Linking satellite data with forage and livestock models

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Overview

- Approach and objectives
- Schematic of linkages between forage and grazing
- Wambiana and Parkville case study sites
- Using C-store biomass output to drive grazing performance
  - Beef fattening examples
  - Whole herd model
- Next steps and challenges to scaling up

Approach & objectives

Remote sensing data

↓ C-store

Grass biomass availability

↕ Herd model

Protein availability from grazing animals

Objectives:

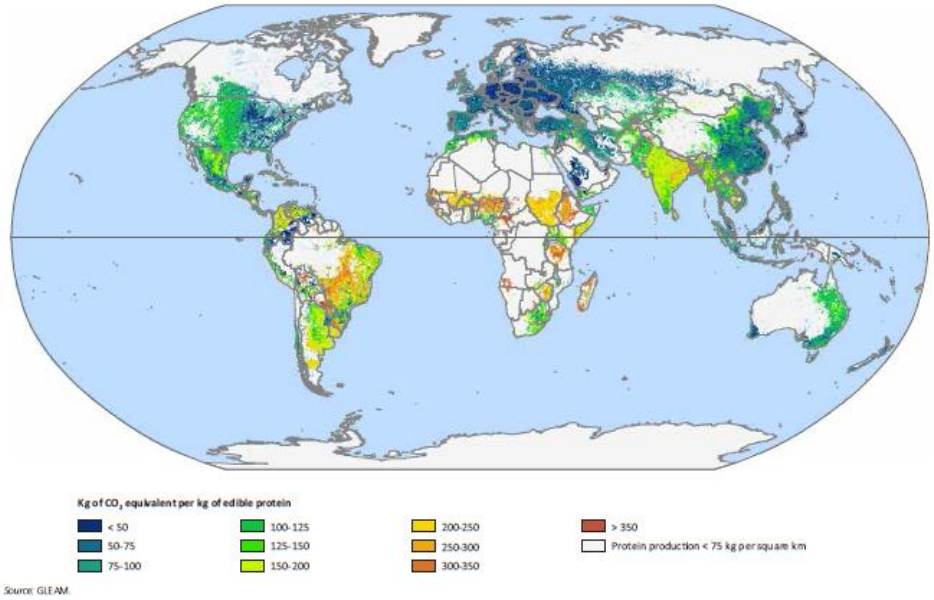
Short term: Assess the plausibility and value of linking dynamic modelled RS outputs with cattle herd models

Long term: Provide near present estimates of livestock production at global scale

Added value

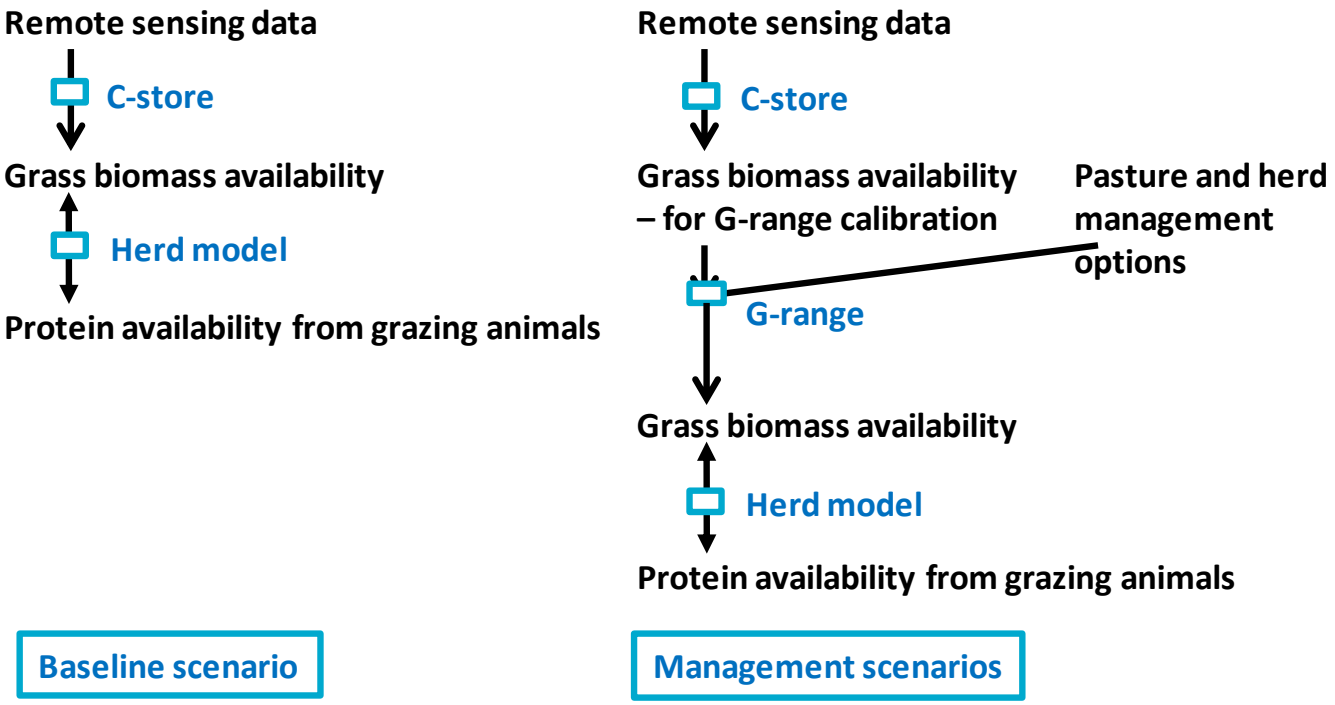
- Current global livestock production models (e.g. GLEAM, Herrero PNAS) provide spatial production data with 5-10 year time lag
- A spatial model with near present estimates of livestock (and GHGs) would fill a massive temporal gap
- Can provide timely data for assessing impact of drought events on livestock production, food security, which can take years to play out

FIGURE 27A. Emission intensity per unit of edible protein



Source: GLEAM

The bigger picture



Wambiana grazing trial

HSR: July 1998

MSR: July 1998

In 1998, both the MSR (above right) and HSR (above left) were in good condition with a good stand of 3-P grasses.

HSR: April 2005

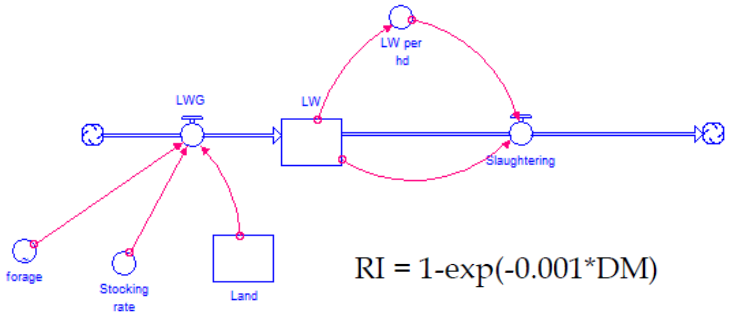
MSR: April 2005

But by 2005 the HSR was in very poor condition due to heavy grazing pressure and drought. Although ground cover declined in the MSR, a healthy stand of 3-P grasses was still maintained.

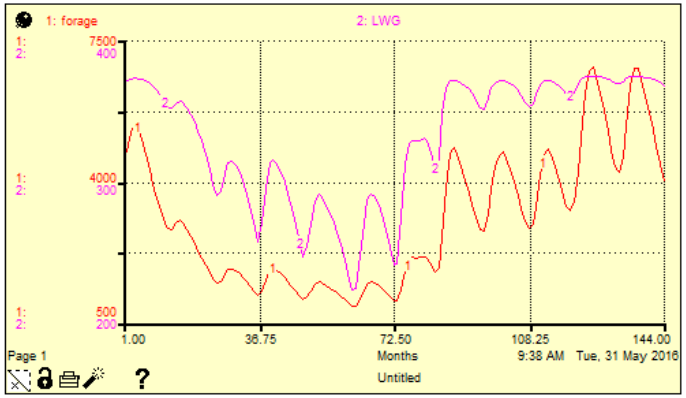
Assesses livestock and forage productivity benefits under a range of stocking rate strategies:

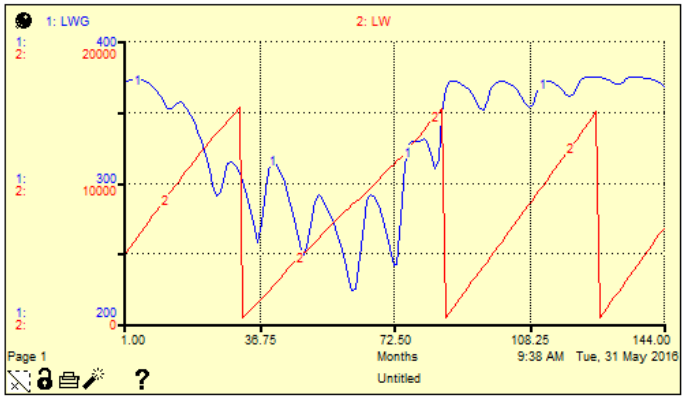
- **Moderate stocking rate (8-10 ha/hd)**
- Heavy stocking rate (4-5 ha/hd)
- Variable stocking rate (3-12 ha/hd)

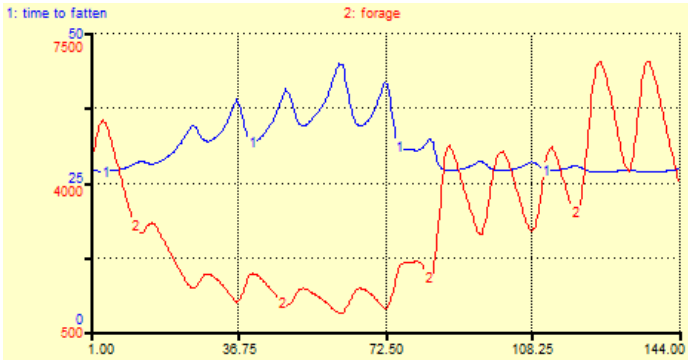
SD simulation of beef fattening with C-Store biomass - Wambiana



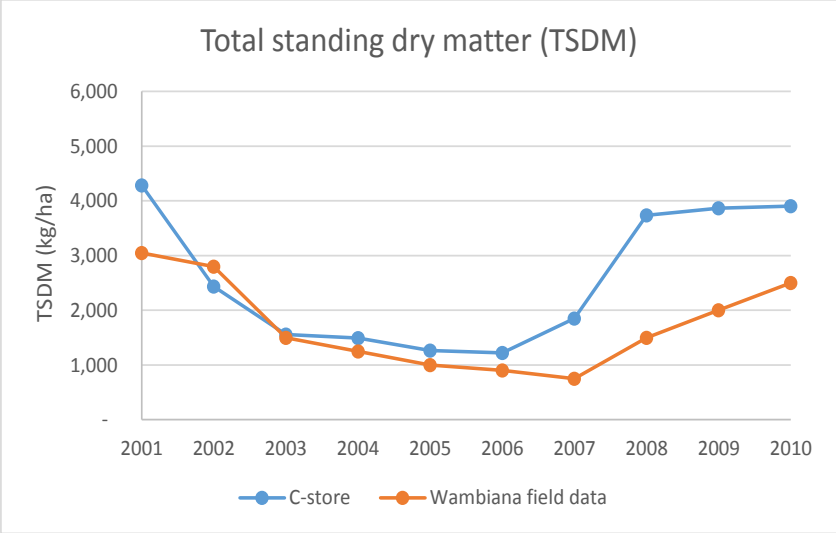
$$RI = 1-\exp(-0.001*DM)$$

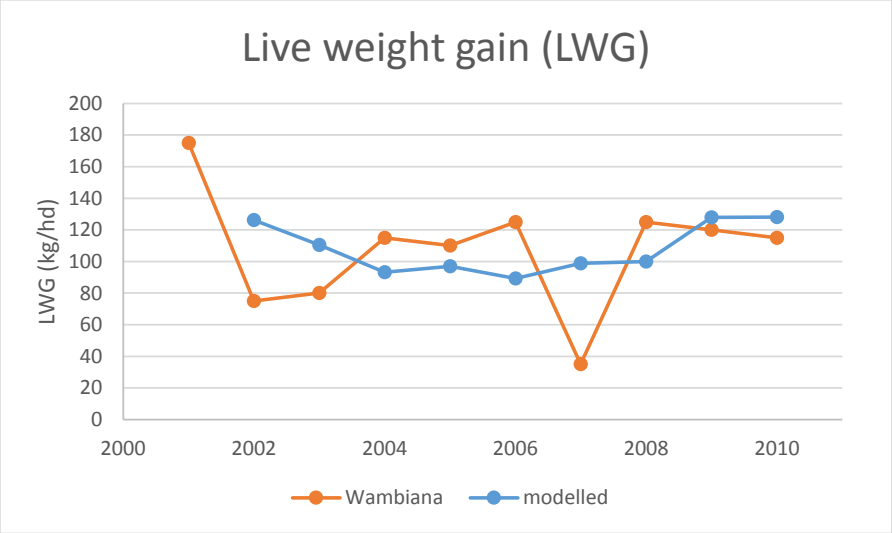






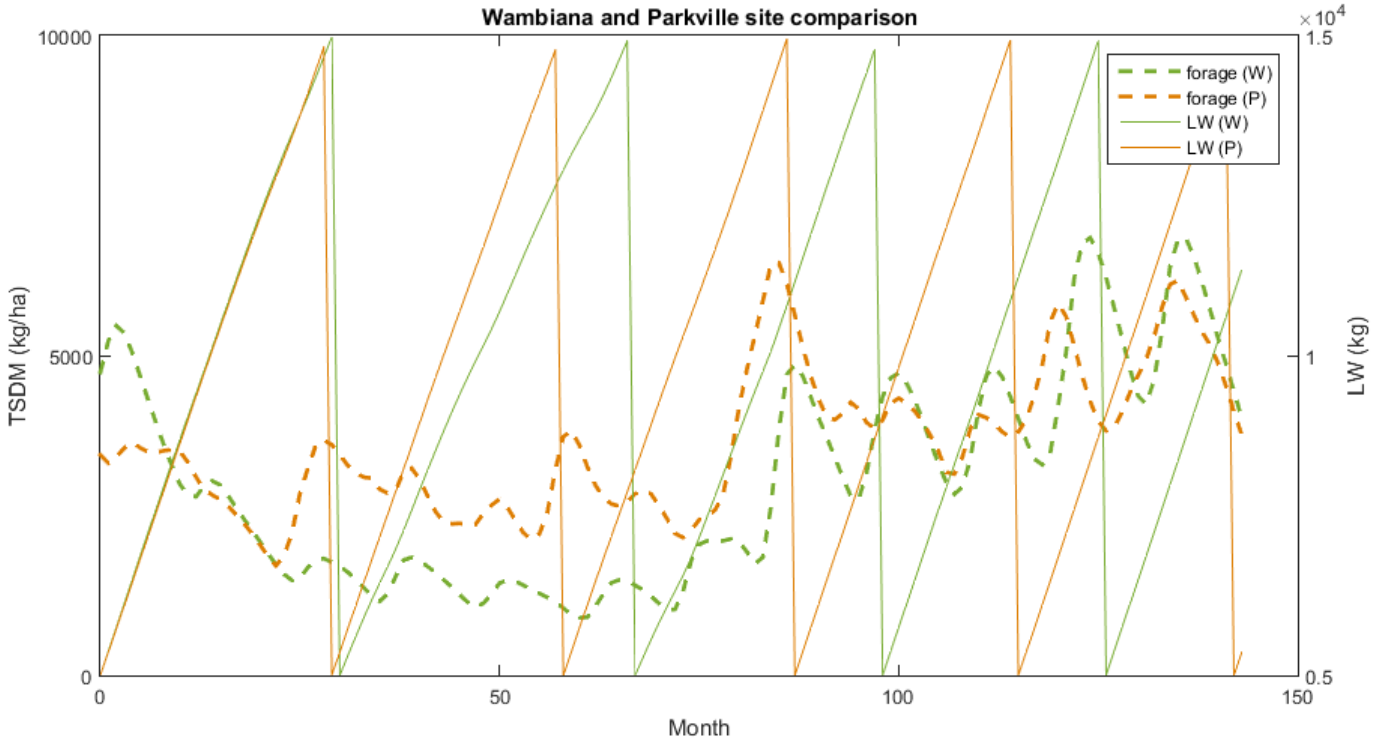
C-store outputs and field data comparison of forage biomass



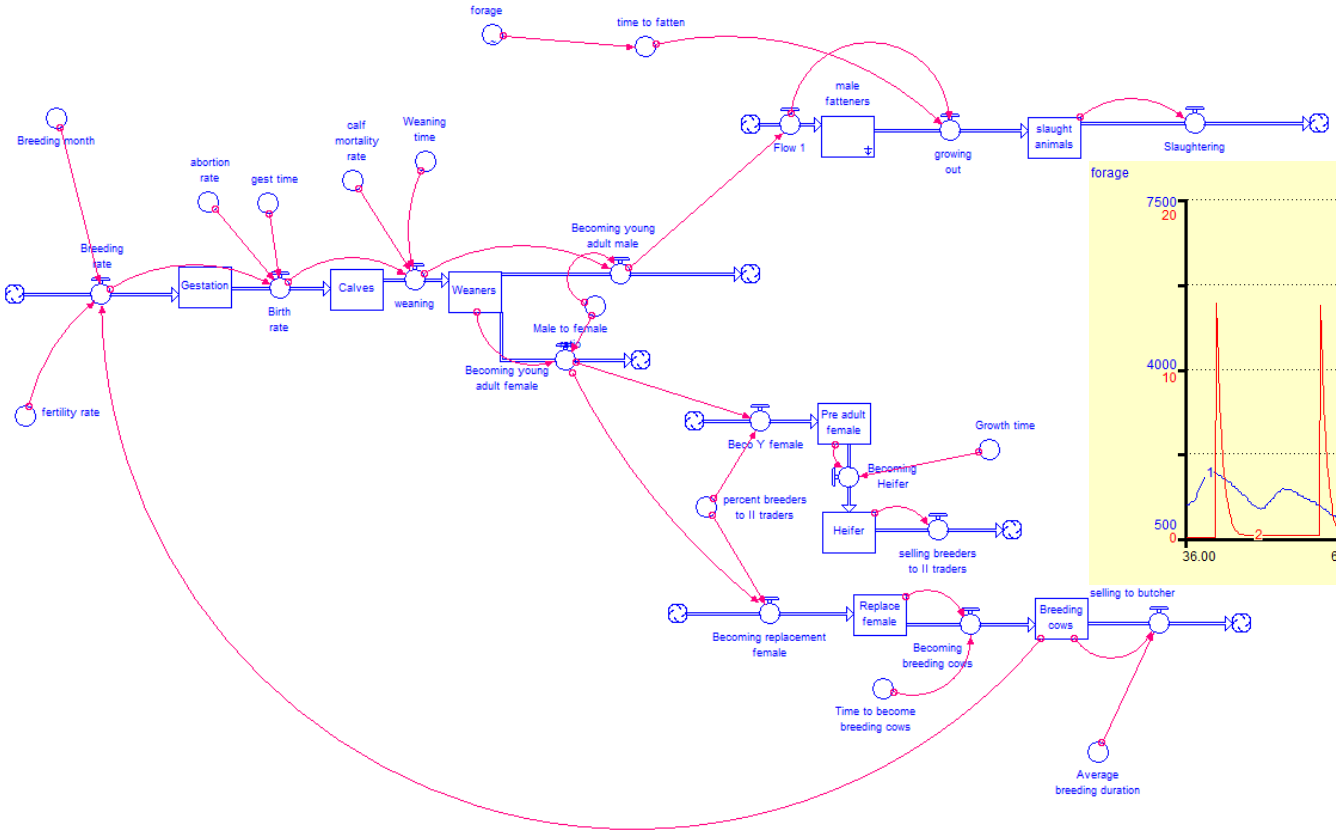


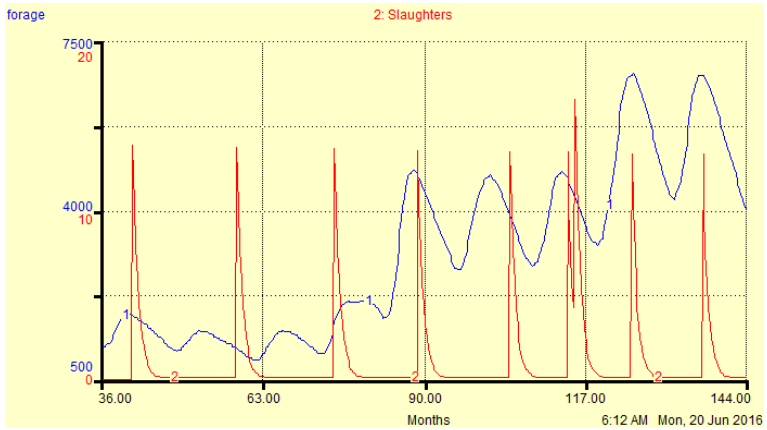
Field $AGNPP_{(1999\text{-}2005)} \approx 2{,}000$ kg/ha/yr

C-store $AGNPP_{(2001\text{-}2005)} = 1{,}936$kg/ha/yr


Wambiana and Parkville site comparison
TSDM (kg/ha)
LW (kg)
Month
forage (W)
forage (P)
LW (W)
LW (P)
10000
5000
0
1.5
1
0.5
×10^4
0
50
100
150

Full herd model for scale-up





Next steps (using pilots, RS products, national statistics)

- Refine relationship between biomass and animal performance
  - include forage quality impacts, e.g. forage types, digestibility, N content (Abel, CSIR)
  - explore link between LAI and relative intake
- Refine full herd model
  - Link mortality and calving rates to forage availability/quality and LWG
  - Selling rules
- Include additional production systems, species, environmental impacts
  - Dairy, Small ruminant, GHGs
- Scale up…

Big challenges/questions

- How to reconcile time series forage RS products with global animal datasets that are spatial but cross sectional (GLW)?
  - Can RS-based grazing intensity measures such those developed by Dan Zhao help?
  - Are there national products with more accuracy and frequency available?
  - Other ideas???
- How far can we go beyond providing users with info on forage condition, and generate useful livestock production info in a timely manner (e.g. following drought events)?