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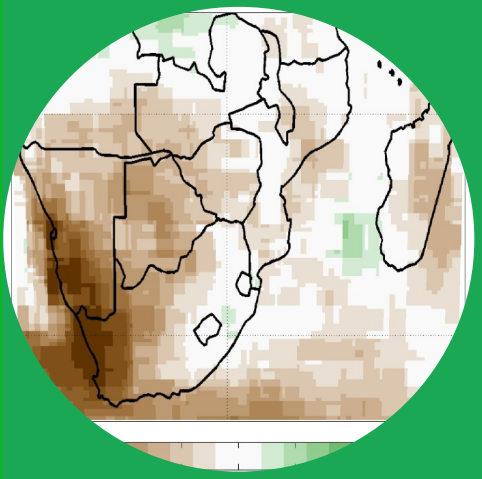
Livestock modelling as part of farming systems assessments in regional integrated assessments



Katrien Descheemaeker (Wageningen University)

UKaid from the British people

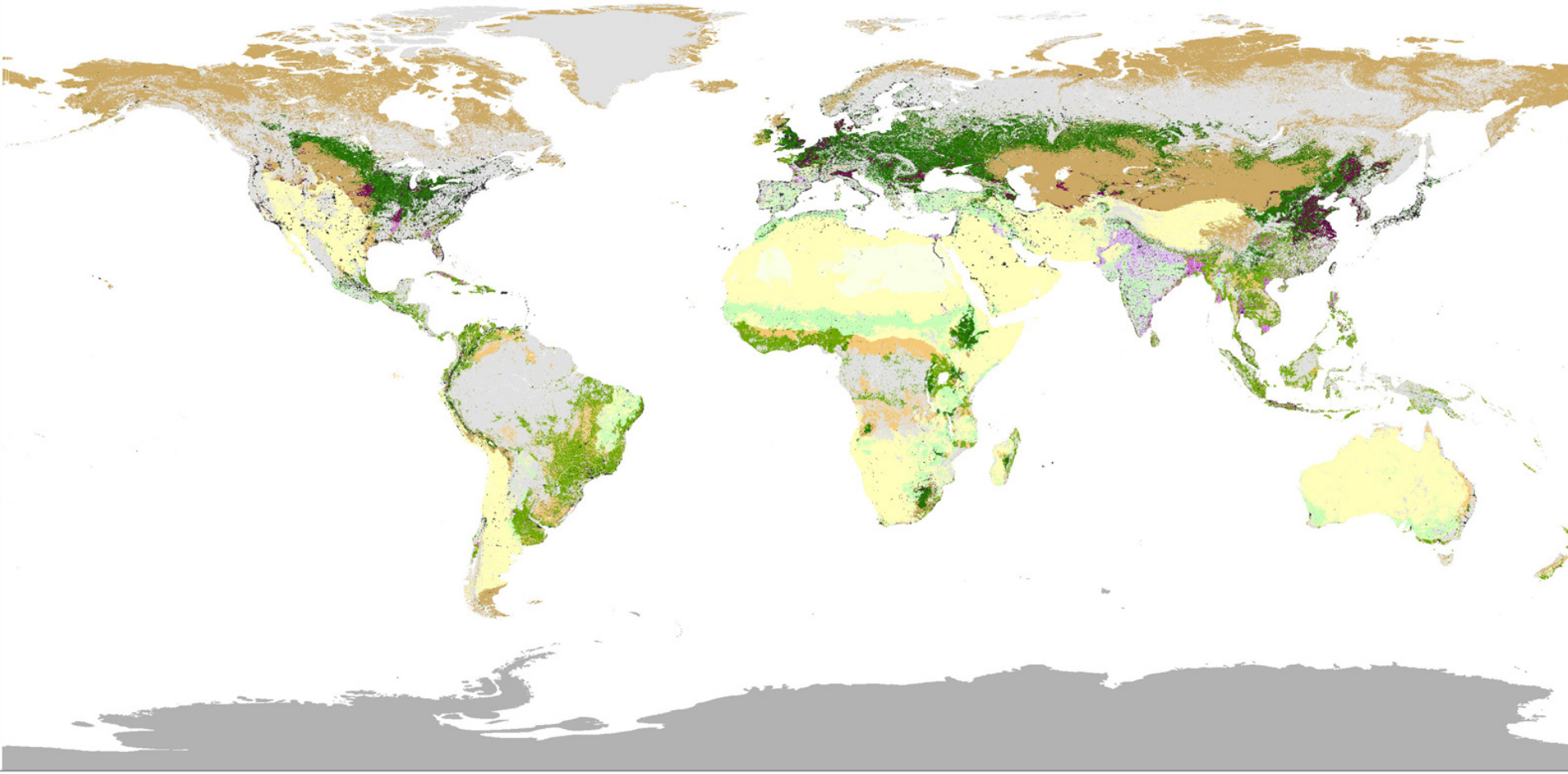
USDA

WAGENINGEN UR For quality of life

ICRISAT Science with a human face

Global Livestock Production Systems v.5 (FAO/ILRI)

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Animal Production and Health Division



	Rangeland-based	Mixed rainfed	Mixed irrigated		
Hyperarid	LGY	MRY	MIY	Urban areas	No Data
Arid/Semi-arid	LGA	MRA	MIA	Other	
Humid/Subhumid	LGH	MRH	MIH		
Temperate/tropical highlands	LGT	MRT	MIT		

September 20

Global Livestock Production Systems v.5 (FAO/ILRI)

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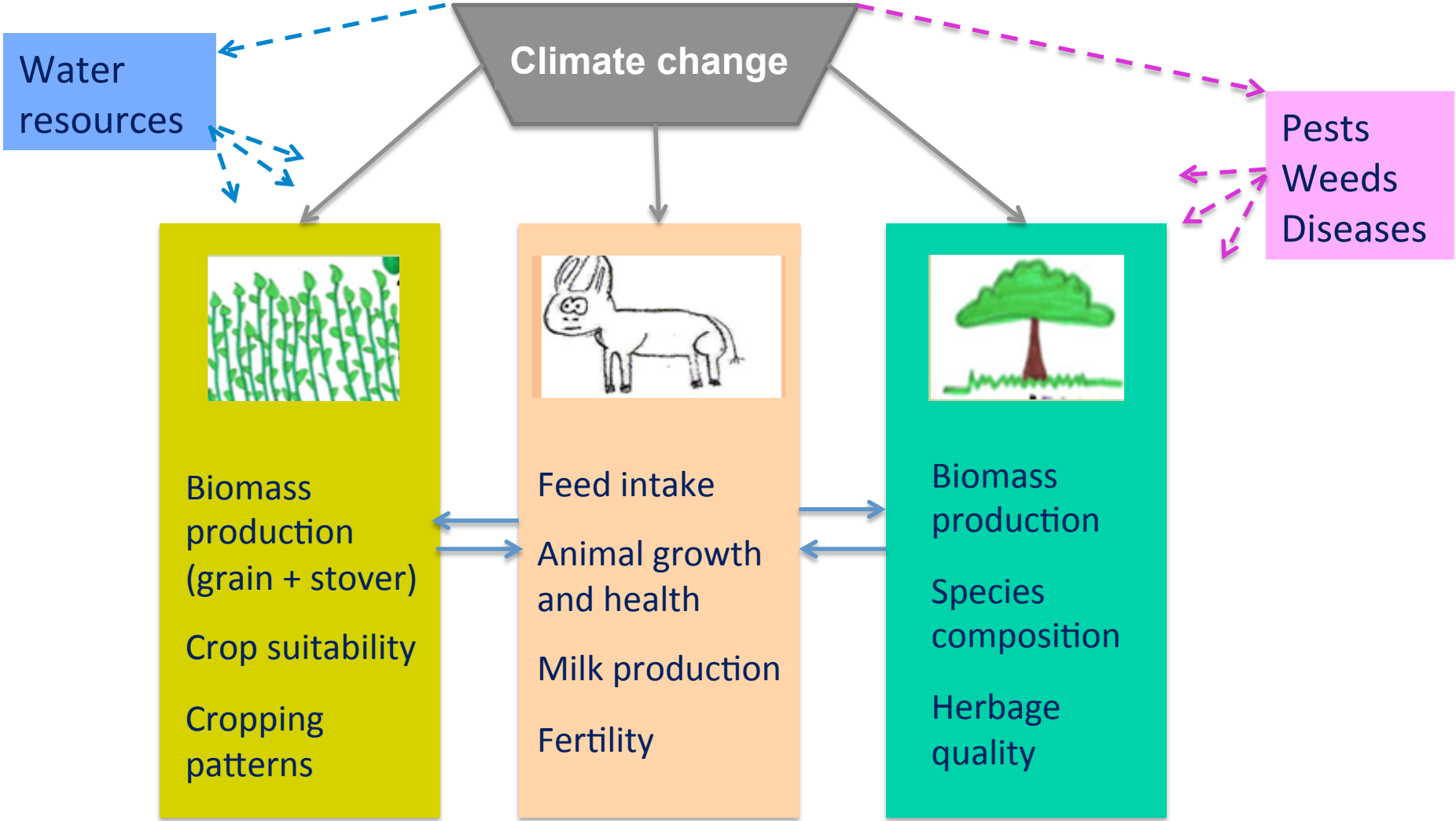
Animal Production and Health Division

Climate change effects on livestock systems



Climate change effects on livestock systems

Effects of climate change also on system shifts

- Livestock may become more important with shortening of growing season
- (Seasonal) migration may become more important

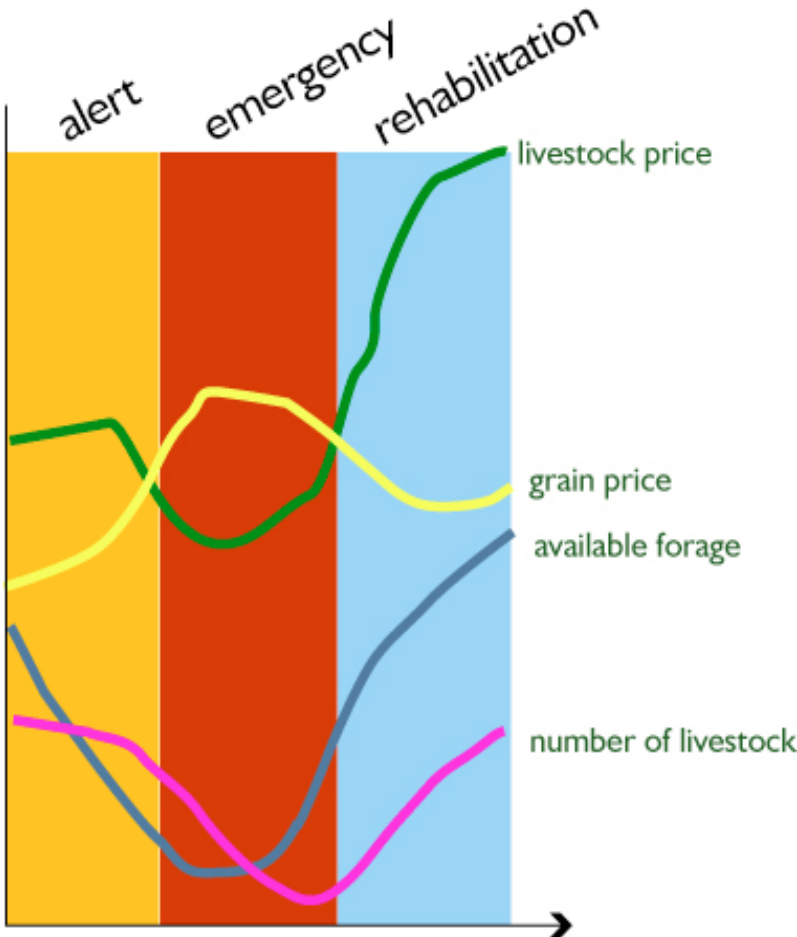
Fig. 3 – Transition zones in the mixed rainfed arid–semiarid system, in which the Reliable Crop Growing Days (RCGD) falls below 90 between 2000 and 2050, as projected using the HadCM32 model and the A1FI scenario.

Jones and Thornton, 2009

Climate change effects on livestock systems

Effects of climate change also on system shifts

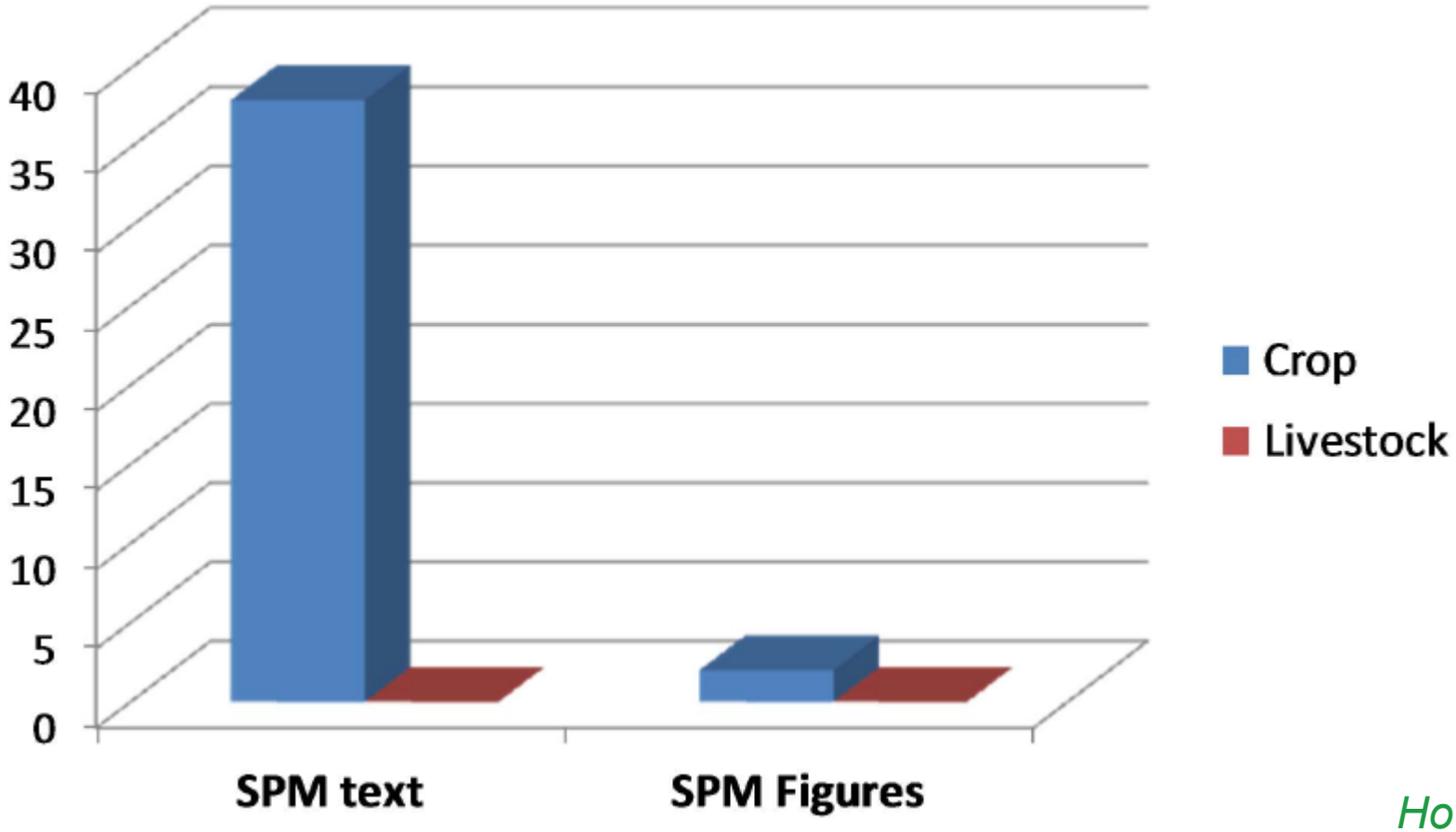
- Livestock may become more important with shortening of growing season
- (Seasonal) migration may become more important
- Extreme events: droughts wiping out entire herds



Toulmin 1994

Climate change effects on livestock systems

IPCC WG2 SPM coverage of crop *vs* livestock



Howden, 2014

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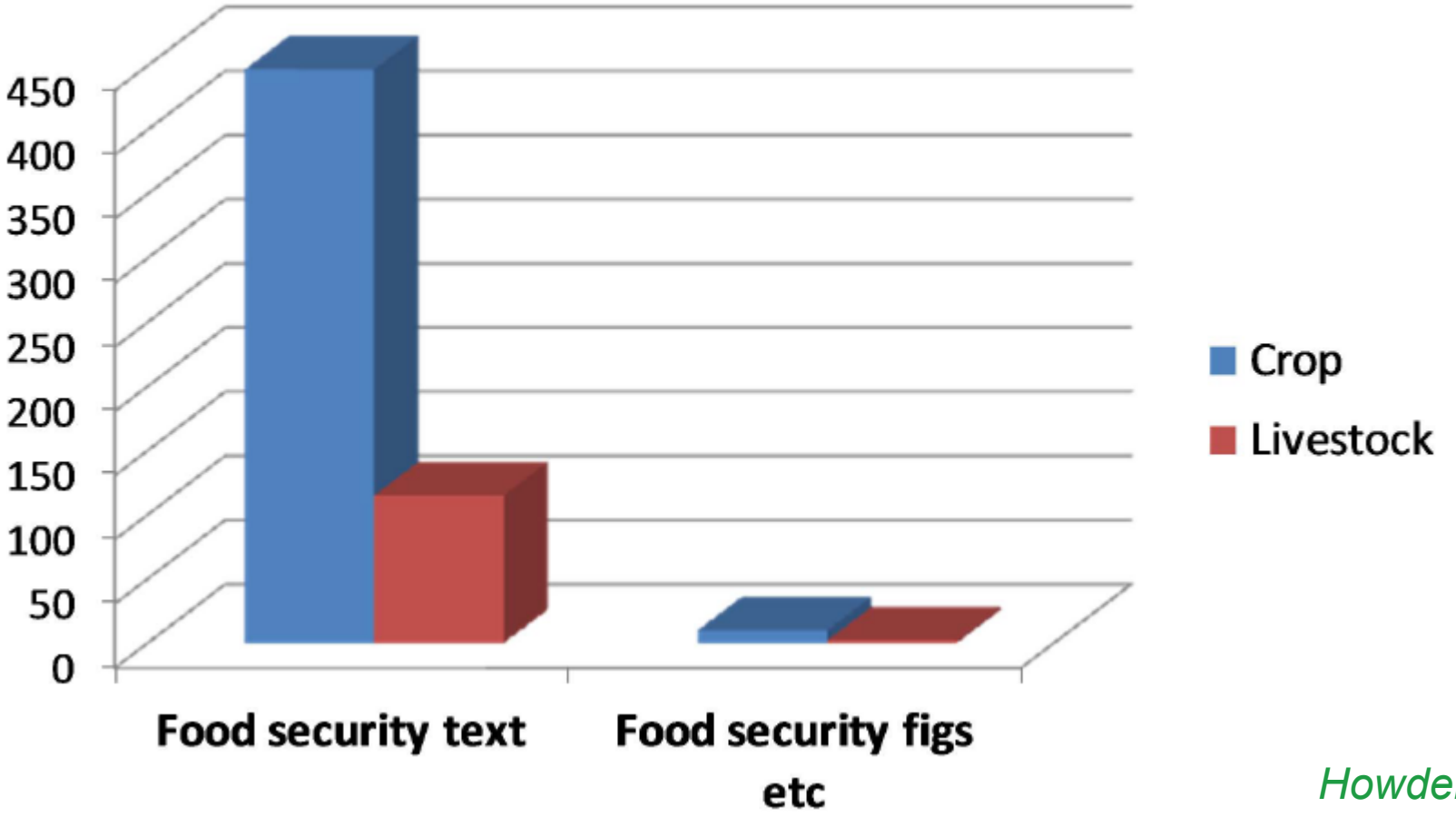
Climate change effects on livestock systems

IPCC WG2 'Food Security' chapter coverage



Howden, 2014

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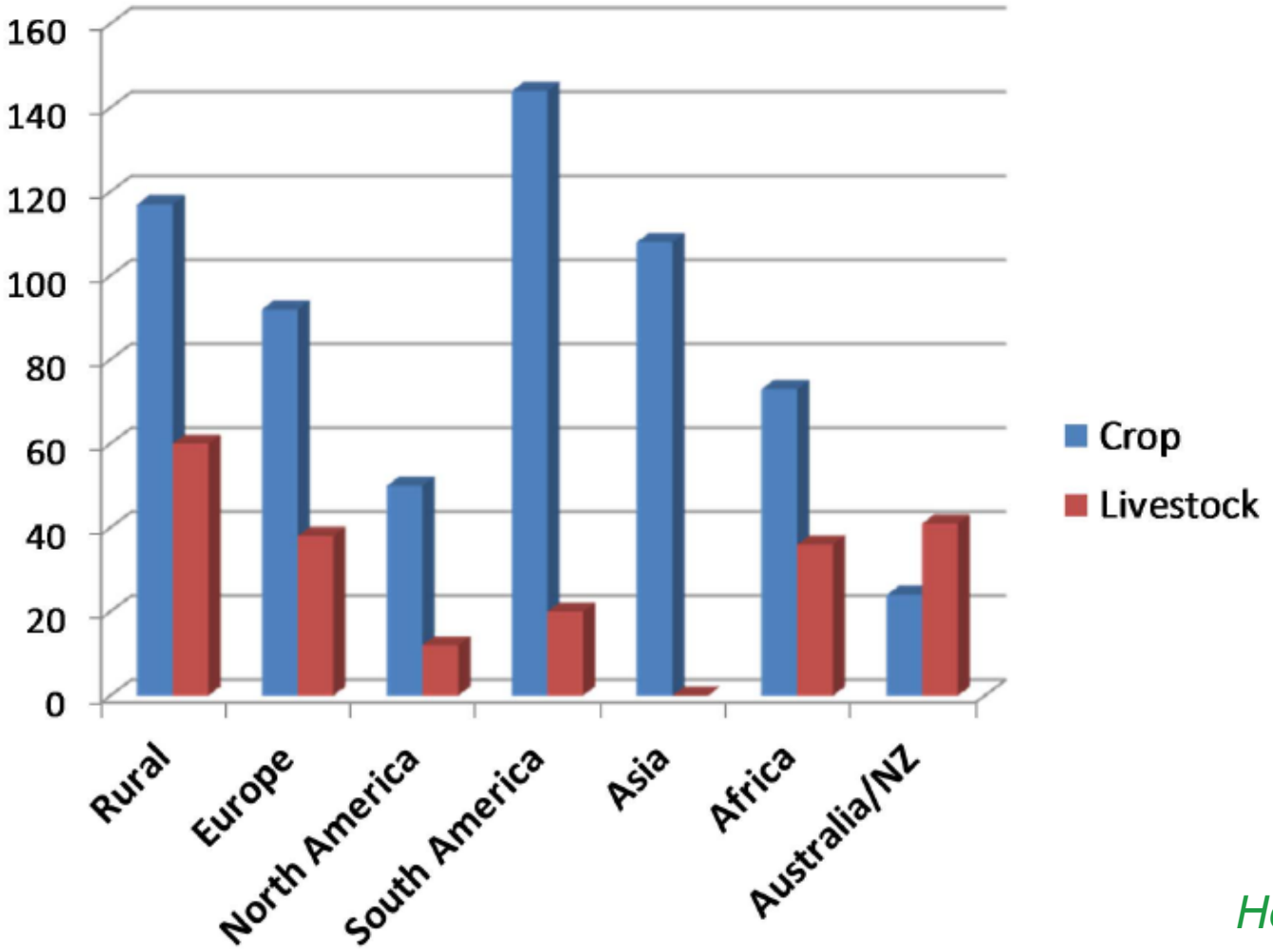
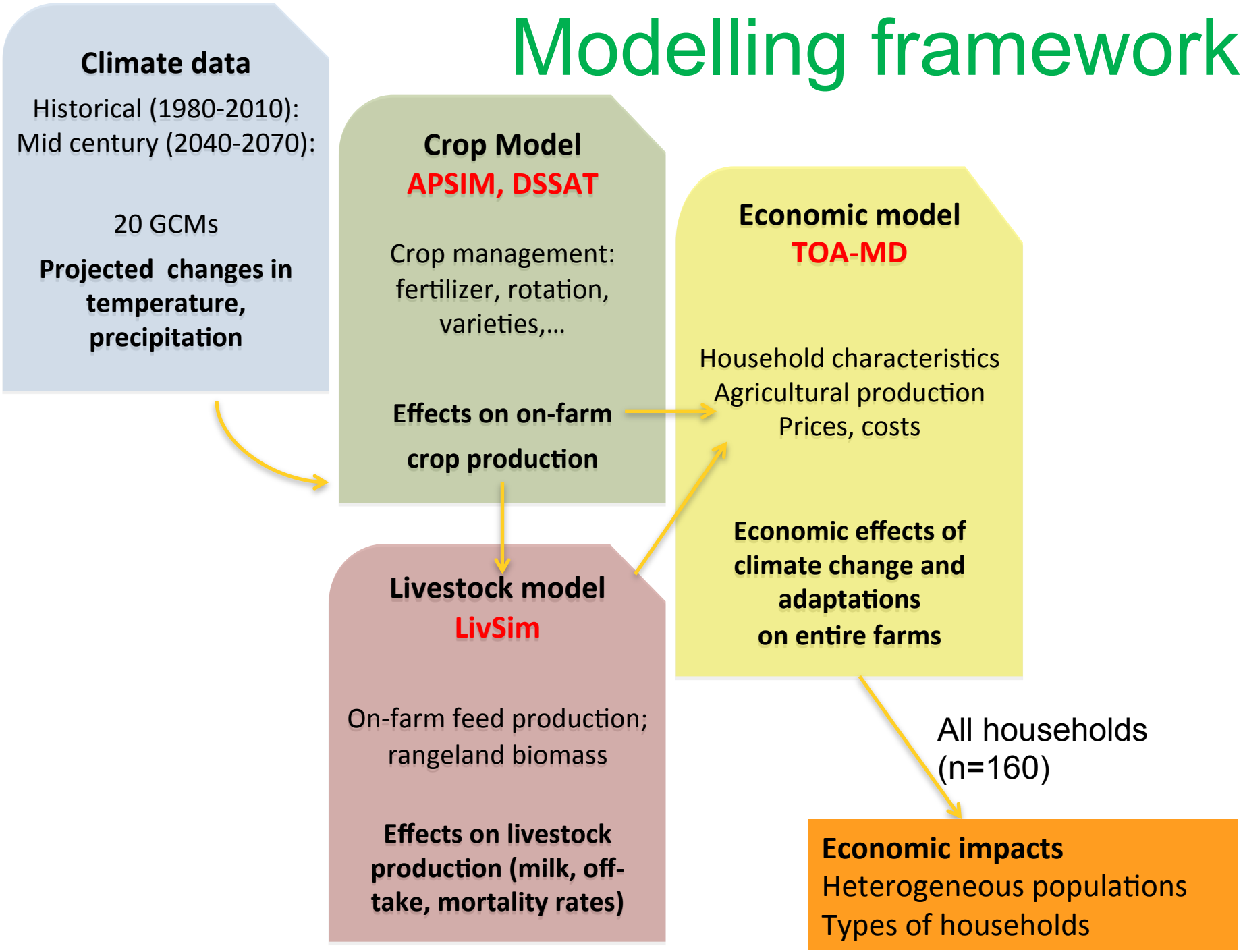
Climate change effects on livestock systems

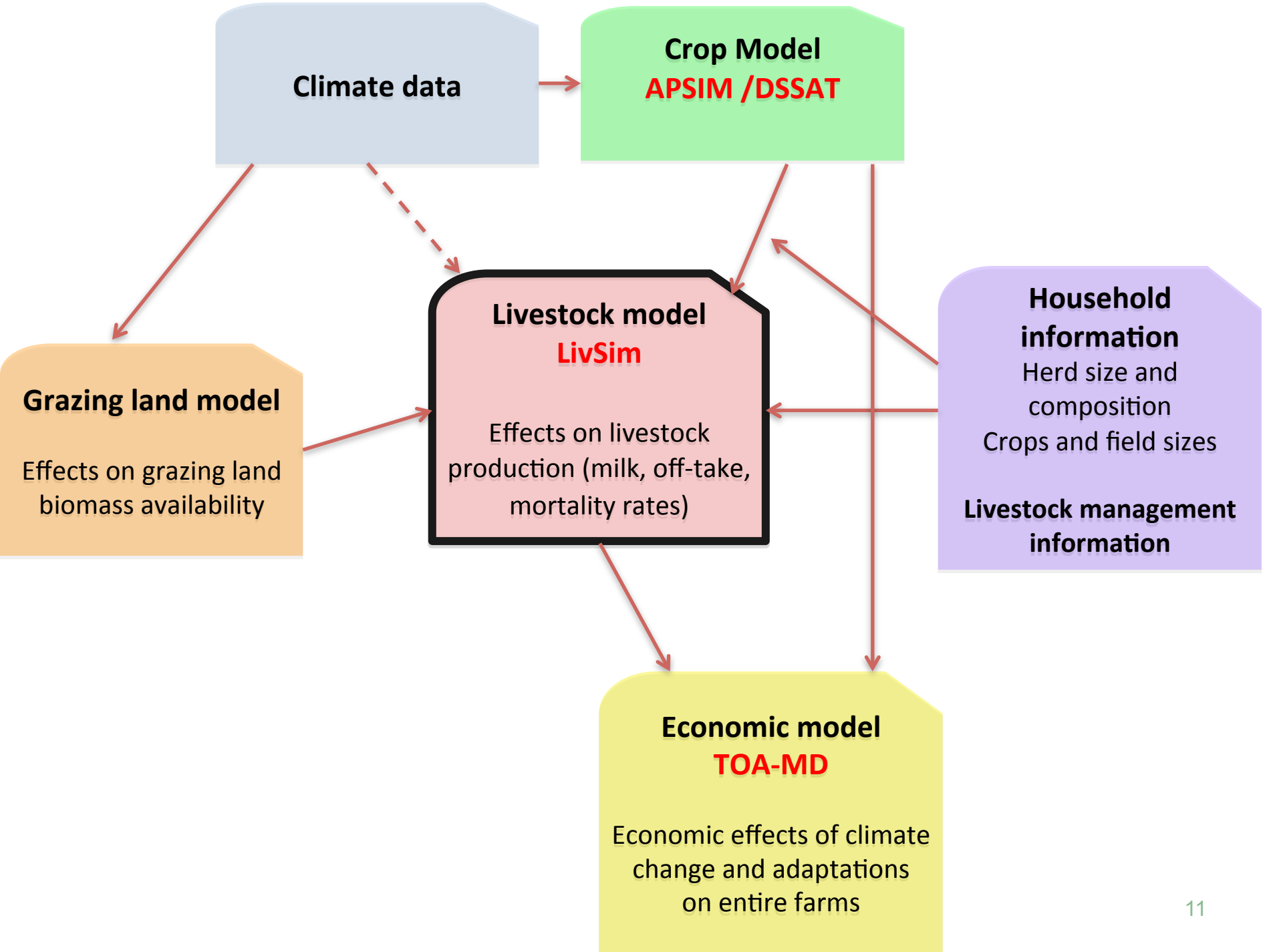
IPCC WG2 'Regional' chapter coverage

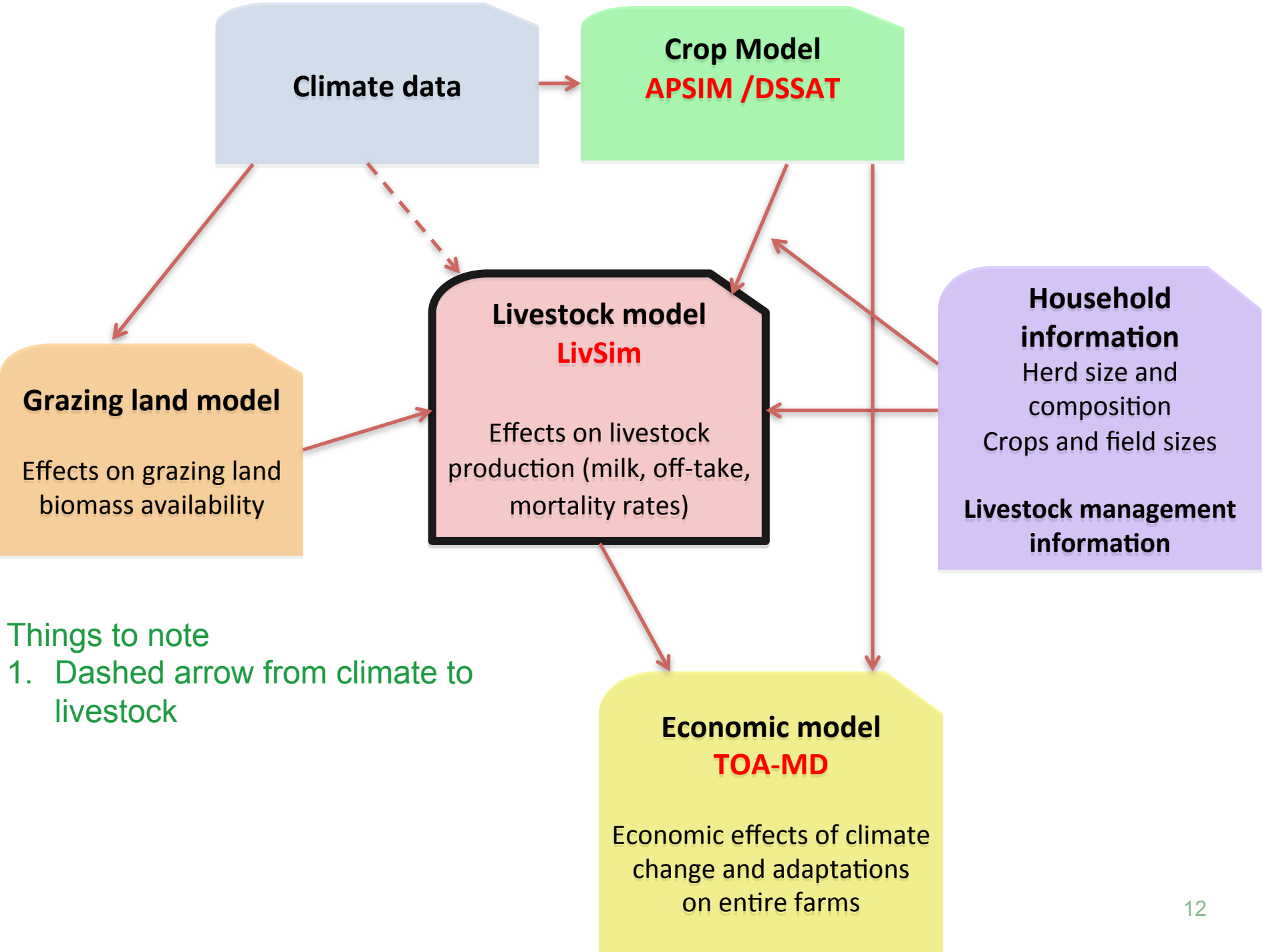


Howden, 2014

Modelling framework

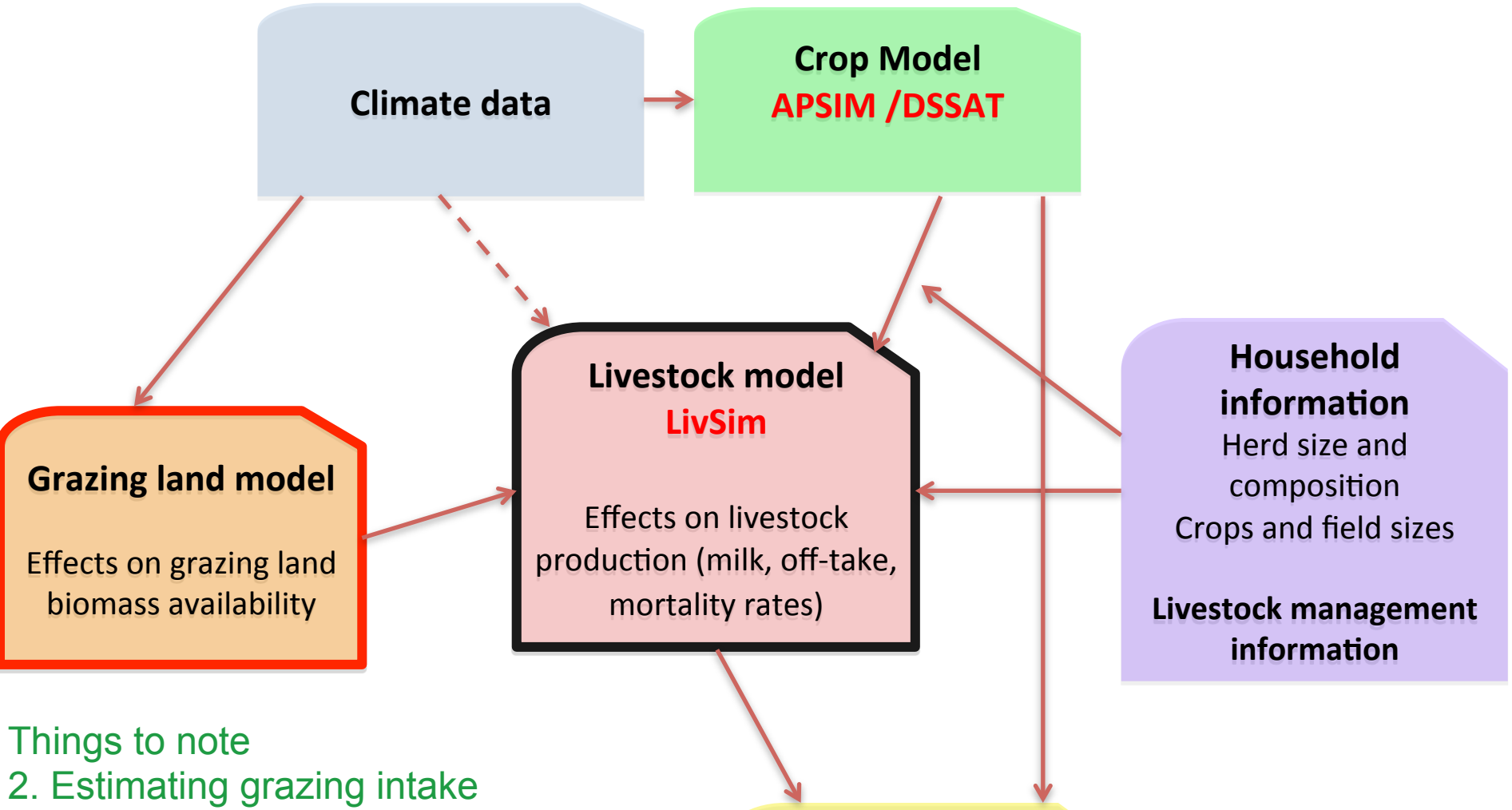



Climate data
Crop Model
APSIM /DSSAT
Livestock model
LivSim
Effects on livestock production (milk, off-take, mortality rates)
Grazing land model
Effects on grazing land biomass availability
Household information
Herd size and composition
Crops and field sizes
Livestock management information
Economic model
TOA-MD
Economic effects of climate change and adaptations on entire farms



Things to note

1. Dashed arrow from climate to livestock

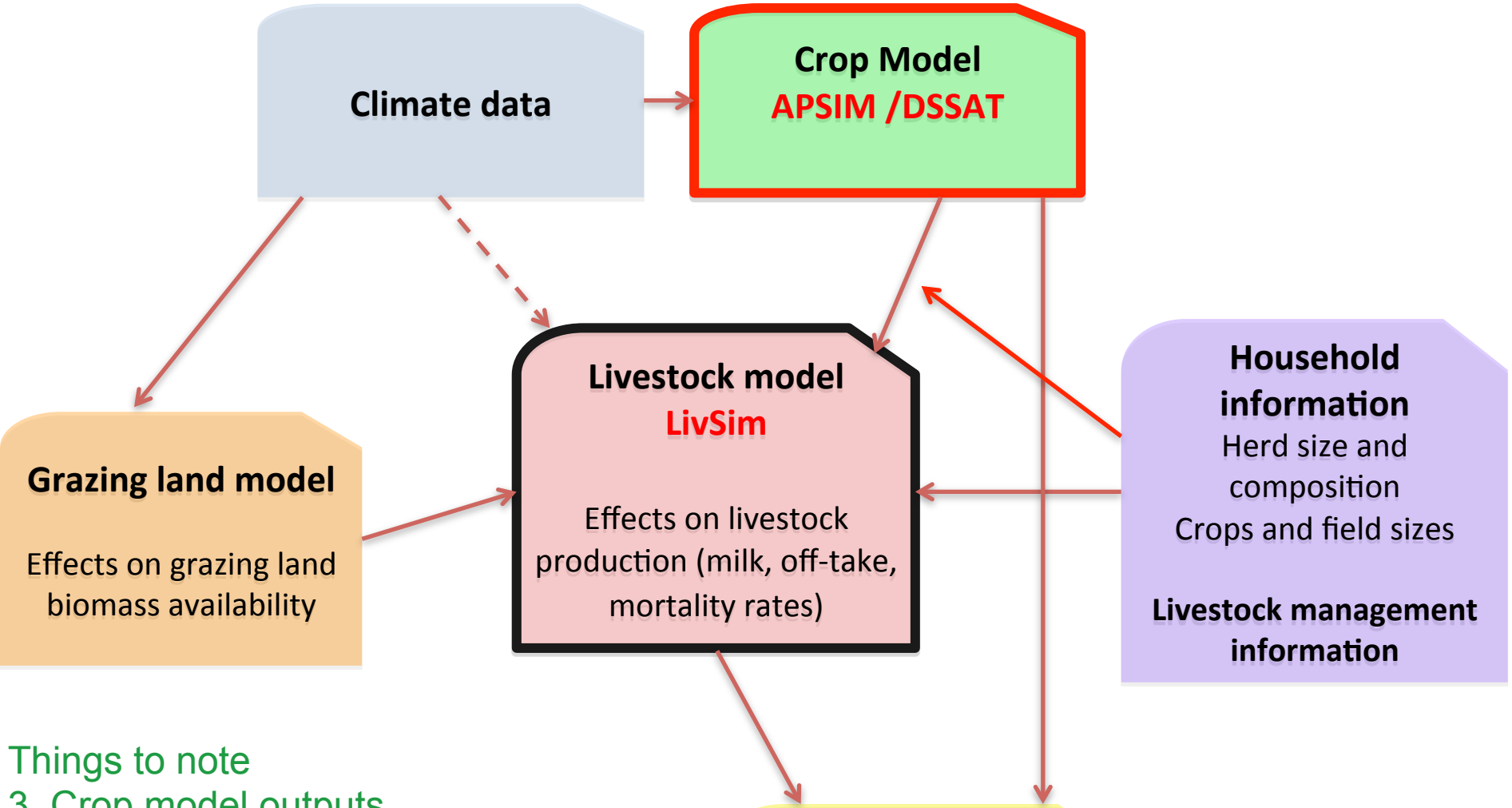


Things to note

2. Estimating grazing intake

grazing land area, stocking density, rangeland/pasture productivity

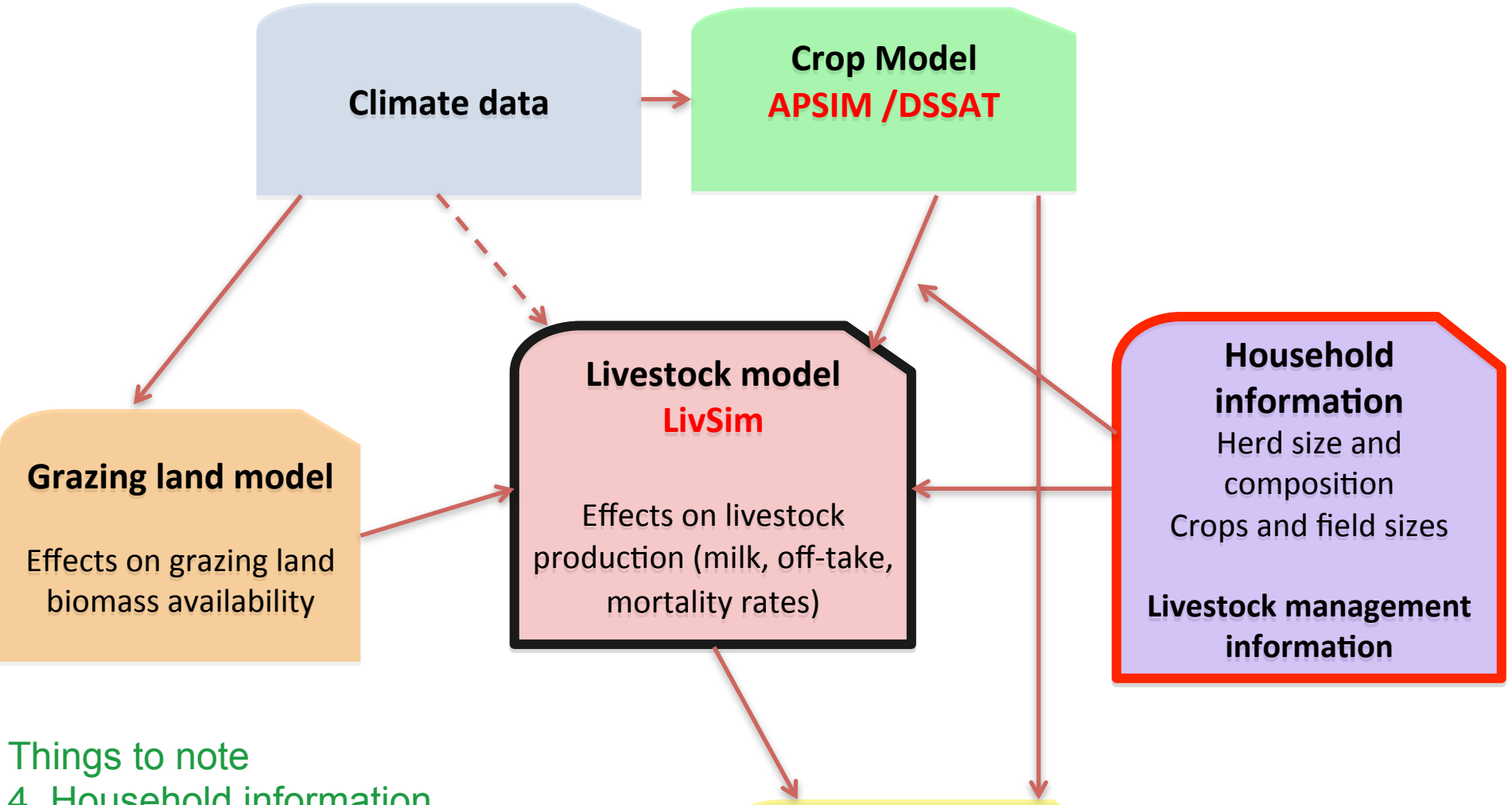
- Rangeland model
- Grass production in APSIM/DSSAT
- Rainfall use efficiency
- Average availability



Things to note

3. Crop model outputs
- Crop residues
- Forages

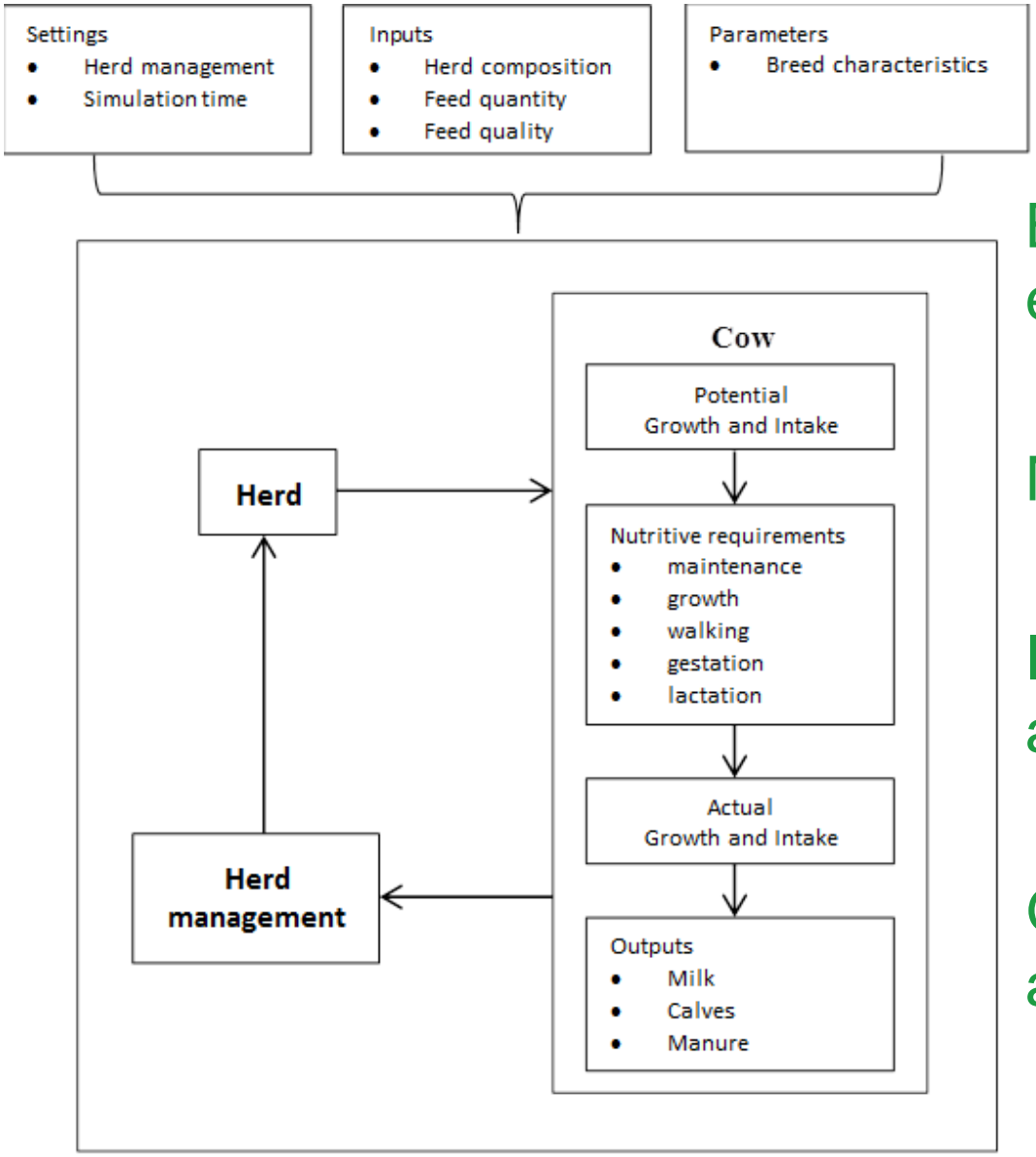
Household info on field sizes



Things to note

4. Household information
- Crops and field sizes
- Initial herd size and composition
- Livestock management

LivSim structure and functioning



Based on production ecology principles

Monthly time step

Individual animals in a herd are modelled

Greenhouse gas emissions added as output

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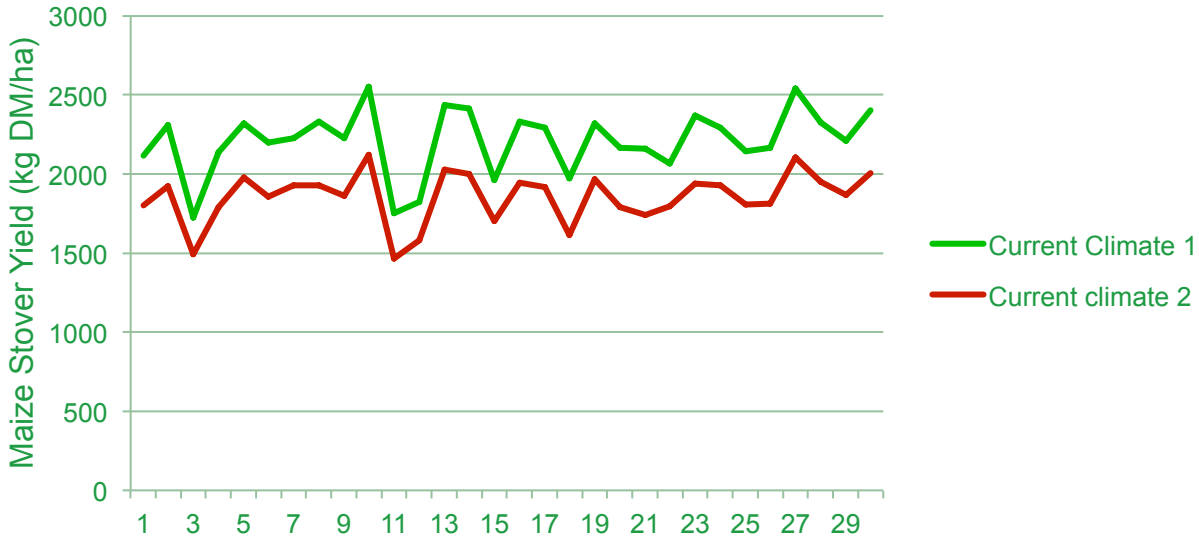
Example

Household ID	Cattle holding	Total cropland (ha)	Maize area (ha)
43101	0	0.40	0.40
43102	5	1.00	0.97
43103	0	5.00	2.40
43104	4	0.70	0.70
43105	0	1.10	0.60
43106	0	2.25	2.25
43107	5	1.00	0.70
43108	0	3.00	2.40
43109	1	6.00	2.90
43110	4	3.50	1.50



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43107	5	1.00	0.70
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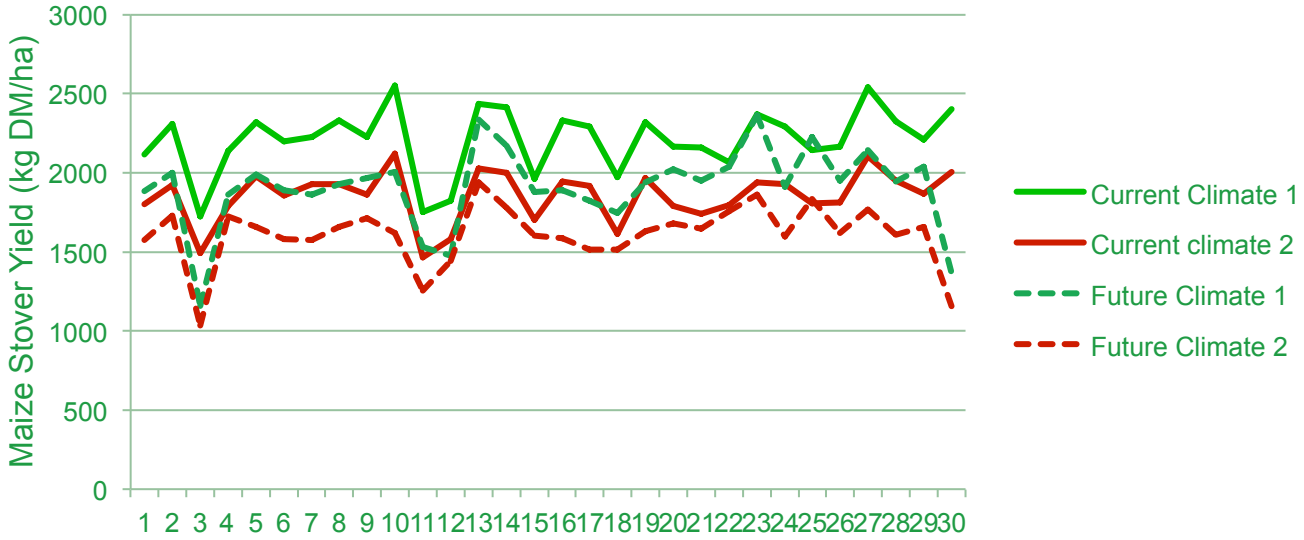
43109	1	6.00	2.90
43110	4	3.50	1.50



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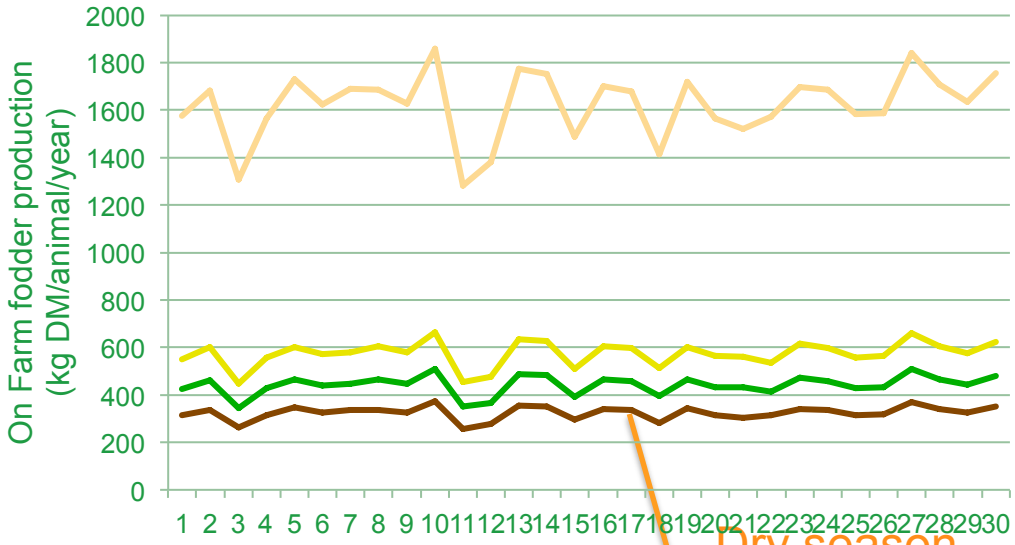
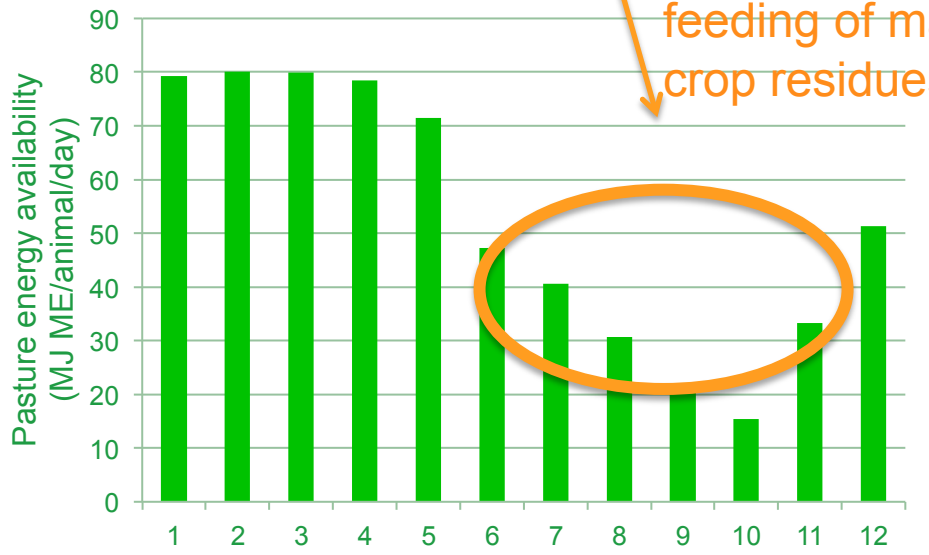
Example



Dry season feeding of maize crop residues



Farm-level fodder availability

Community-managed grazing land

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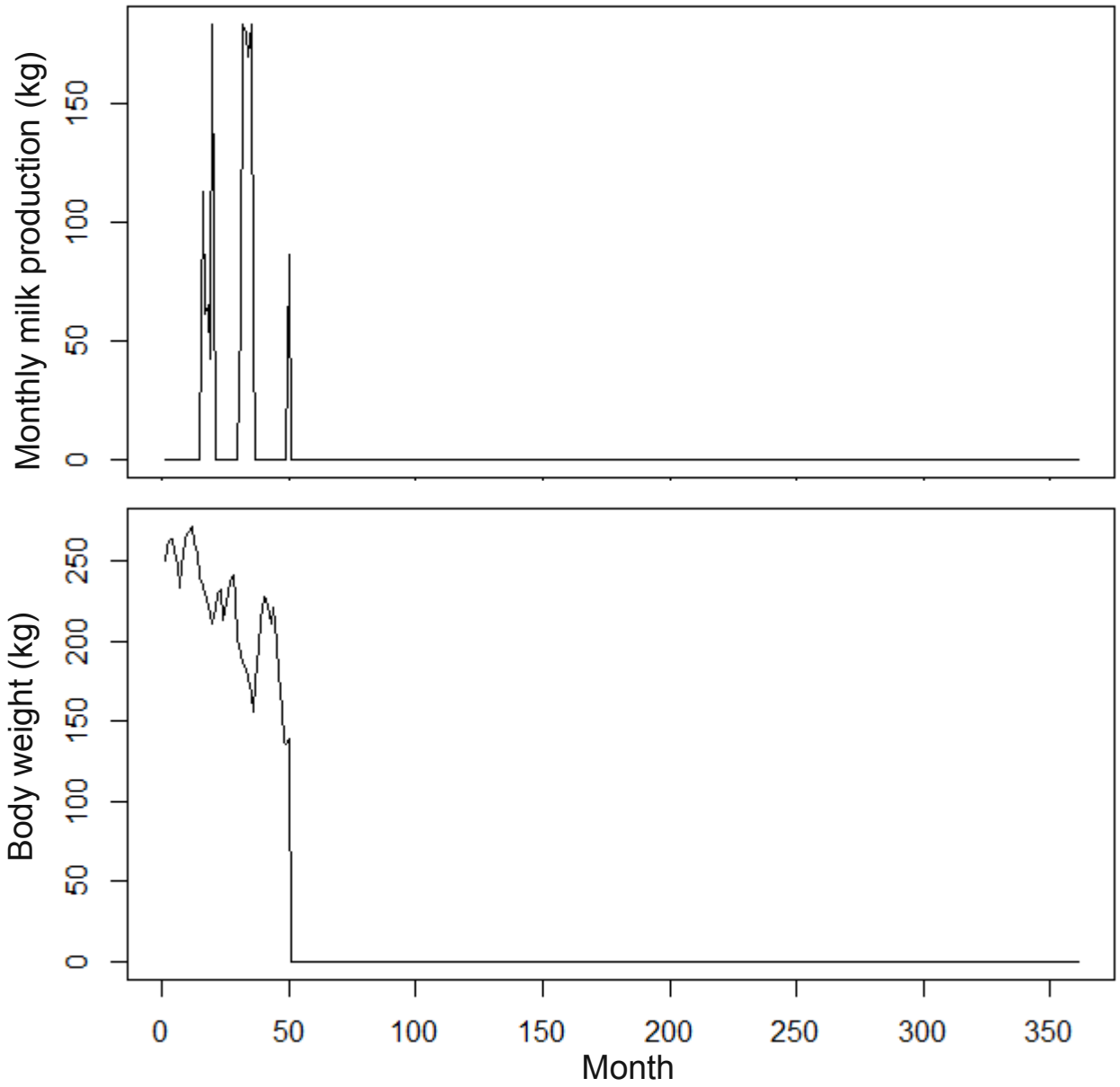
Example



One cow

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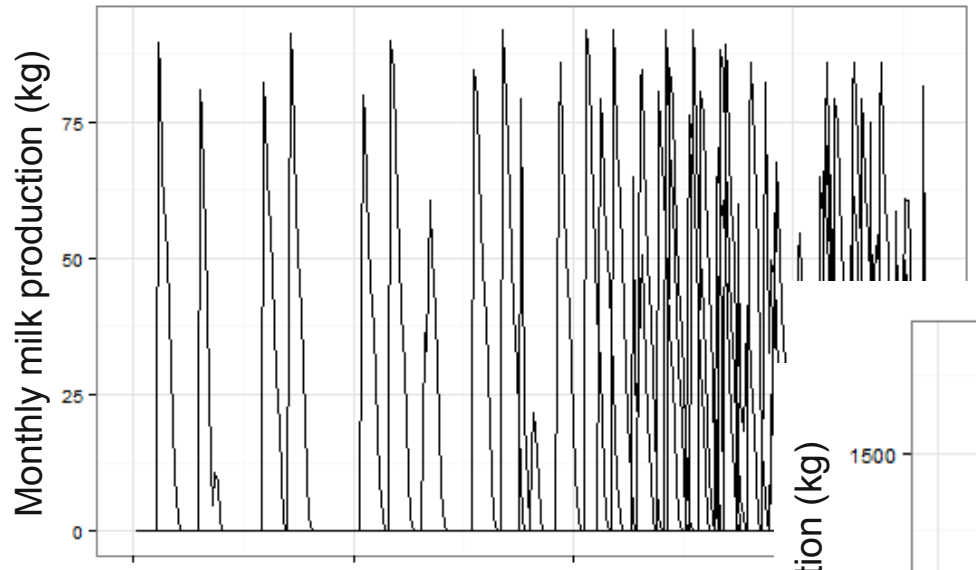
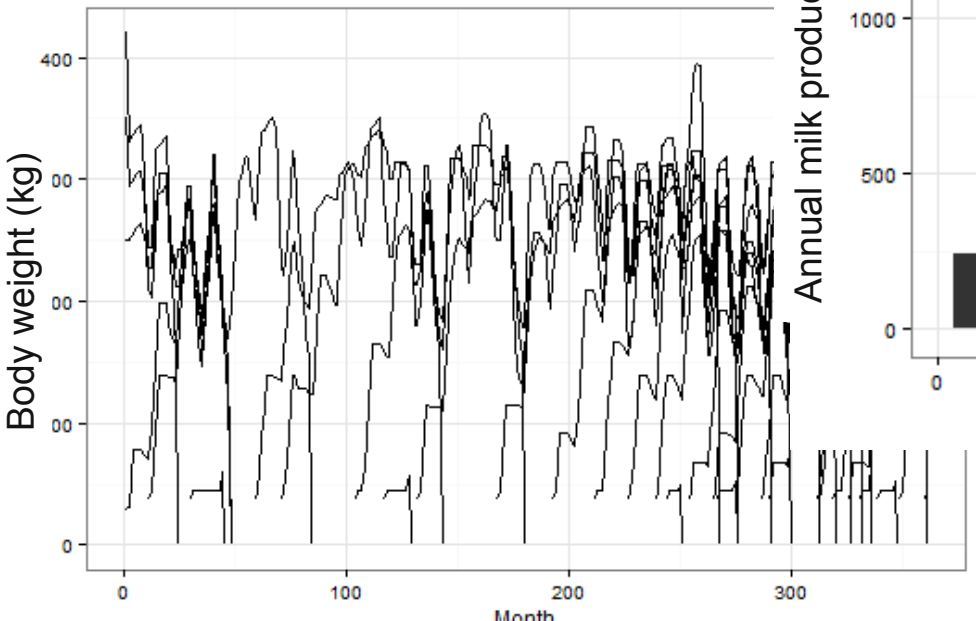
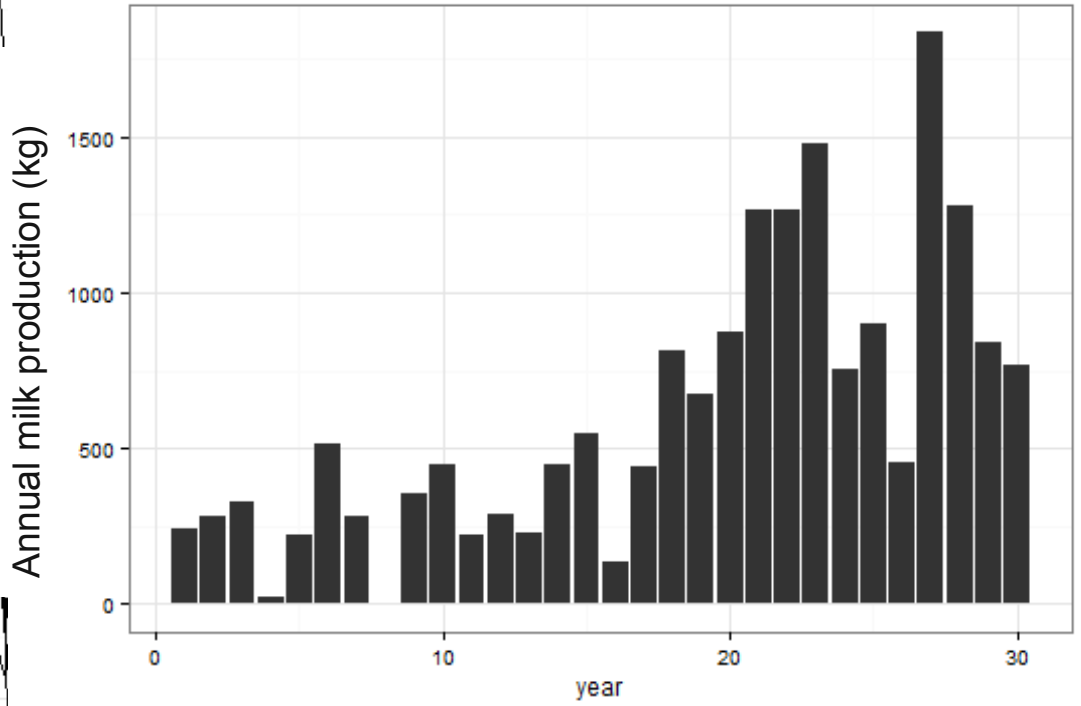
Example

Entire herd







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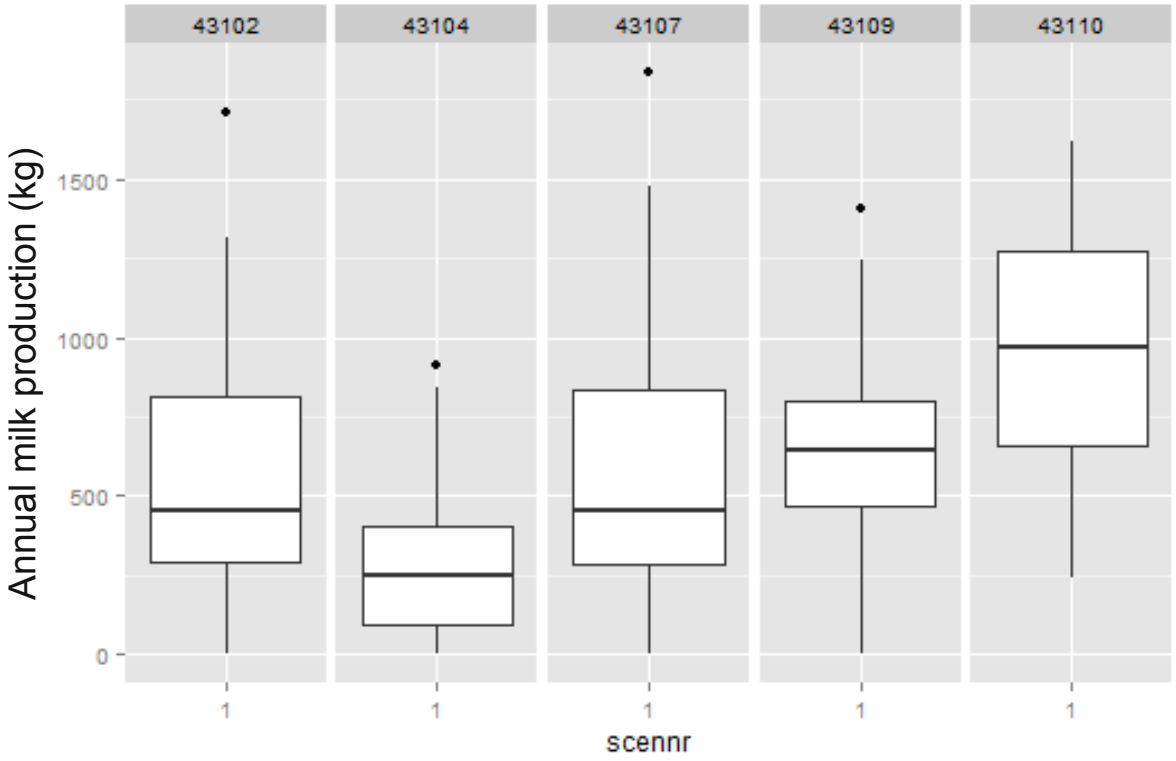
Example

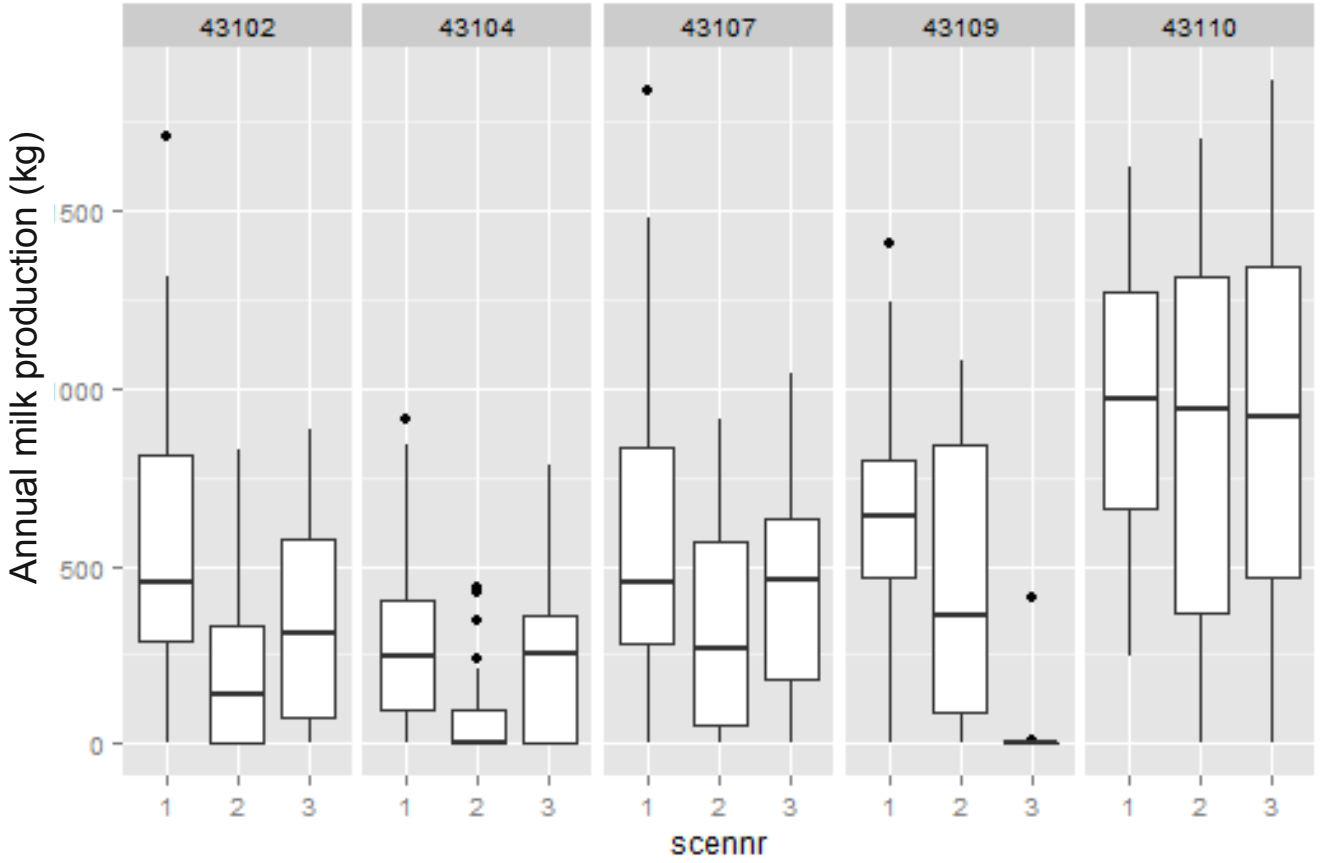


5 households

Example

Scenarios

1. Current climate
2. Future climate
3. Future climate with “incremental improvement package”



Challenges

- Livestock model comparison, sensitivity analysis
- Direct T effect not yet included
- Uncertainty in feed availability estimates for extensive systems
- Data availability for model calibration, model setup and input data
- Weak modelling capabilities in the region

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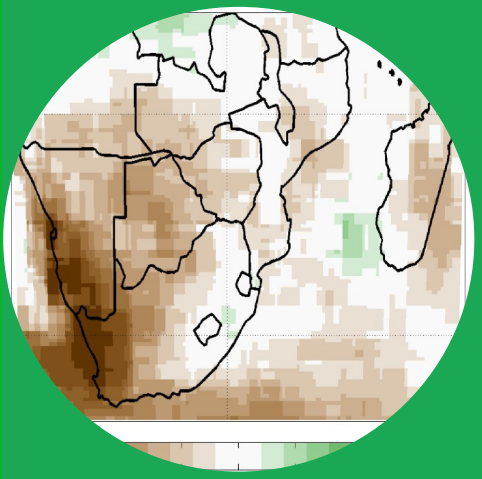
THANK YOU



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