RESEARCH PROGRAM ON Livestock

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More meat, milk and eggs by and for the poor

Livestock feed feasibility mapping in East Africa – a scoping study

Simon Fraval, John Mutua, An Notenbaert, Philip Thornton, Alan Duncan

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

ICARDA Science for Better Livelihoods in Dry Areas

CIAT International Center for Tropical Agriculture

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Developing livestock feed "feasibility surfaces" – an overview

How is a feed feasibility surface produced?

Techfit technology feasibility components

- Feed technologies rated by experts on their potential to mitigate feed constraints

- Technologies are matched based on spatially explicit:
  - Feed constraint
  - Livestock commodity
  - Farming system
  - Enabling attributes

Feed feasibility analysis overview

What are the components of a feed feasibility surface?

“Techfit” technology feasibility components

- “Techfit” is a prototype method for ranking livestock feed options based on suitability to a given location.
- Feed technologies
  - Hay, forages, fodder trees, irrigated fodder, concentrates ...
- Constraints
  - Overall feed availability
  - Seasonal feed availability
  - Feed quality
- Applicability to commodity
  - Dairy
  - Beef cattle
  - Sheep/goat
  - Pig

Techfit technology feasibility components

- Applicability to farming systems
  - Intensive mixed crop-livestock systems
  - Agro-pastoral /extensive mixed
  - Pastoral
- Enabling attributes
  - Land availability
  - Water
  - Access to inputs and market
  - Labour, finance, skill/knowledge

Feed technologies

How are feed technologies evaluated and scored?

Feed technology evaluation

- Candidate livestock feeding interventions identified
  - 31 technologies
- Experts scored each technology in terms of each feasibility component
- Scores range from 0 to 4 for potential to mitigate, applicability to commodity and applicability to farming systems (4 being the most suitable)
- Scoring for enabling attributes was based on a series of standardised questions e.g. Is credit available?
- Scores range from 4 to 1 for enabling attributes (4 being that the technology does not require the attribute)

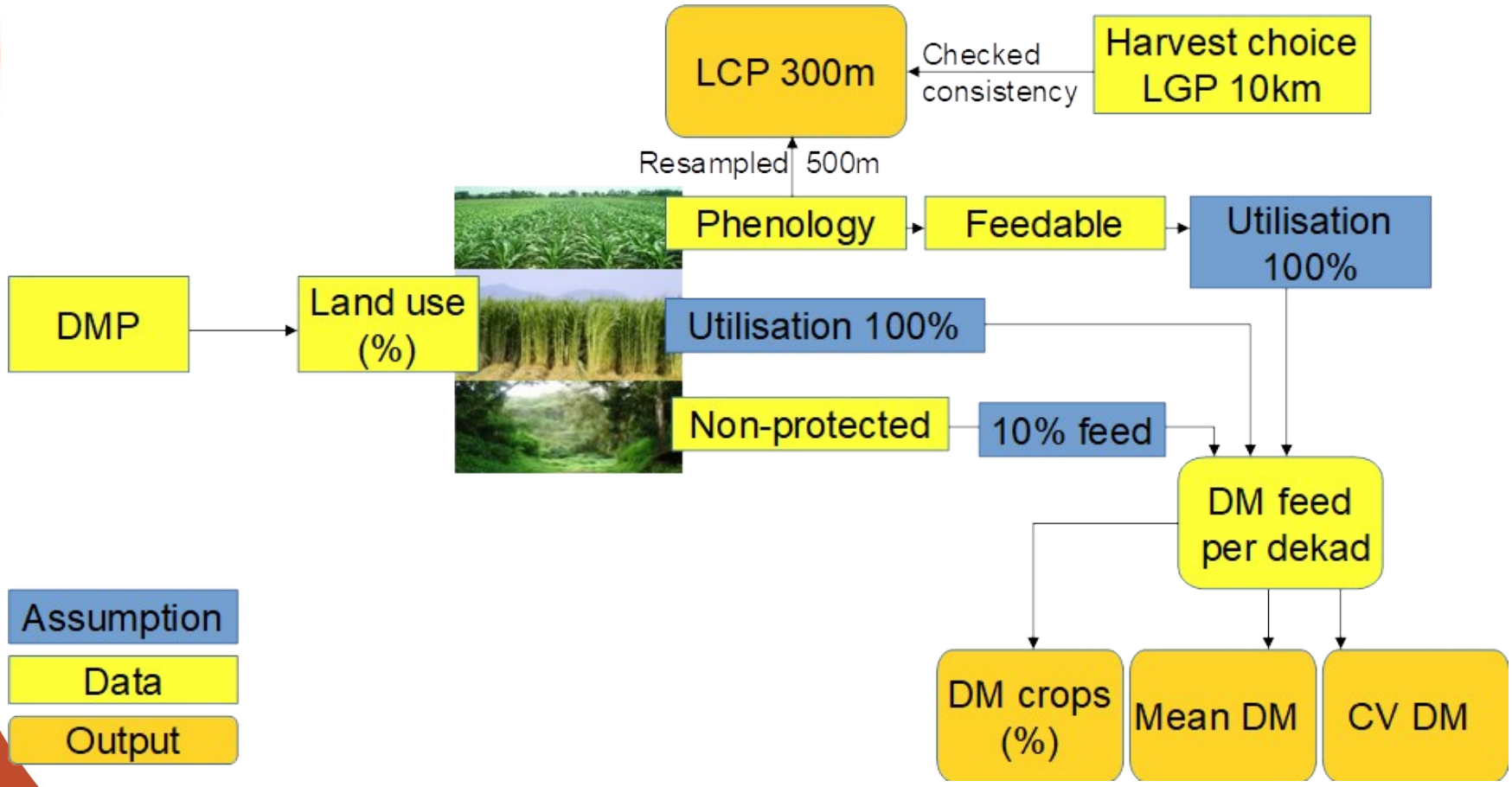
Spatially explicit metrics: constraints

How are the feed quantity and quality constraint metrics produced?

Constraints: quantity and quality

- Feed quantity
  - Length of cropping period
  - Mean feed quantity
  - Coefficient of variation of feed quantity
- Feed quality
  - Proportion of dry matter production that is crop residue

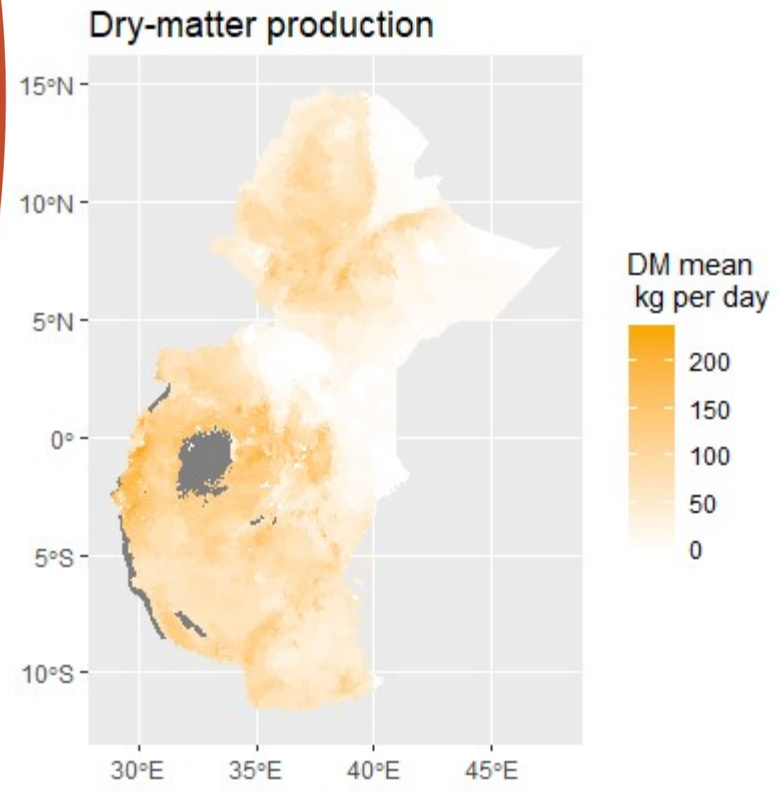
Constraints: quantity and quality modeling



Spatially explicit metrics: constraints

What are the resulting metrics for East Africa?

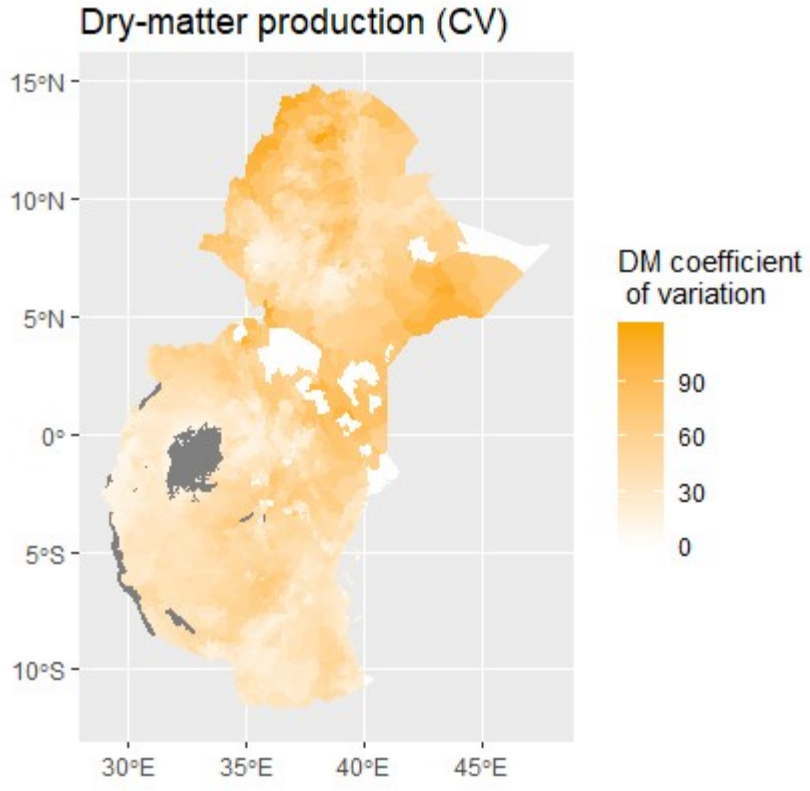
Constraints: average feed availability



Mean deakadly dry-matter production is higher in the humid tropics and highlands.

Grey shading is of large water bodies

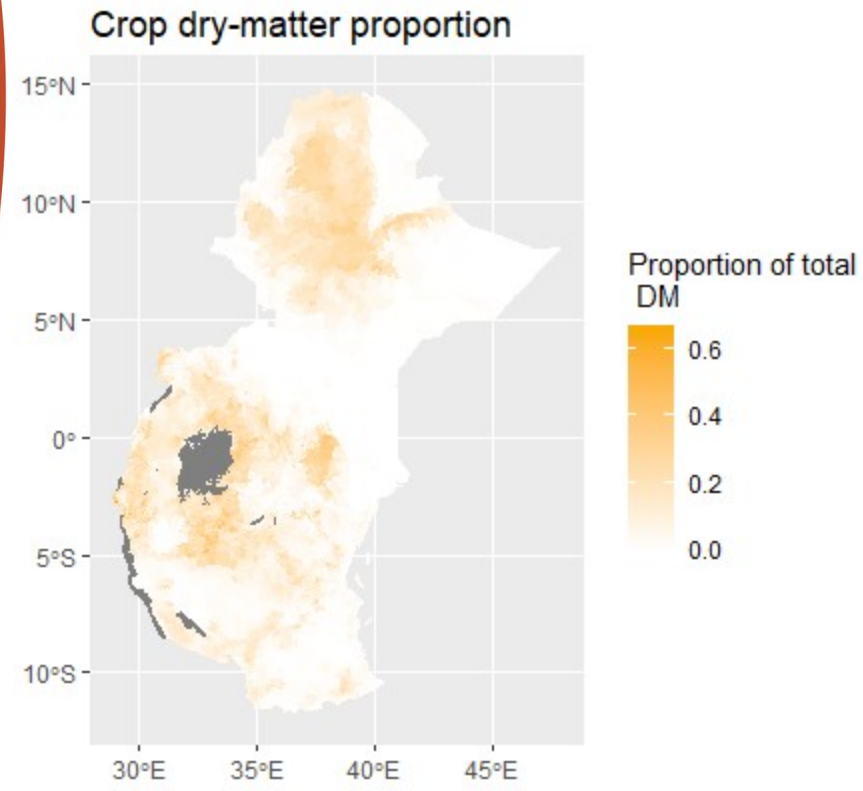
Constraints: average feed availability



Grey shading is of large water bodies

Dry-matter production coefficient of variation shows that variability occurs in arid-semi-arid locations as well as higher potential locations.

Constraints: dry season feed availability



Dry-matter from crops is limited to cropping locations and rarely exceeds 40% of total DMP.

Grey shading is of large water bodies

Commodities and farming systems

What are the data sources for aligning to commodities and farming systems?

Commodities and farming system suitability

- Gridded livestock of the world
  - Initial analysis limited to locations with dairy cattle present
- Farming systems
  - Initial analysis limited to mixed crop-livestock and irrigated

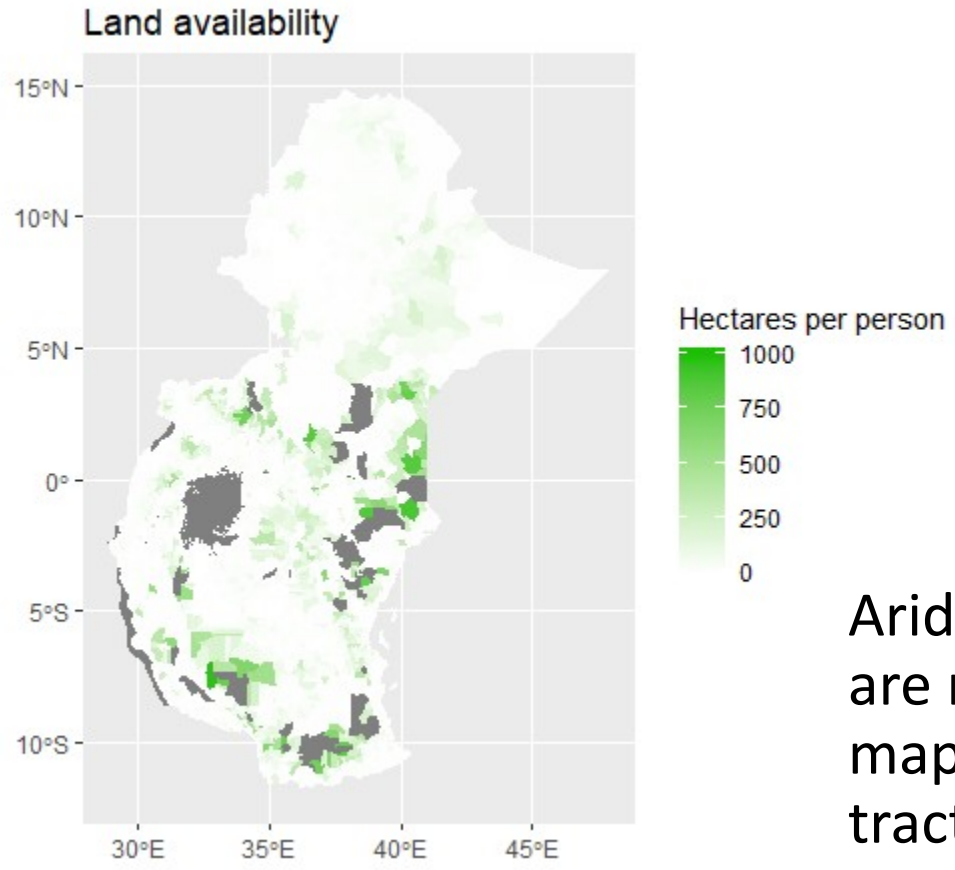
Enabling attributes

How are the enabling attribute layers produced and what are the resulting metrics?

Enabling attributes: land availability

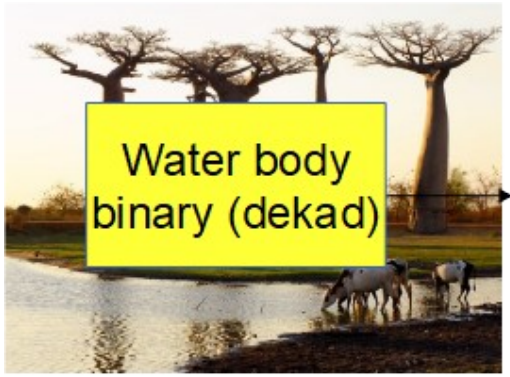
- Hectares of crop land per person
  - Crop land per square km
  - Population density (WorldPop)

Enabling attributes: land availability



Arid and semi-arid locations are more prominent on this map as they have large tracts of land with limited populations

Enabling attributes: water availability



Phenology

Seasonal water body extent

Maximum waterbody extent

Minimum waterbody extent

Friction

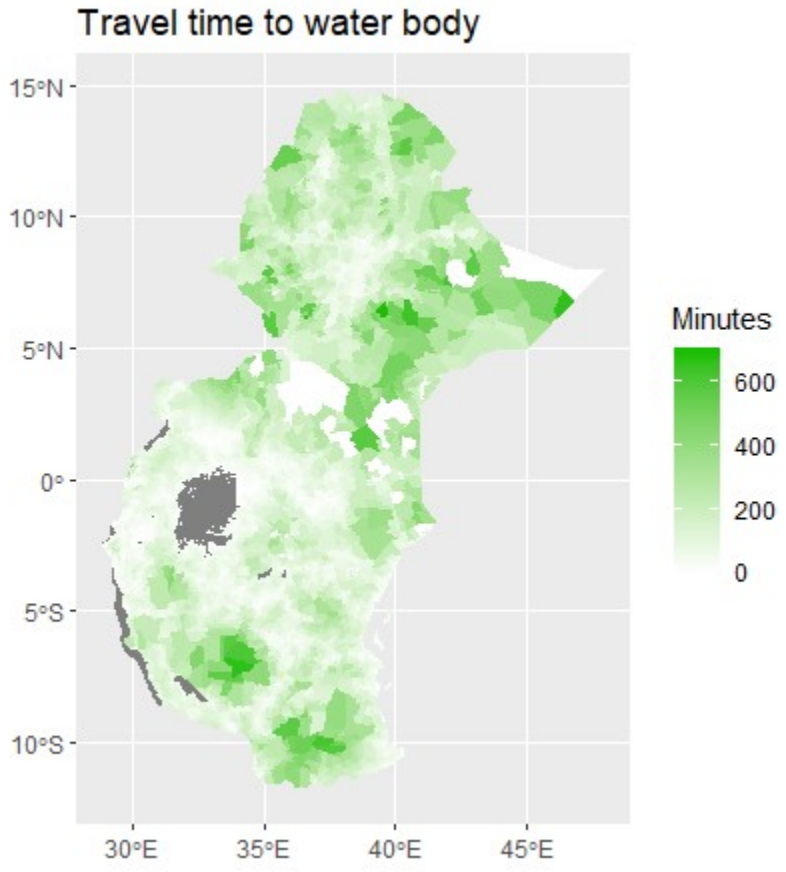
Minimum TT to waterbody

Maximum TT to waterbody

Data

Output

Enabling attributes: water availability

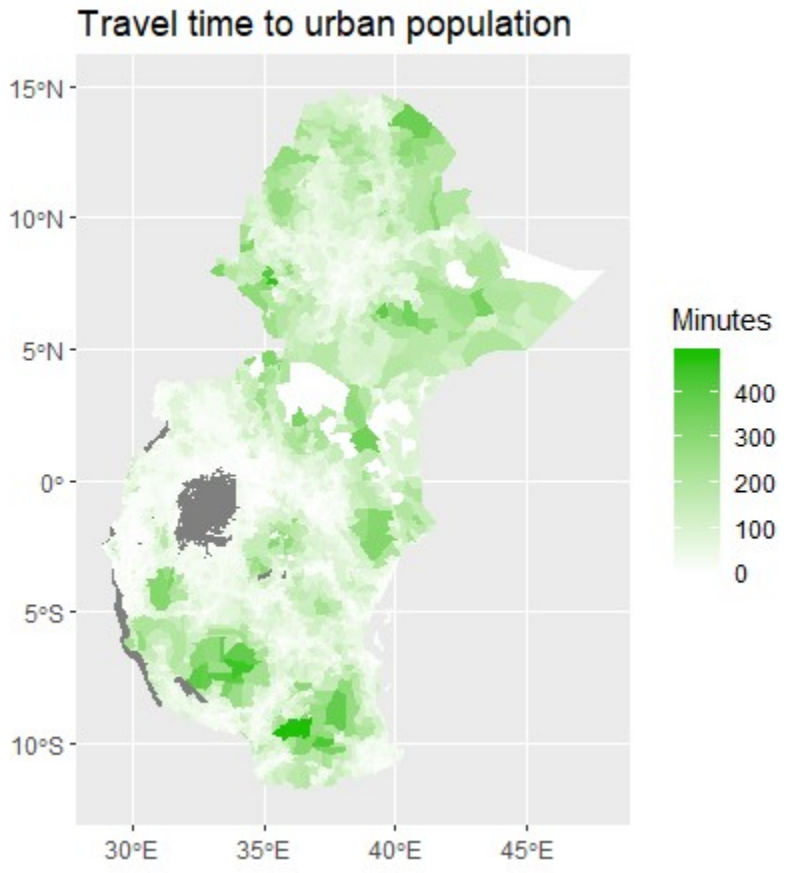


Minimum travel time to water body as a measure of water availability

Enabling attributes: inputs and market access

- Travel time to city/market/input supplier
  - Friction surface provided by Weiss et al. (2019)
  - Travel time to city generated by
  - Market and input supplier locations available for Kenya and Uganda from FinScope → travel time generated with friction surface

Enabling attributes: inputs and market access



Road access and topography influence travel time

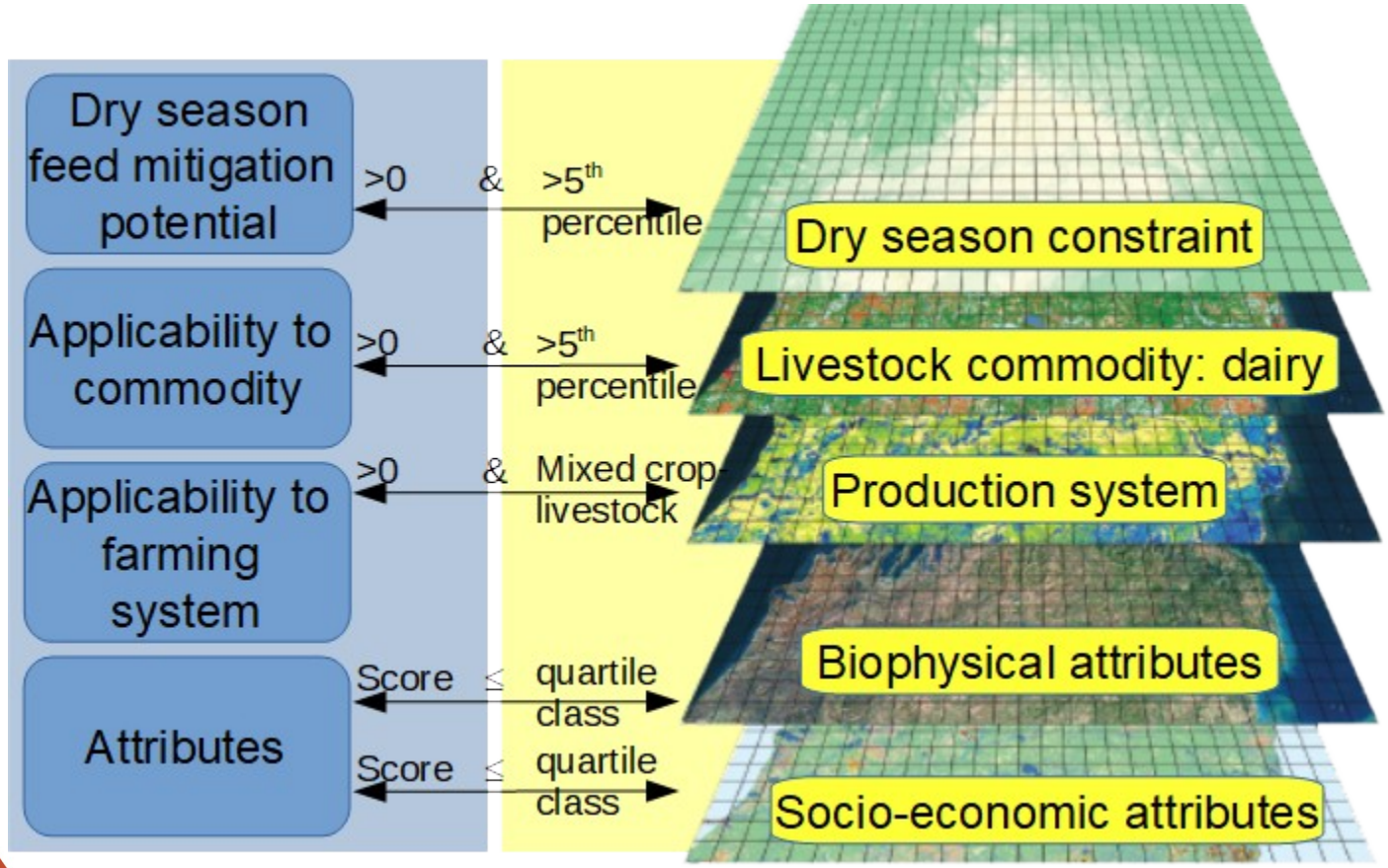
Feasibility assessment

Exactly how is a feed feasibility surface produced?

Feasibility assessment

- Matching expert scores with spatial layers
  - Low threshold for constraint, commodity and farming system – simply needs to be present
  - Enabling attribute scores matched to quartiles of spatial data

Feasibility assessment: visual representation

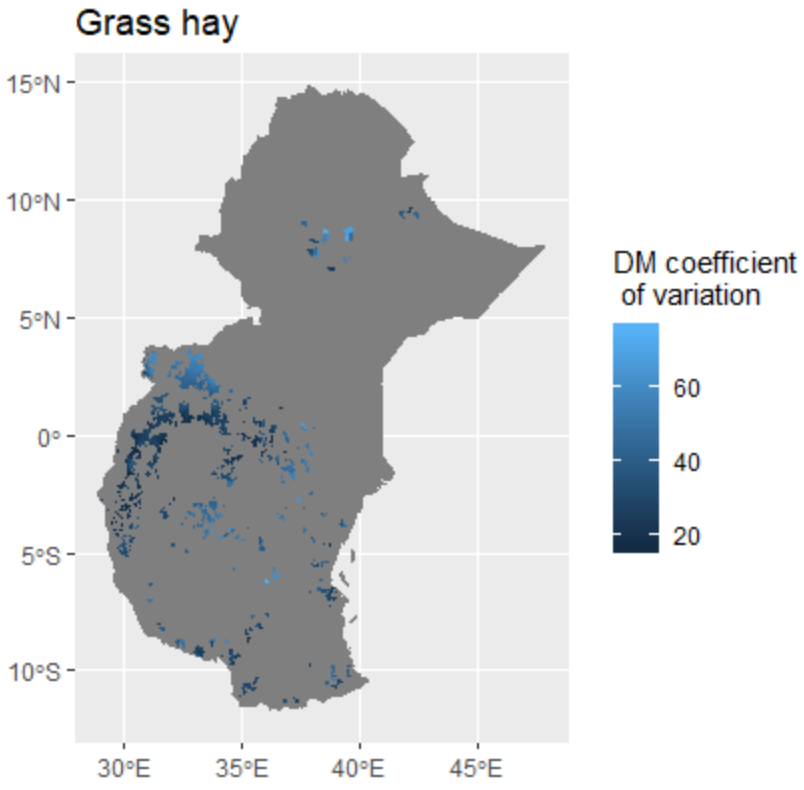


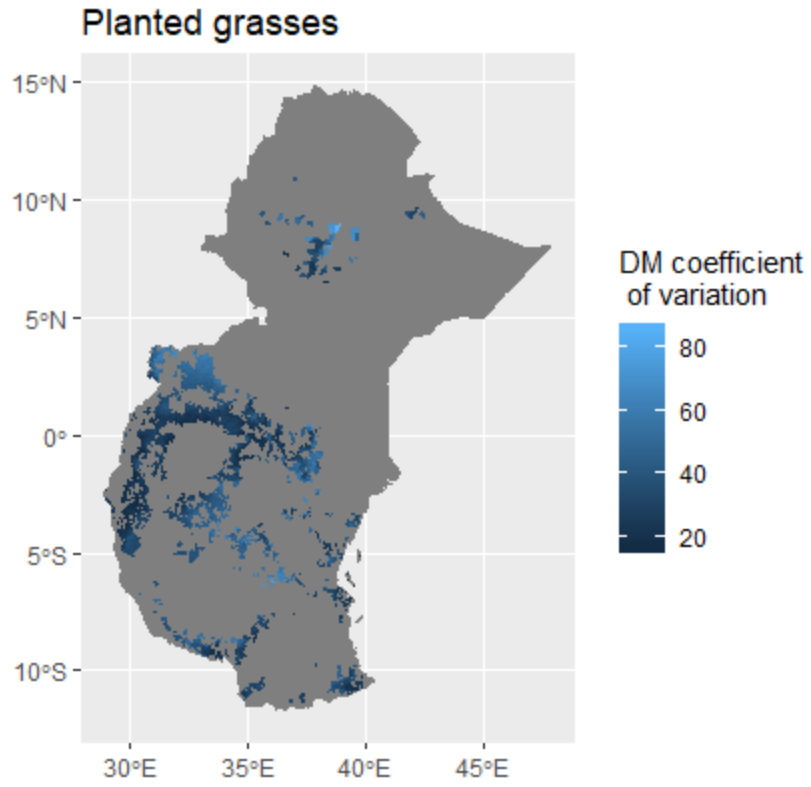
Feasibility assessment

Where are feed technologies feasible?

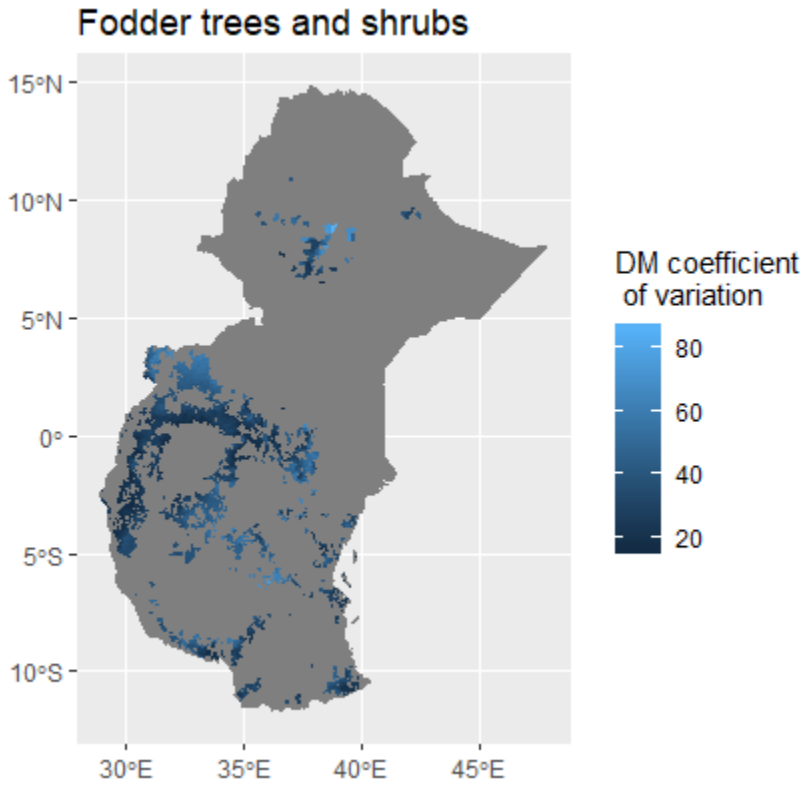
(preliminary)

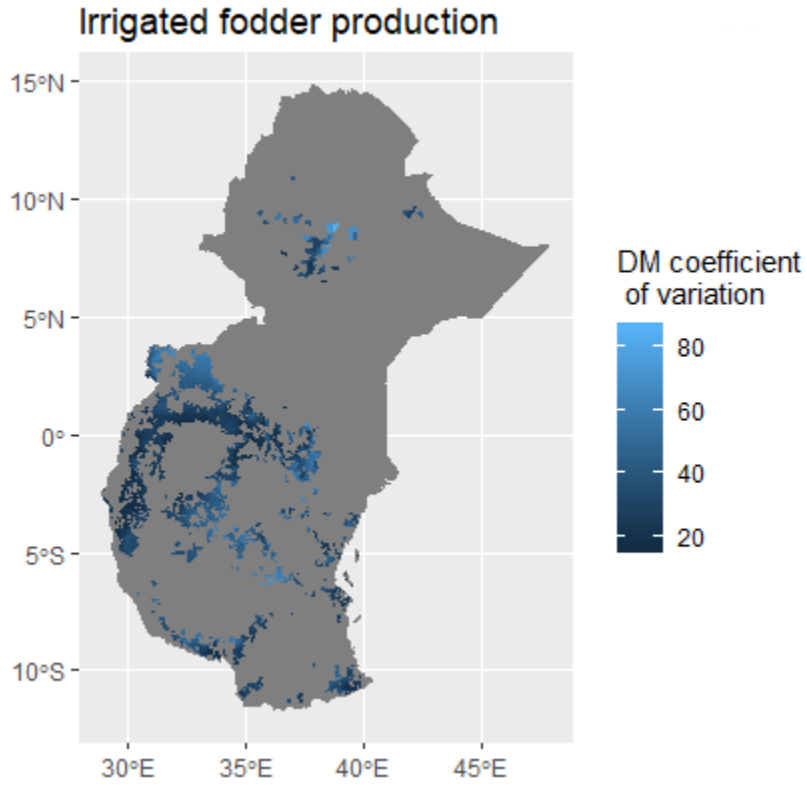
Techfit feasibility surfaces





Techfit feasibility surfaces





Techfit feasibility surfaces: observations

- There is wide spatial extent with suitable technologies within mixed-crop livestock and irrigation locations
- Smaller spatial extent for feasible hay production
- Similar feasibility for other technologies
  - Differentiation with more enabling attributes

Further work

What are the next steps to improve these feasibility surfaces?

Further work

- Add metrics for feed quality, labour, finance, skill/knowledge
- Refine feed availability, market access and input market layers
- Ground-truthing constraints and enabling attributes
- Ground-truthing technology recommendations
- Identify critical gaps for future development
- Develop into a user friendly tool

CGIAR Research Program on Livestock

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The **CGIAR Research Program on Livestock** aims to increase the productivity and profitability of livestock agri-food systems in sustainable ways, making meat, milk and eggs more available and affordable across the developing world.

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