Paper 4

Steady-state Modelling:

For better understanding of current livestock production systems and for exploration of optimal short-term strategies

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Introduction

- obstacles for rigorous scientific modelling of grazing farms
  - lack of pasture data
  - lack of animal data
  - lack of soil data
  - lack of understanding of system
- hence alternative approach: **steady-state models** tailored for a small dataset

Data source

- farm surveys – data provided by farmers and local officials
- original research – from experiments where possible
- guesses – using the literature and experience to fill information gaps

Two-steps

- ***StageONE***
  understanding of current livestock production system
- ***StageTWO***
  exploration of optimal **short-term**, whole-farm farming strategy

Common philosophy

- Key to win-win improvement (grassland and net farm income) lies in energy balance
- Efficiently matching energy demand with supply is the first step

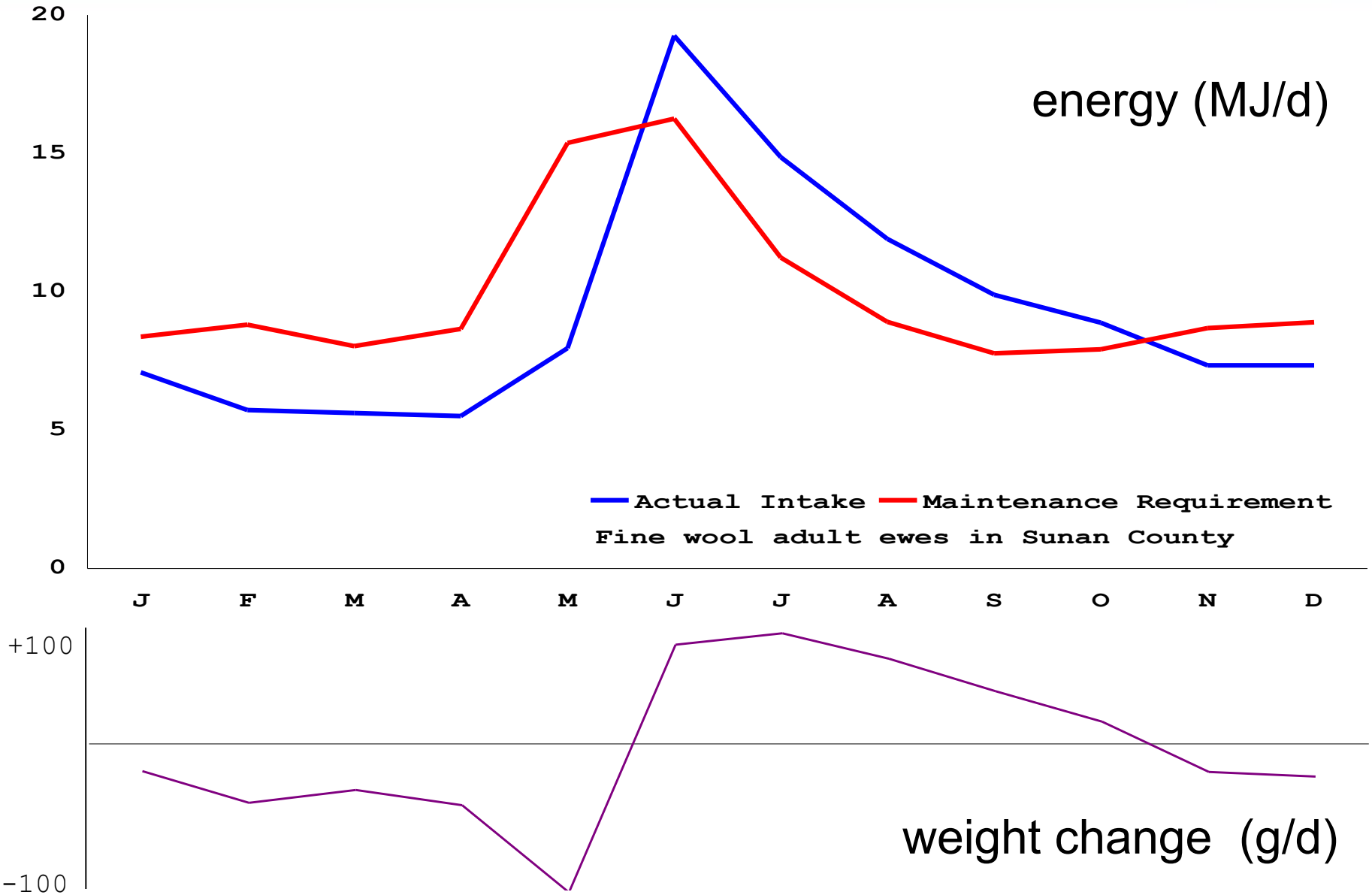
  i.e. better utilisation of pastures and timely feeding of supplements

StageONE model

① Estimates energy requirement for each animal class under current conditions

$$ME_{base} + ME_{graze} + ME_{cold} + ME_{preg} + ME_{lact} + ME_{lwg}$$

② Independently of that requirement, estimates energy intake by each animal class according to feed on offer


20
15
10
5
0
energy (MJ/d)
Actual Intake
Maintenance Requirement
Fine wool adult ewes in Sunan County
J
F
M
A
M
J
J
A
S
O
N
D
+100
-100
weight change (g/d)

StageTWO model - concept

① Estimates energy requirement for each animal class under user-specified conditions

$$ME_{base} + ME_{graze} + ME_{cold} + ME_{preg} + ME_{lact} + ME_{lwg}$$

② Satisfies that energy requirement in the cheapest possible way

StageTWO model - application

- Finds the most efficient energy allocation on the whole-farm basis under the constraints, or **options**, specified by users
- By comparing farm profits and associated environmental implications ***under different options***, we can explore ideas about optimal farming strategy

StageTWO model - options available

- different enterprises (mutton / fine wool / cashmere / cattle)
- different lambing dates
- different paddock rotational patterns
- different feed growing environments
- different environmental targets (e.g. biomass, dry matter consumption)

Summary

- surprisingly abundant sets of information can be excavated (as you will see) from a micro dataset once **steady-state** is assumed
- only data required were those on general pasture growth, animal's bodyweight and climate
- however, long-term future of grassland cannot be evaluated under this assumption

► ***StageTHREE*** dynamic model