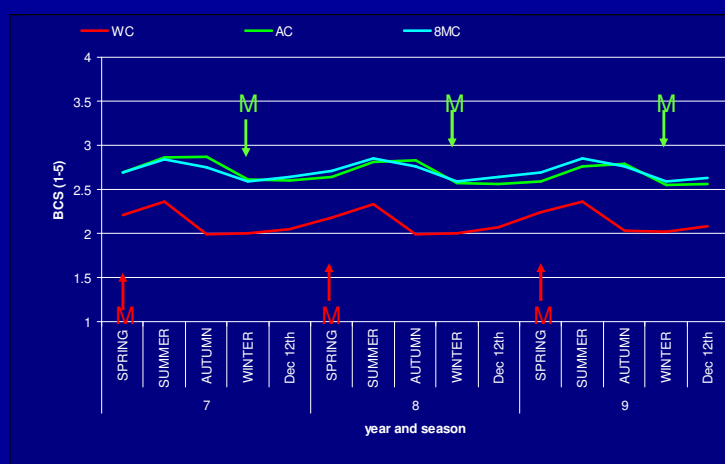
Grazing management simulated



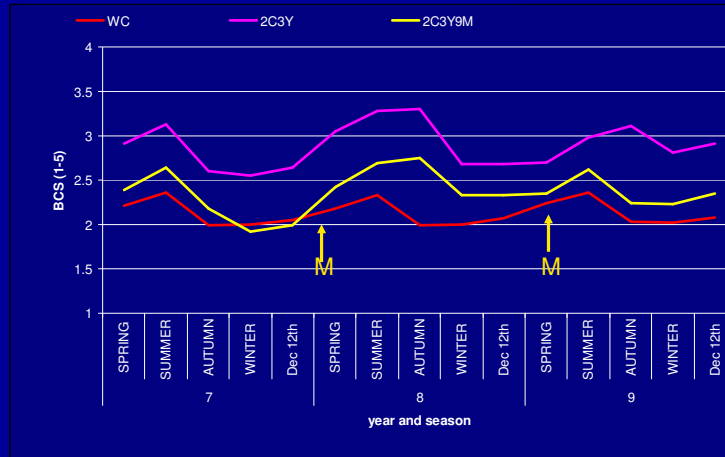
Simulated Strategies

Management strategy	Calving length	Weaning
Winter calving (WC)	3 months	180 days
Autumn calving (AC)	3 months	160 days
8 months calving (8MC)	8 months	180 days
2 calving in 3 years	2 months	170 days (2C3Y)
Reduction of labour costs & Better use of some natural resources		270 days (2C3Y9M)

Simulation Results: Body Condition Score (BCS)



Simulation Results: Body Condition Score (BCS)



Simulation Results: Reproductive performance

	Strategy ¹				
	WC	AC	8MC	2C3Y	2C3Y9M
Fertility (%) ²	78.0	88.2	92.2	93.5	94.4
SD (%)	3.71	2.21	1.83	0.85	0.52
max (%)	81.7	92.1	94	95	95
min (%)	70.7	83.9	90.1	92.8	93.9

¹ WC, winter calving; AC, autumn calving; 8MC, 8 months calving; 2C3Y, 2 calving in 3 years; 2C3Y9M, 2 calving in 3 years with weaning at 9 months.

² number of pregnant cows at the end of mating season *100/total cows

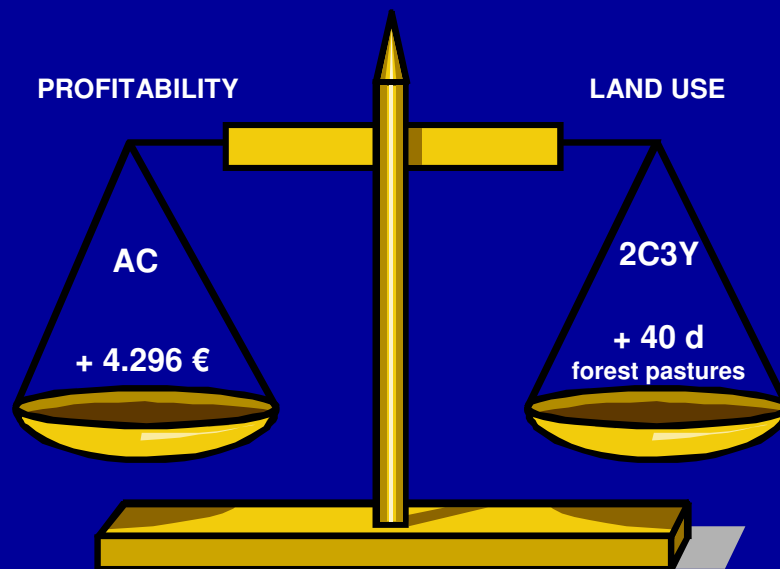
Simulation Results: Production and labour

	WC	AC	8MC	2C3Y	2C3Y9M
<i>Production</i>					
Weaned calves ¹	76	86	90	59	60
Calving days per year (d)	90	90	240	40	40
Weight at weaning (kg)	219	197	204	201	298
Length of fattening (d)	176	189	185	187	126
<i>Labour</i>					
Total labour (h)	458	519	670	379	420
Grazing management (h)	183	102	126	147	180
Feeding in-door (h)	173	312	290	182	190
Calving supervision (h)	102	104	255	50	50

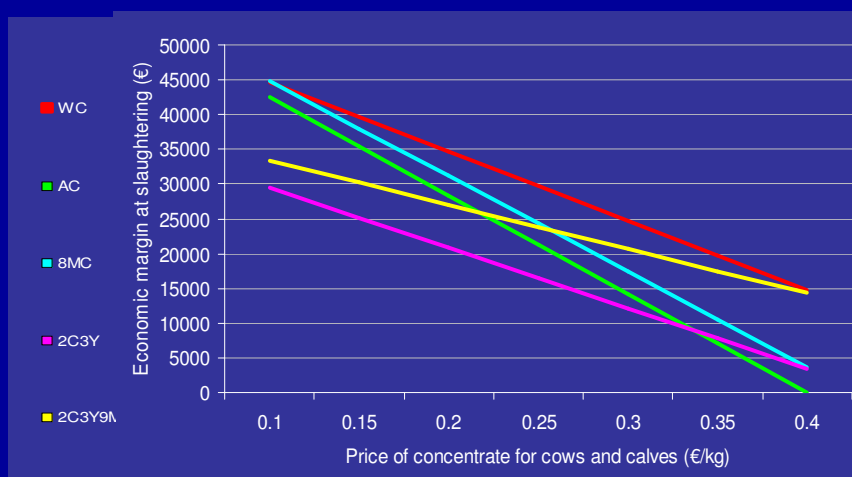
Simulation Results: Land use

	WC	AC	8MC	2C3Y	2C3Y9M
<i>Land use</i>					
Winter supplementation (d)	122	165	165	122	122
Supra-forest pastures (d)	106	106	106	106	106
Valley meadows (d)	42	16	38	20	65
Forest pastures (d)	95	78	56	117	72

Trade-offs: an example



Simulation Results: Sensibility



Conclusions

- Relatively intensive strategies, such as 8MC and WC, yielded the highest economic margins, but the alternative low-labour/ extensive strategy is feasible and less sensible to increases of feed prices.
- Simulations should be used to explore new management strategies and analyze the consequences of their implementation under diverse scenarios, rather than being conclusive tests for choosing the optimal strategy.

Models (A Map)

- Construct a model is a way to summarize and order information proceeding from different sources.
- The simulations yields answers about the scenarios tested, but also questions arises (either no-information or questionable hypothesis).
- So Models are also a tool to define new research ways.

