# A dynamical model to assess the efficiency of grazing strategies for biodiversity conservation

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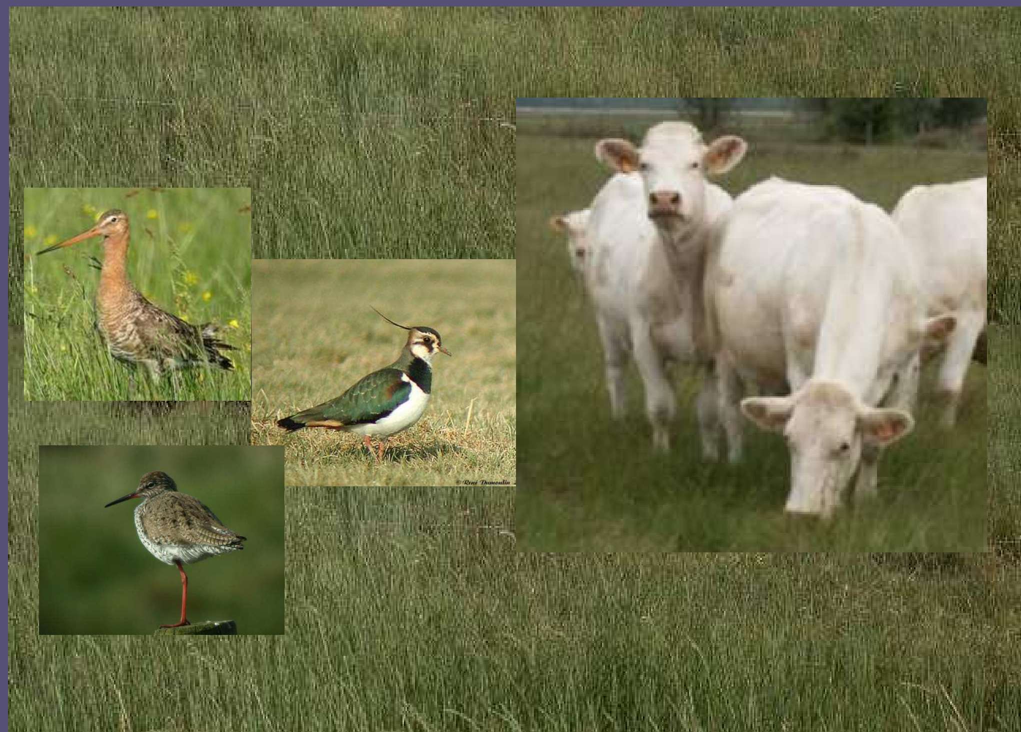


57th EAAP meeting, September 17-20 2006, Antalya

WHY matter Decision Support tools in livestock grazing management?

- Incorporate trade-offs / short & long term consequences of management

- Identify changes in habitat quality

- Link these changes to biodiversity and production outcomes

- Illustrate for stakeholders trade-offs among different priorities

Integrative modelling framework → HOW to manage grasslands to benefit both livestock production and biodiversity conservation

## Outline:

- A few insights in modelling framework
- Compatibility between productive ecological constraints
- Trade-offs among multiple goals
- DST weak & strong points

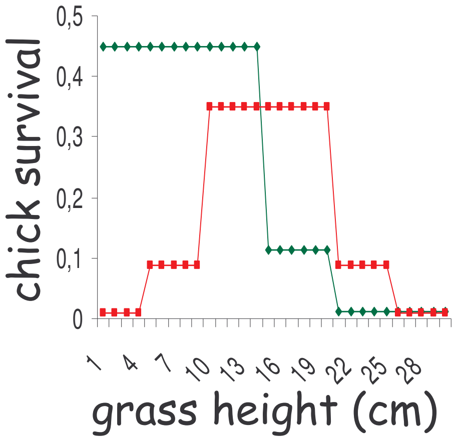
# Modelling framework:

Grazed grassland dynamics

Management decisions

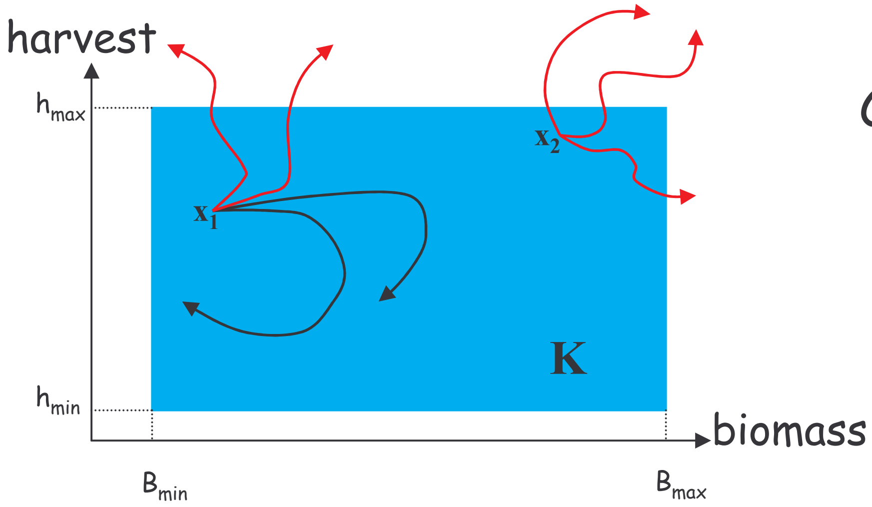
Habitat quality = sward height

Bird community dynamics




Viability theory

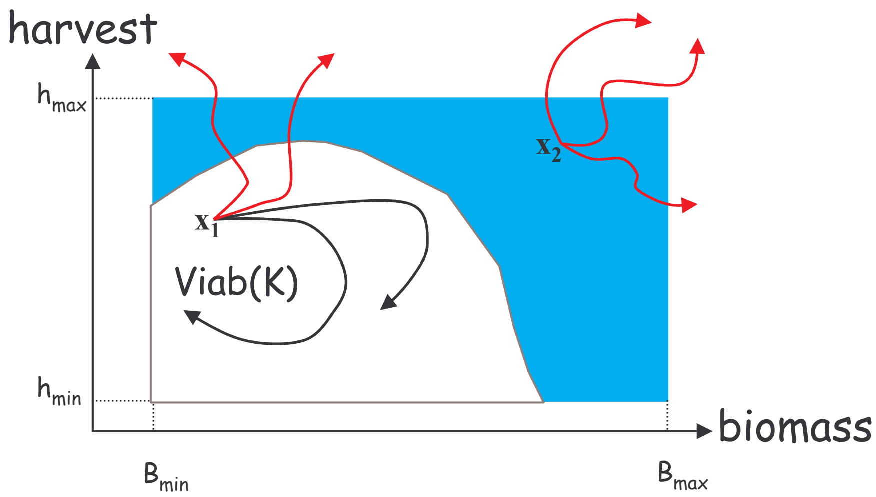
# Modelling framework: viability theory




Constraints = thresholds to be avoided

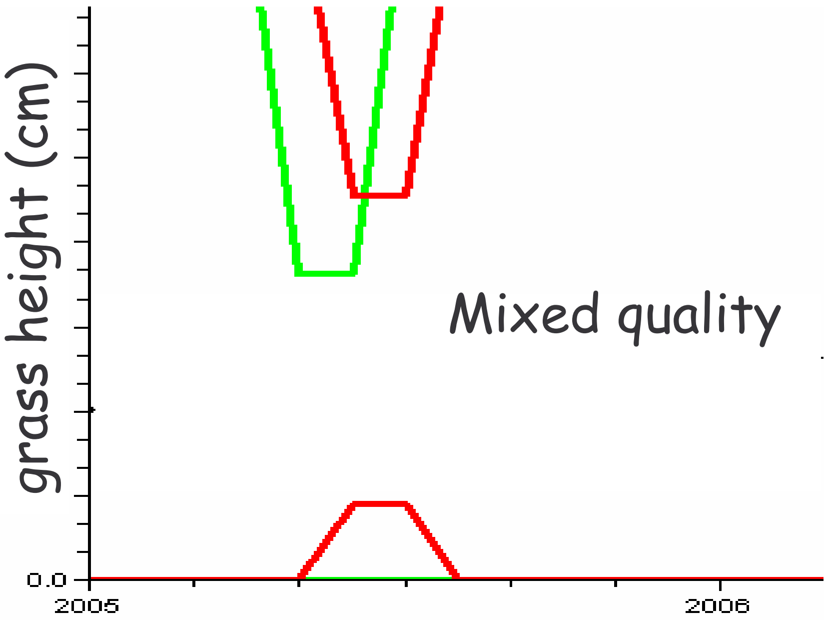
$$K \begin{cases} b_{\min} \leq biomass \leq b_{\max} \\ h_{\min} \leq harvest < h_{\max} \end{cases}$$

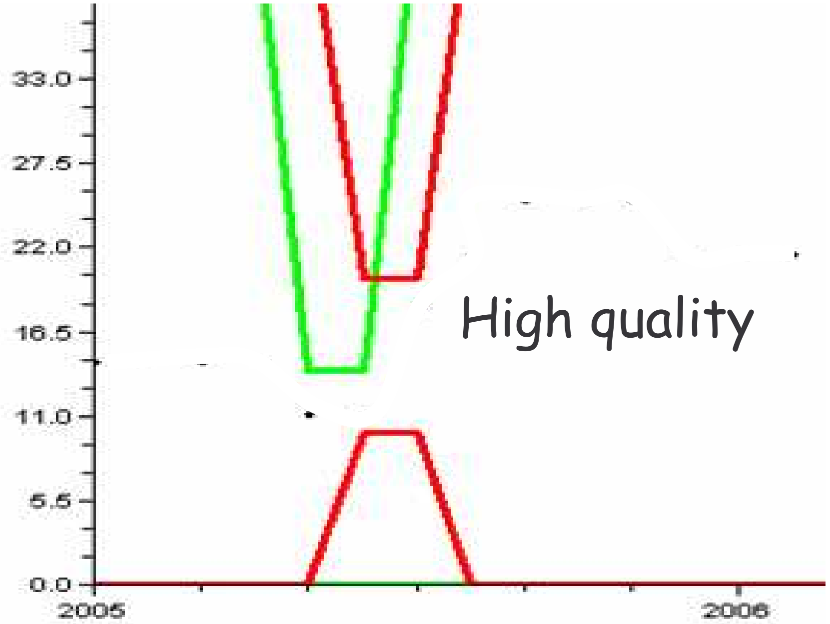
Viable trajectory: verifies constraints at any point in future time




Viability kernel: largest set with one viable trajectory

# Viability constraints (1): habitat quality



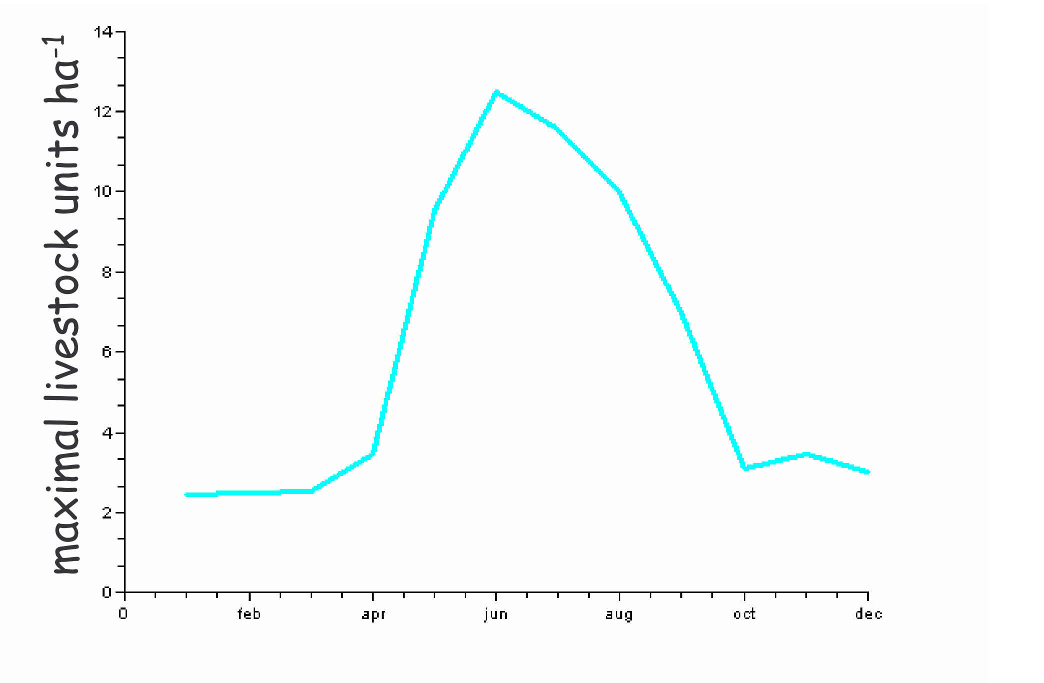

— $height_{max}$ lapwing in <u>May</u>

— $height_{min}$ – $height_{max}$ redshank in <u>June</u>

# Viability constraints (2): cattle requirements

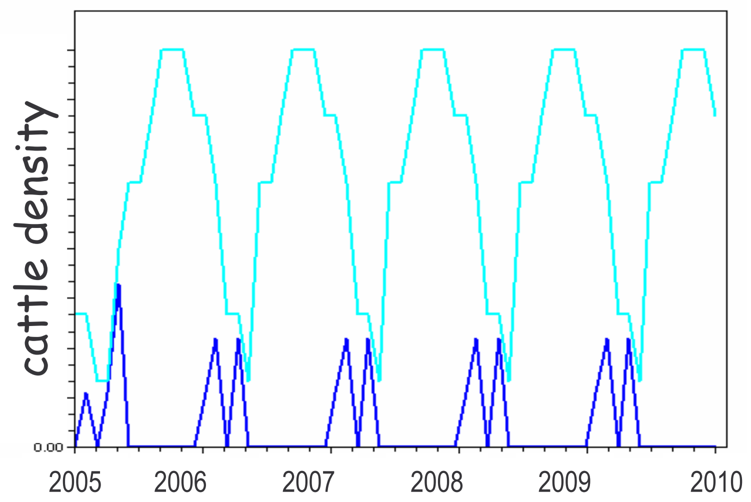
$$sward\ mass\ demand \leq available\ biomass\ \forall\ t > 0$$

=> Implicit limit on livestock density ($LU_{max}$)

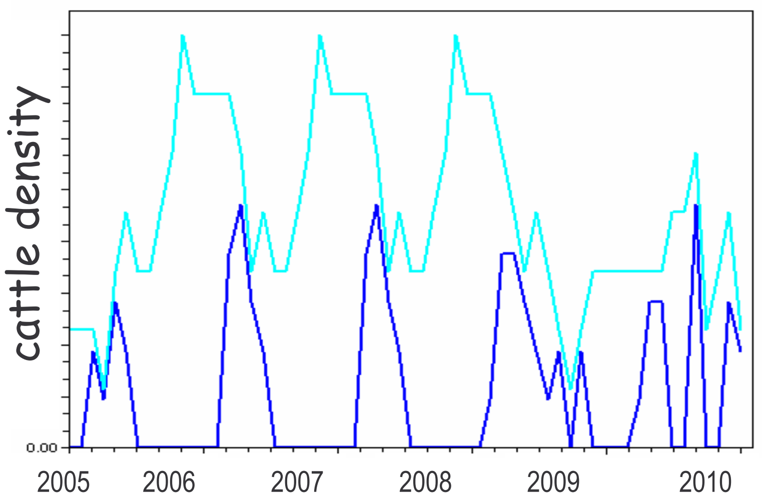


# Viable grazing regimes trajectories

## Minimal grazing




## Maximal grazing

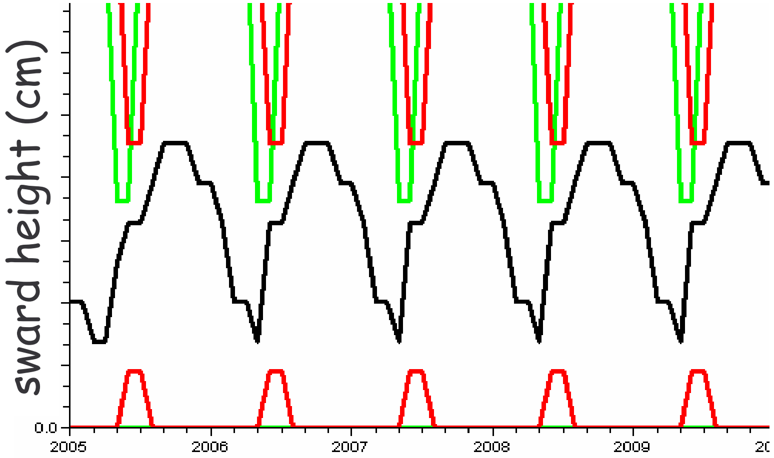



Viable grazing

$LU_{max}$

# Viable sward height trajectories

Minimal grazing

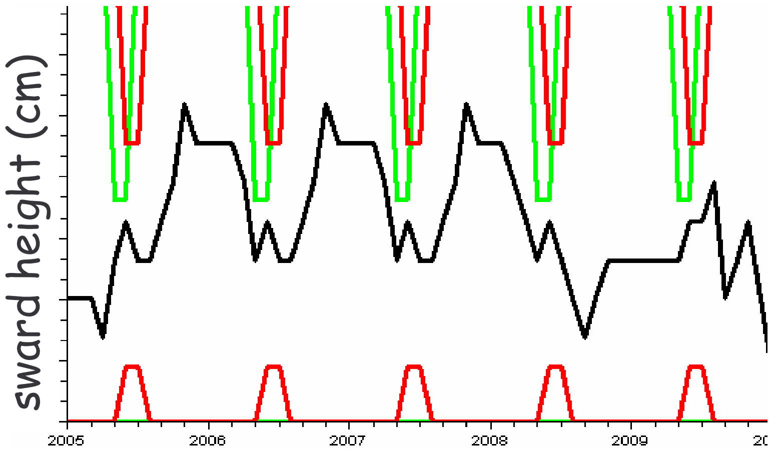



Habitat quality constraints:

Lapwing / May

Redshank / June

Maximal grazing

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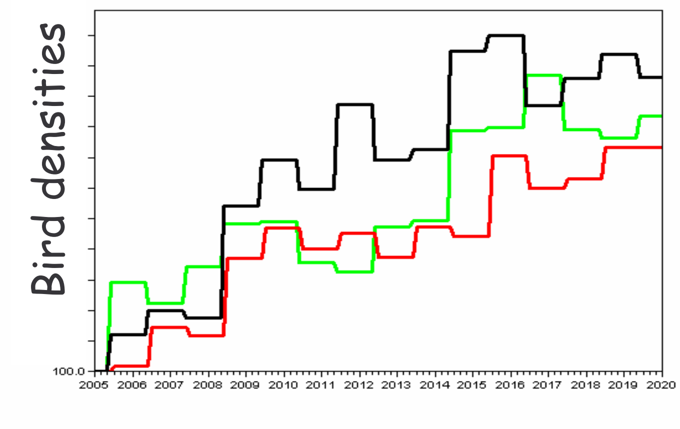
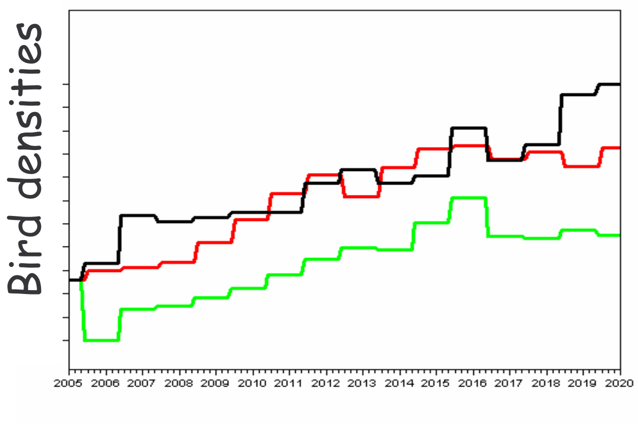
# Average economic merit of grazing regimes
(n=50 simulations)

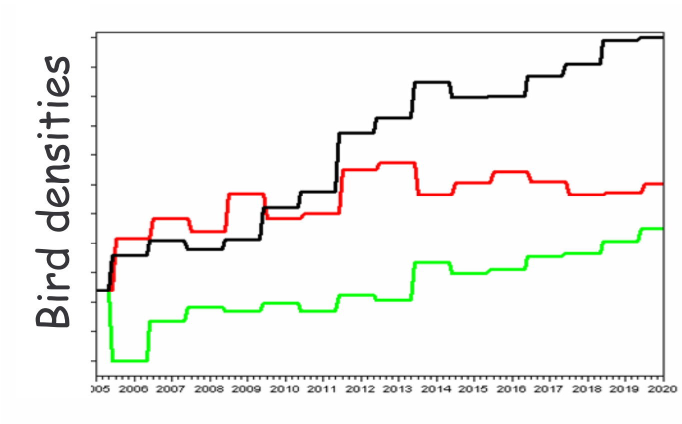
| Habitat quality | Grazing economic merit € $ha^{-1}$ $year^{-1}$ | |
|---|---|---|
| | minimal | maximal |
| high | **240** | **349** |
| mixed | **151** | **431** |

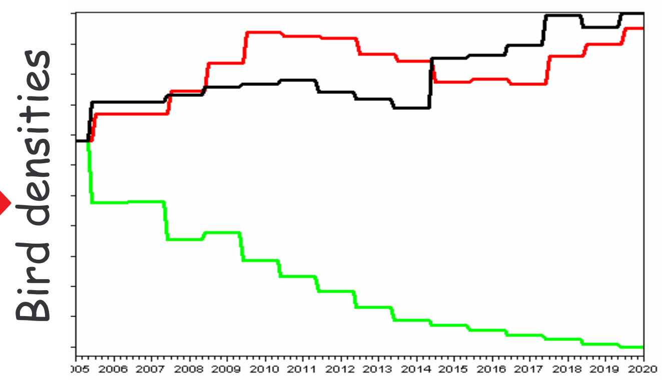
# Consequences on bird community over 15 years




| | |
|---|---|
| 240 | 349 |
| 151 | 431 |



# CONCLUSIONS (1)

- Modelling management dynamics

- Management as a driver of habitat quality -> irreversibility thresholds?

- Flexibility & limited data requirements

- Productives and ecological outcomes → complex trade-offs

# CONCLUSIONS (2)

- No a priori hierarchy between productive and ecological constraints

- Range of acceptable outcomes

- Promoting exchanges among multiples stakeholders

- Facilitation tool to reflect on potential conflicts between conservation and productive objectives

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