

Phenotypic plasticity, multiple species, spatial heterogeneity and grazing; plenty of challenges

Nick Hutchings
Dept of Agroecology

UNIVERSITY OF AARHUS

Faculty of Agricultural Sciences



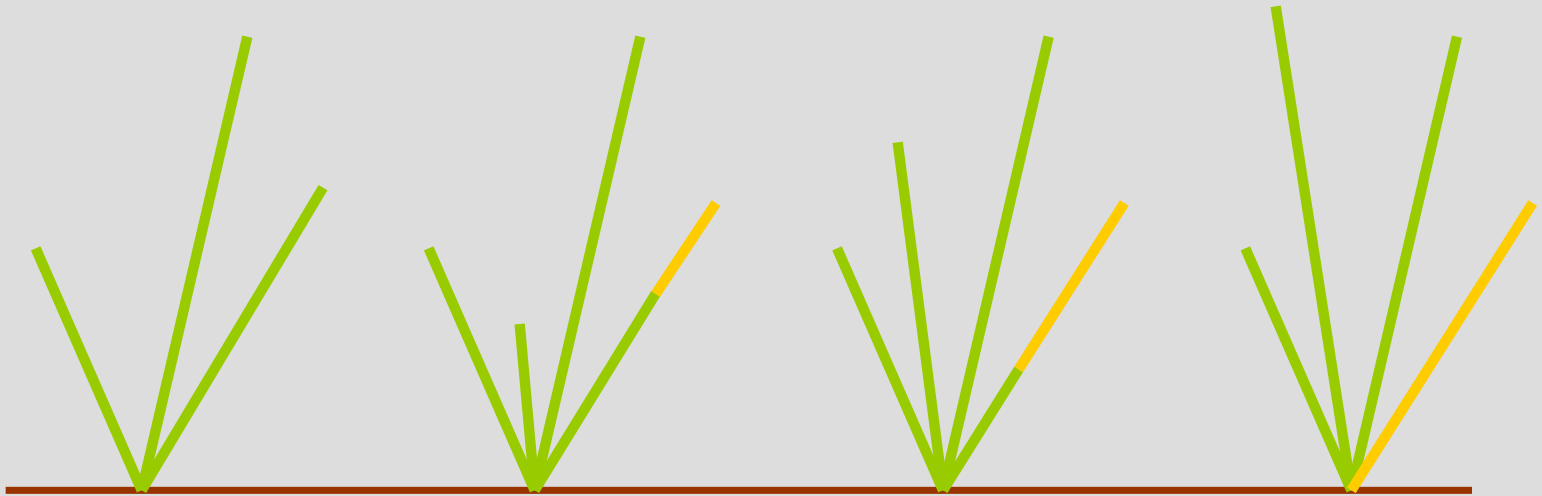
Grass is special

- **Leaf turnover**



— live

— dead

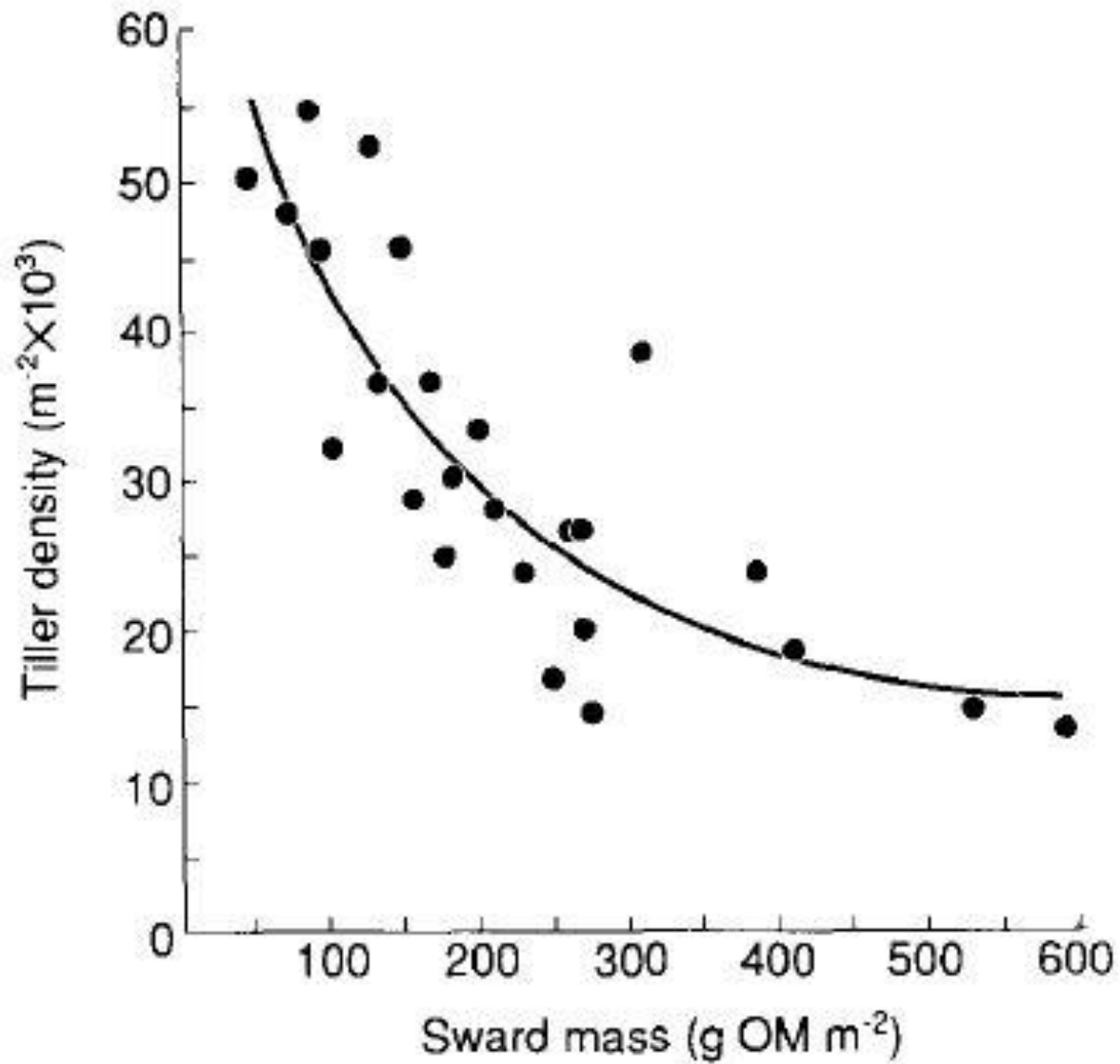


Time 

Grass is special

- **Leaf turnover**
- **Tiller density varies greatly**





Grass is special

- **Leaf turnover**
- **Tiller density varies greatly**
- **Vegetative & reproductive growth**



Modelling

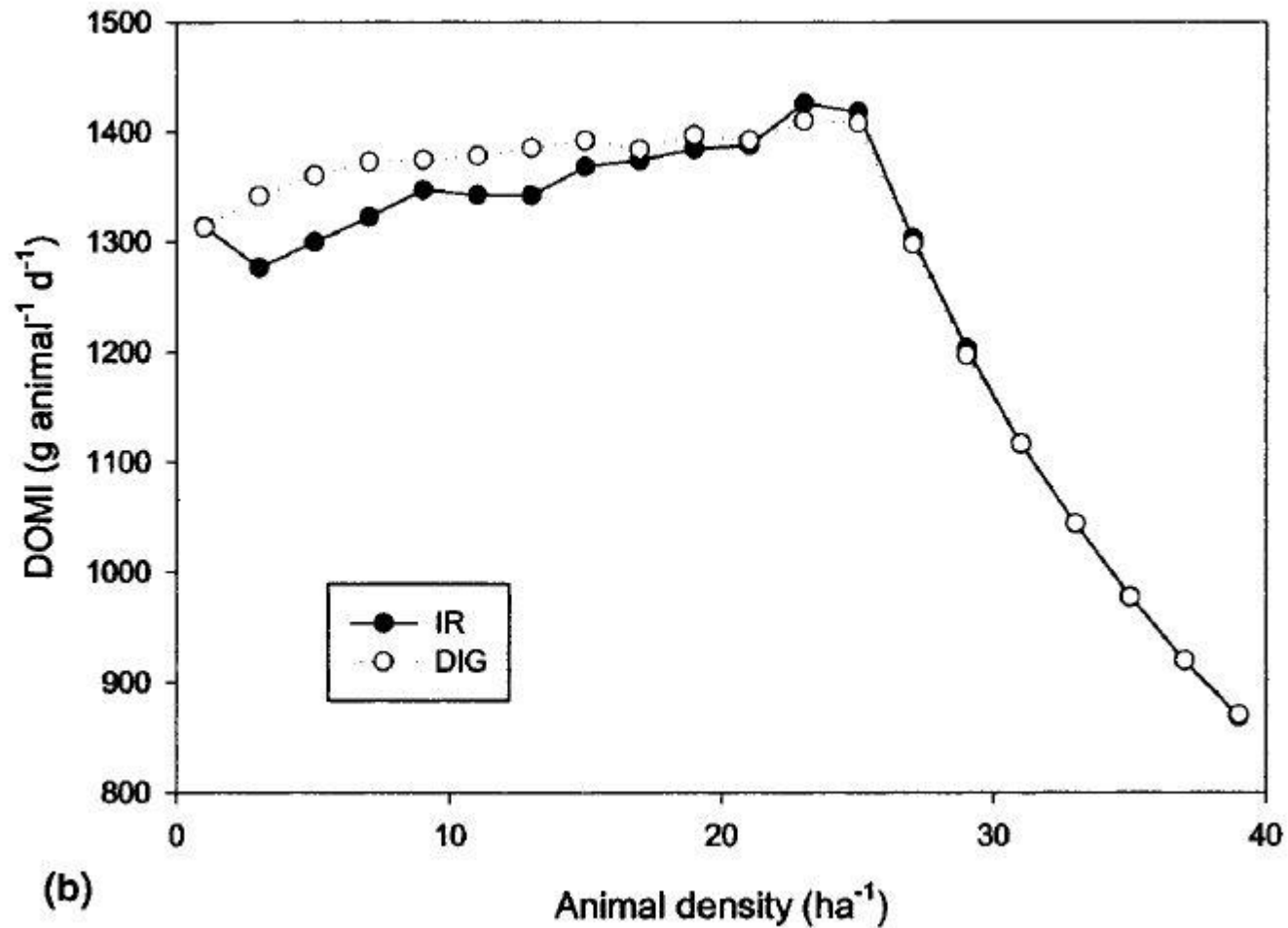
- **Tissue flow**
 - Leaf age classes (Thornley approach)
- **Tiller density varies greatly**
 - Model bulk density
- **Vegetative & reproductive growth**
- **Model development stage**
 - Cutting/grazing
 - Vernalisation and daylength effects

Grassland is special

- **Perennial crop, repeatedly harvested**
- **Multiple species**
 - Grass/clover
- **Grazers are not mowing machines**
 - Periodic not continuous defoliation
 - Selective grazing
- **What goes in one end comes out the other**
 - Dung and urine patches

Modelling

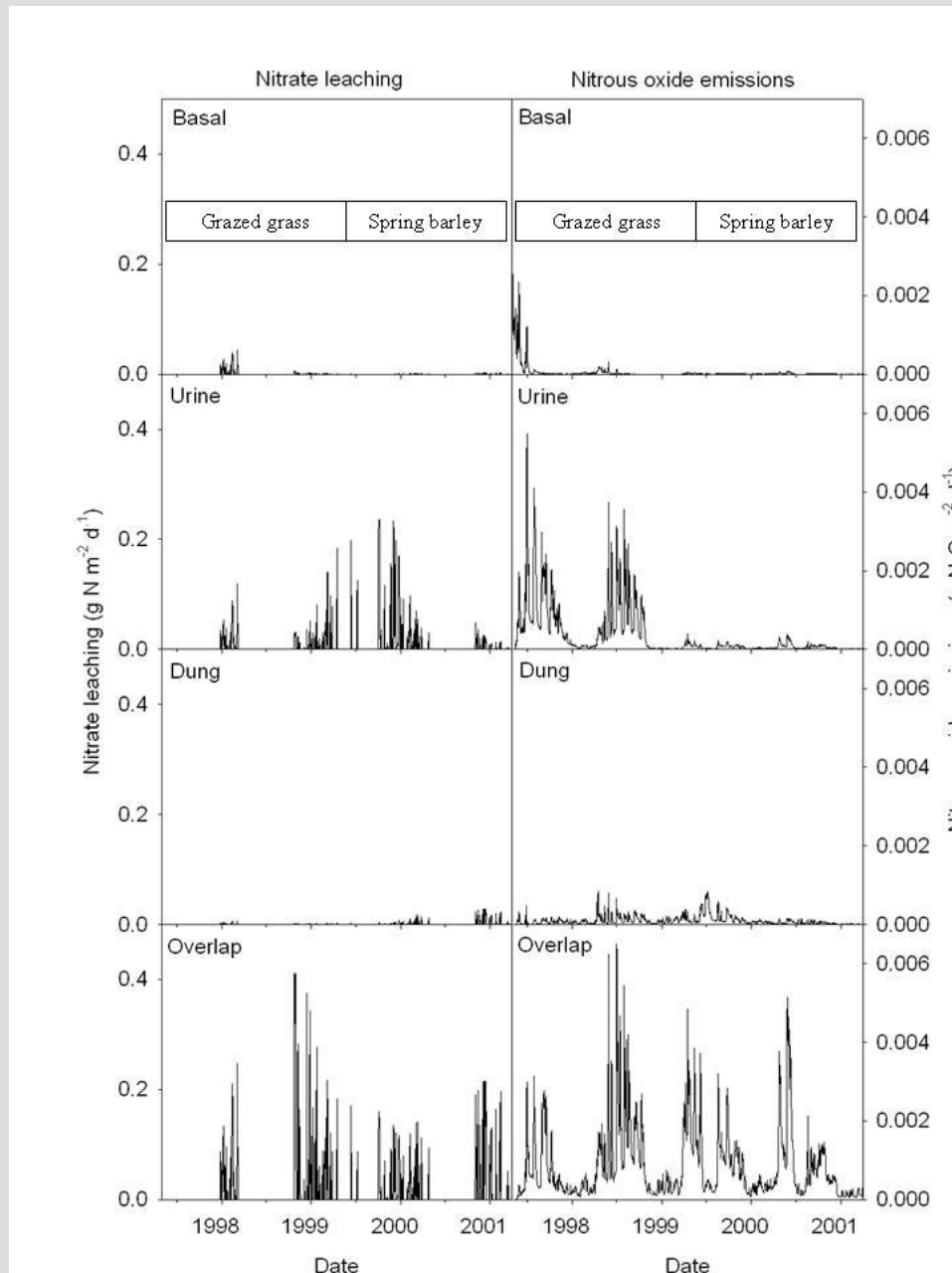
- **Perennial crop, repeatedly harvested**
 - Generally not a problem
 - Regrowth after large harvests (low LAI)
- **Multiple species**
 - Modelling competition is difficult
 - Spatial refuges
- **Periodic defoliation/selective grazing**
 - Divide sward into homogenous patches, based on history of defoliation
 - Model animal selection



Hutchings and Gordon (2001) Ecological Modelling 136: 209–222

Modelling (cont)

- **Dung and urine**
 - Divide sward into homogenous patches, based on excretal returns

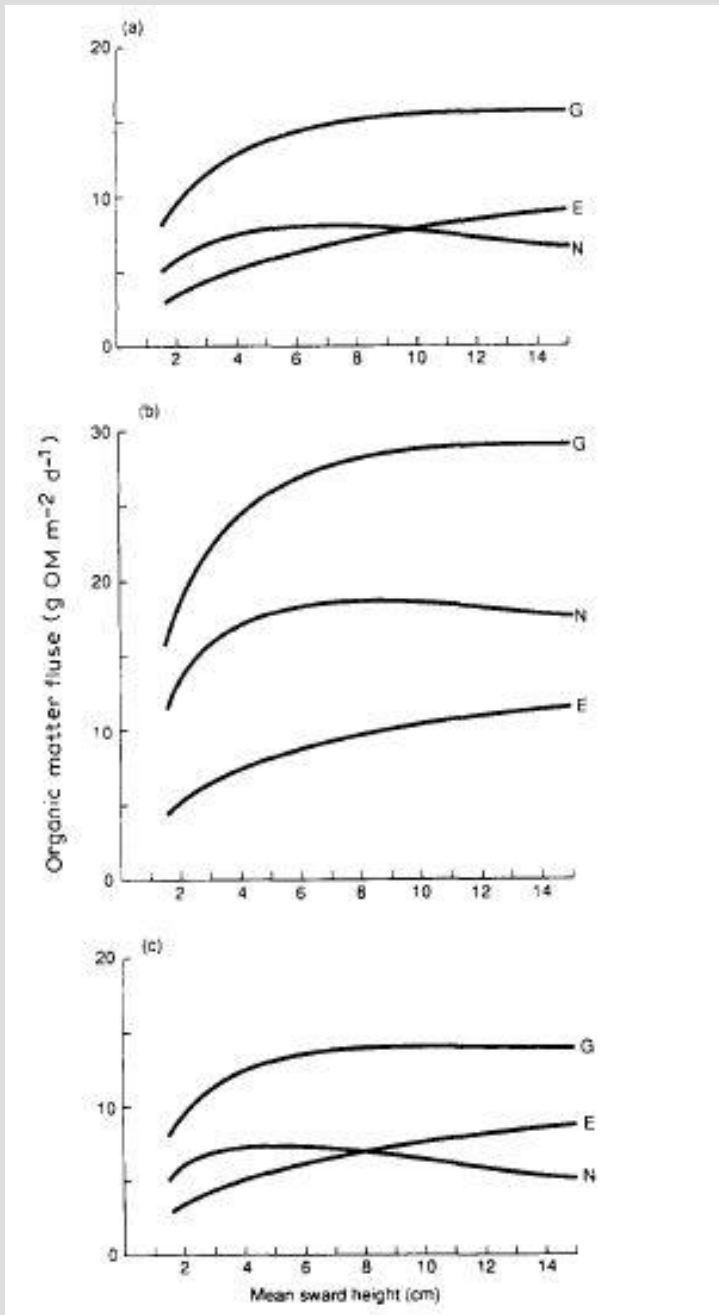


Grassland management is special

- **Farmers aim to balance roughage production and demand**
- **Decisions are made day-to-day**
 - Current feed demand
 - Winter feed demand
- **Management methods**
 - Conservation v grazing
 - Vary animal feeding
- **Several models available**

Summary

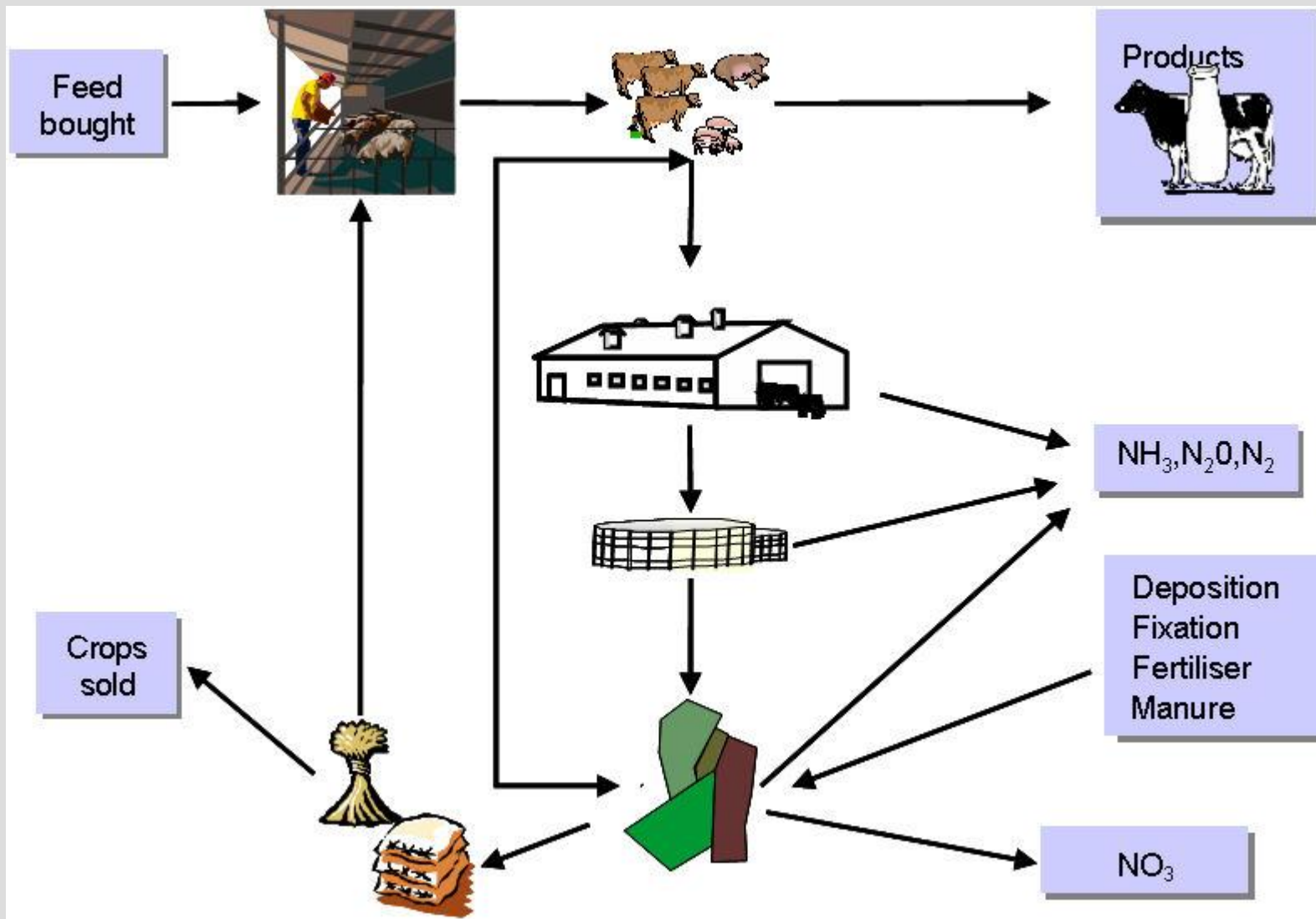
- **Modelling grass, grassland and management is challenging**
- **A range of tools exist, varying in complexity**
- **How should we use them?**



- **Detailed questions need detailed models**

Hutchings (1991)

Ecological Modelling, 59: 73-91



Conclusions

- **Modelling grazing is complex**
- **A range of tools/models are available**
 - Some questions remain
- **No universal approach**
 - Tailor modelling to objectives
- **How to choose an appropriate level of complexity?**
- **How to link existing models?**
 - Conceptually
 - Technically