

Regional Characterisation of FMD Status

Meeting held at FAO, 27th March 2005

MAPPING THE FMD HOMELANDS:

An exploratory look at global ruminant production systems and associated movements to market

by

William Wint, Environmental Research Group Oxford

and

Keith Sumption, FAO, Secretary, EU Commission on Foot and Mouth

Prepared in collaboration with the European Food Safety Authority (EFSA)



Main objectives

to work towards a logical basis for identifying FMD epidemiological zones and assessing incidence and prevalence in area with patchy or unreliable data using a Geographic Information System (GIS) based approach

Exploratory Analyses

i.e. a toe in the water to see if there is any potential in the ideas
extends and adapts outputs from previous and on going FAO projects:

FAO Animal Health Programme

Livestock Geography Atlas

Atlas of Epidemiological Instability

Agriculture Towards 2020

Global Livestock Distribution Mapping

Identify Data Needs

to ensure adequate risk assessment in medium term
to quantify and map risk to EU from outside its borders



Main Conclusions

- Trade and husbandry related indices of livestock movement can be produced
- A number of different incidence indices can be produced using expert rankings of Degree, pattern and frequency of FMD presence
A combination of a range of additional ranked disease parameters
- The incidence indices can be effectively combined with livestock species density distributions to provide credible prevalence indices
- Calculated prevalence is highest in China (pigs), India (cattle), the Near East (small ruminants) and the Sahel (small ruminants and cattle)
- Results suggest that methods can be used to provide some useful information at national and sub-national resolution, even for countries for which quantitative FMD data is currently unavailable.
- Work is required to refine and improve the data and the techniques,



Assumptions

FMD persistence/spread likely where:

livestock densities are high
cattle (& buffalo), sheep & goats, pigs
incidence is high

stock movements are frequent

no movement records as for e.g. UK so

pastoral transhumance
trade

**CTS DATA 2001
MONTHLY MOVEMENTS
PER SQUARE KILOMETRE
INTO CELLS**

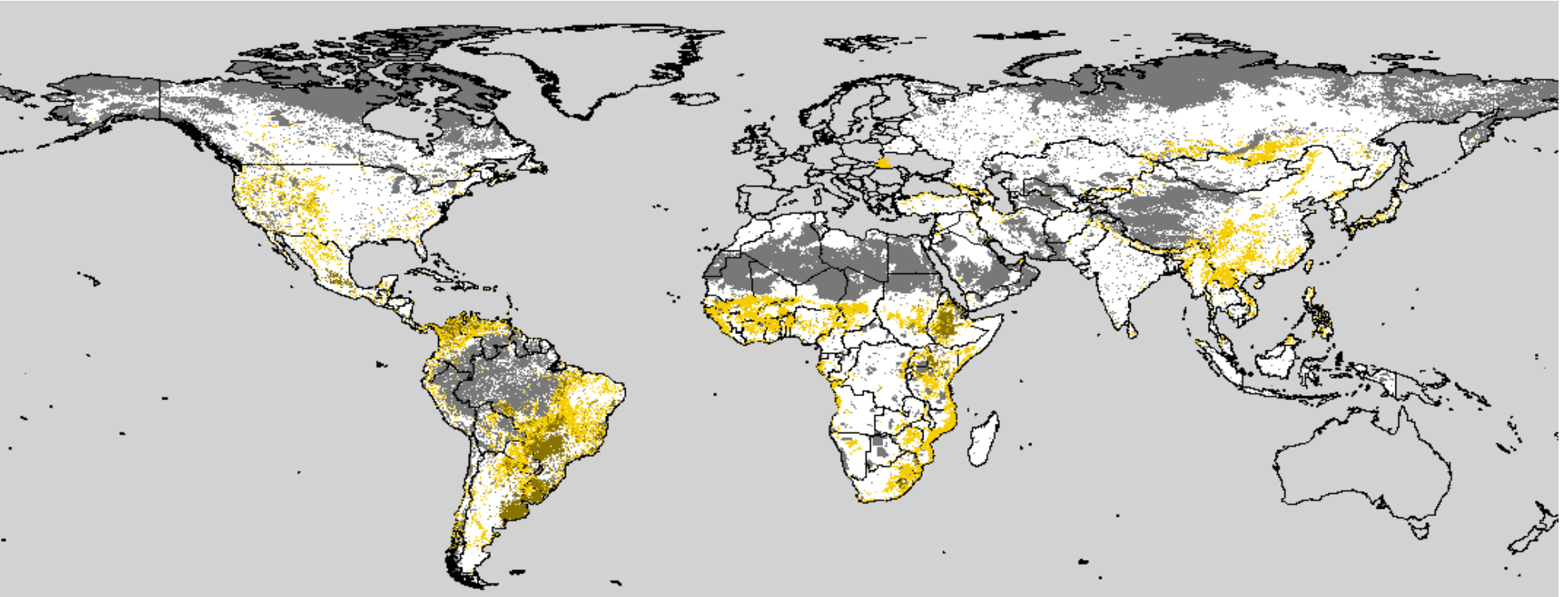
limited preventative measures

?? Climatic or environmental factors relevant

?? Wildlife hosts



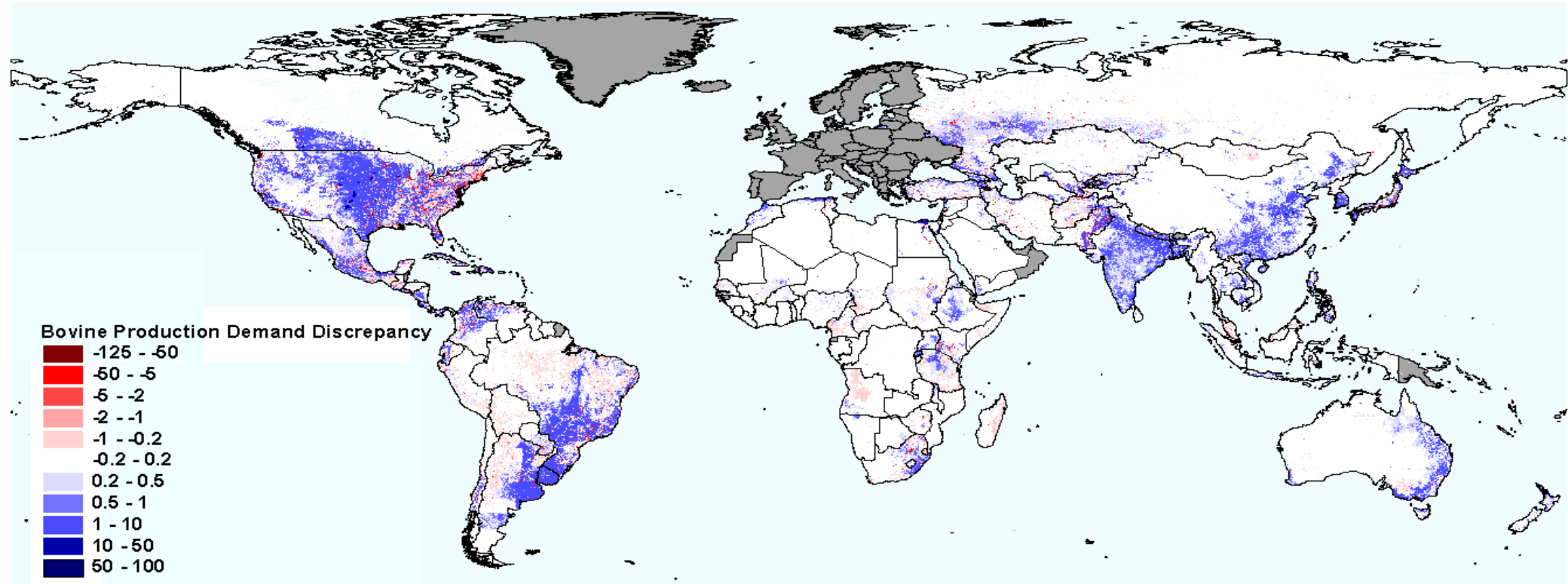
Movement 1: Husbandry related



Low density bovine systems, minimal crops

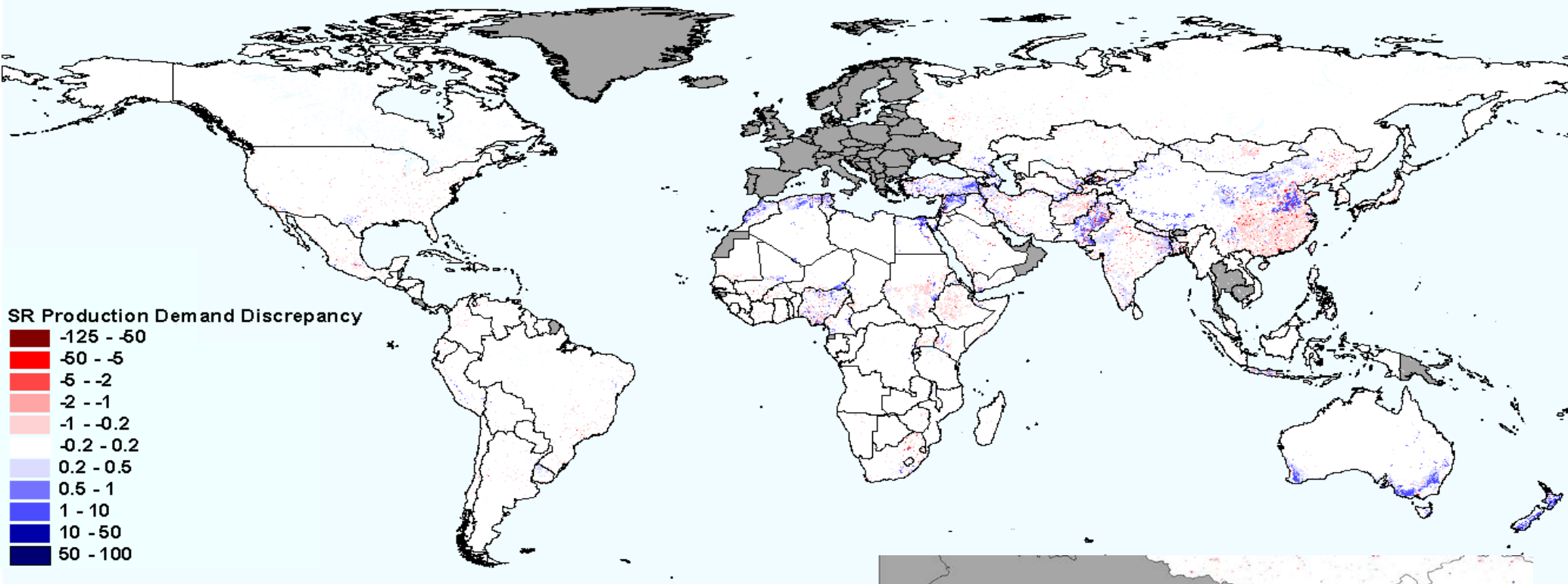


Movement 2: Trade related = Production minus demand



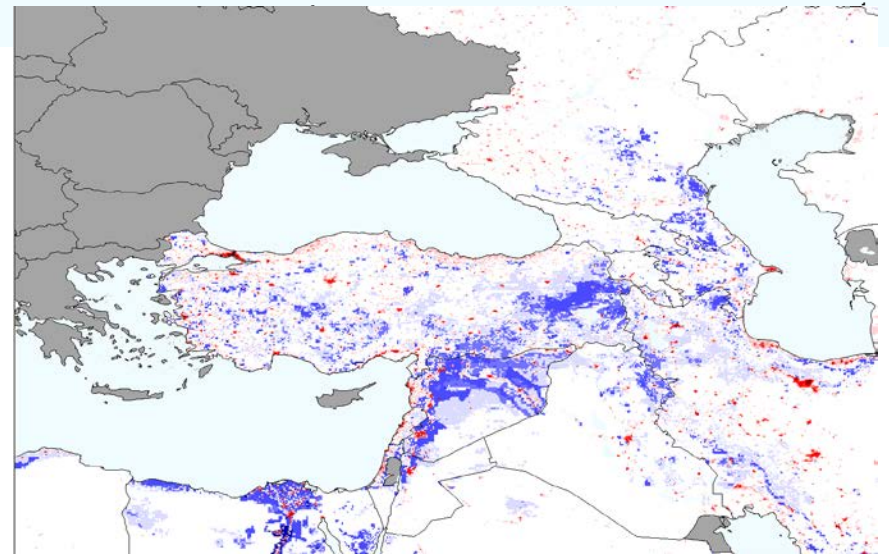
Production 'Surplus' – Cattle

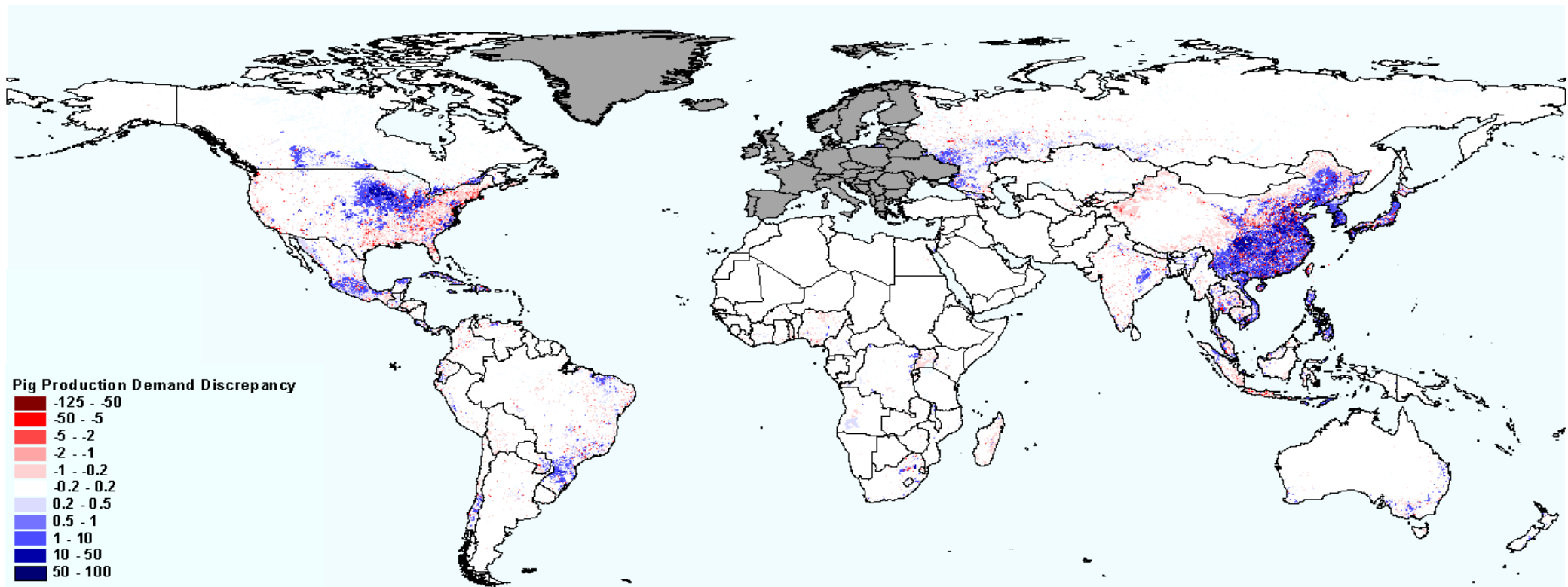




Production 'Surplus' – Small Ruminants

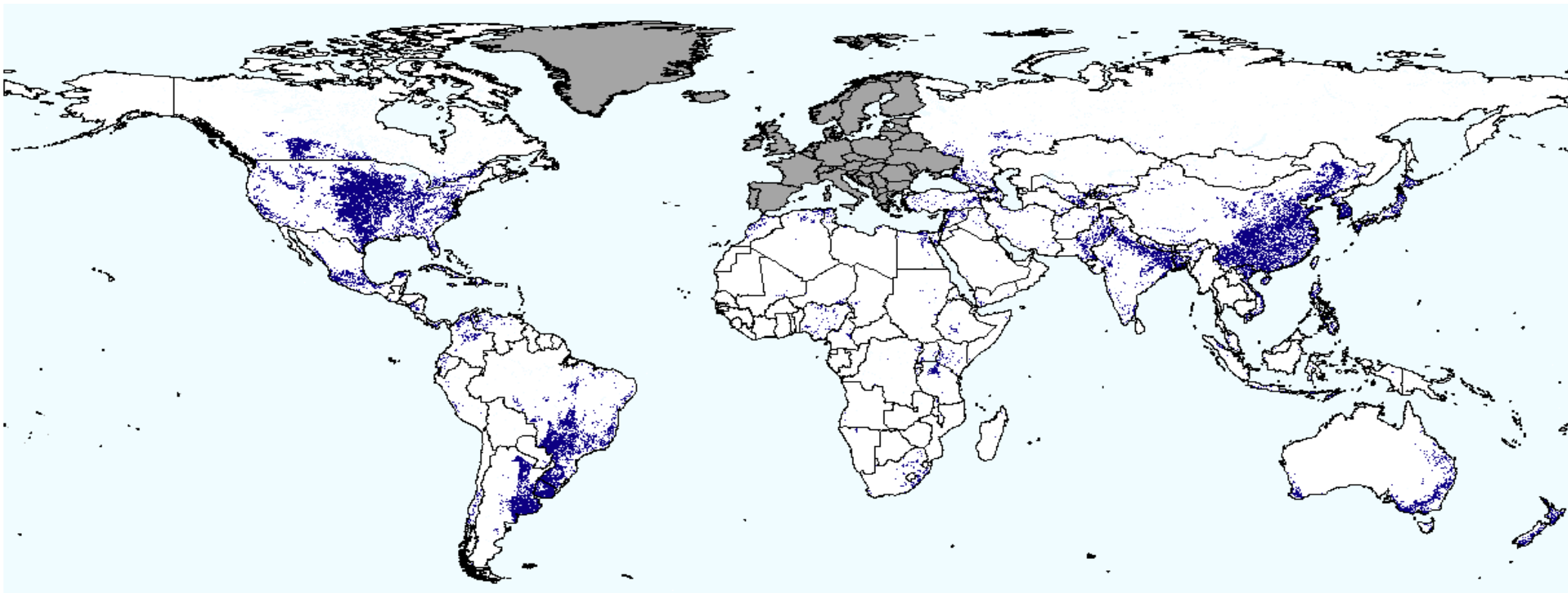
Note 5km resolution





Production 'Surplus' – Pigs

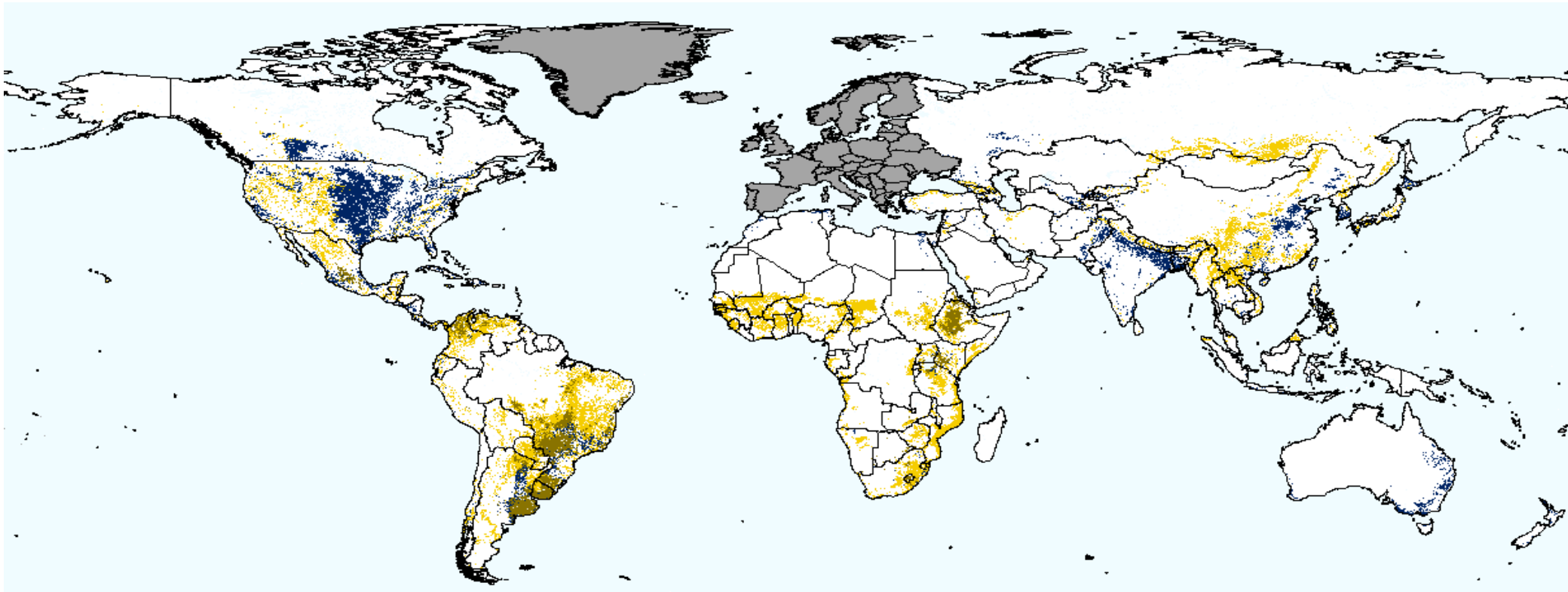




Combined High Bovine, SR or Pig Production Surplus



Areas with **exclusive or high density bovines** or moderate to high beef production surplus

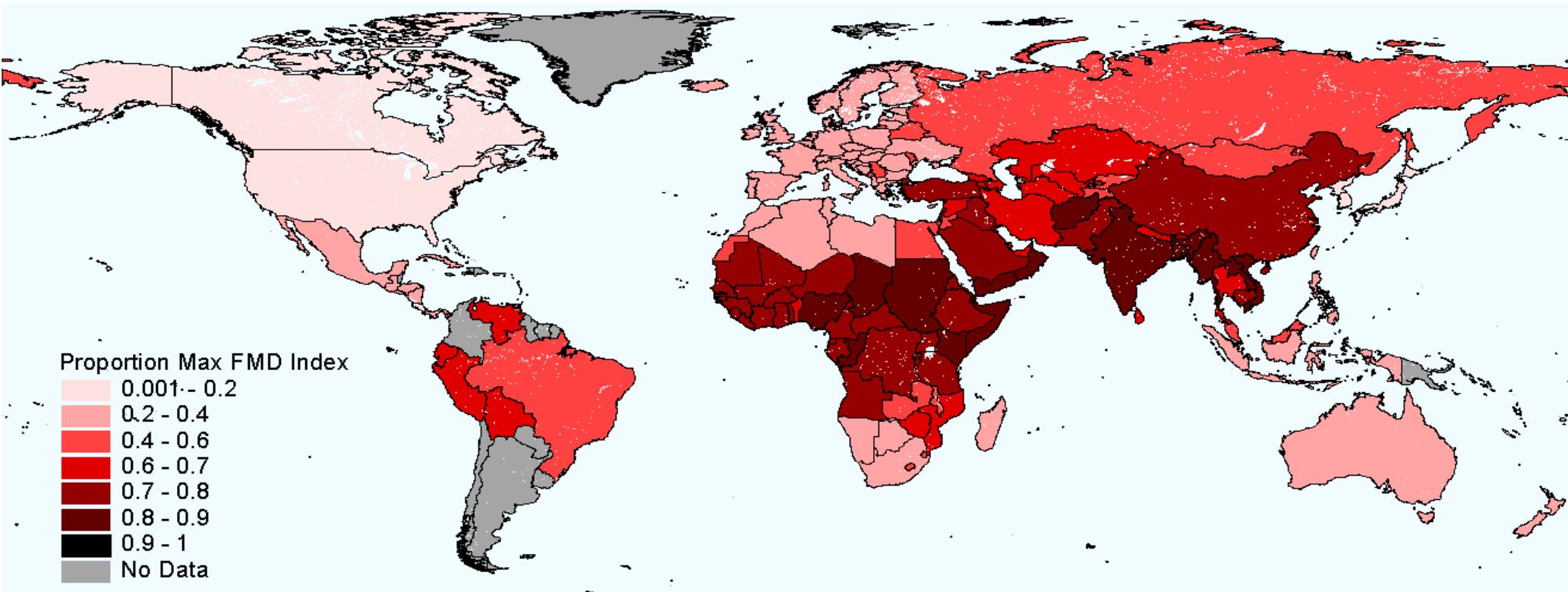


Movement related spread risk if disease present and little prevention



Measures of Incidence and Prevalence 1: Expert Ranking

Normalised sum of : reported incidence, reporting, border and movement controls, serotype number, wildlife reservoirs:

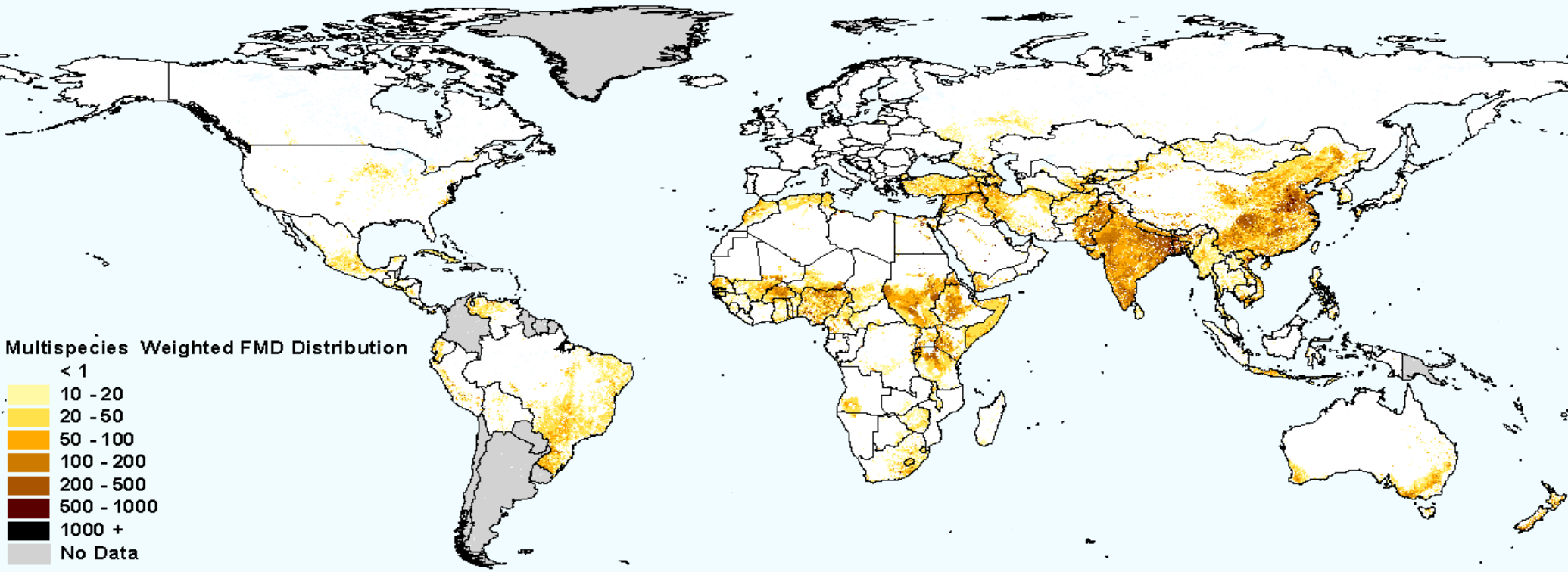


M. Rweyemamu and K. Sumption with EFSA



Measures of Incidence and Prevalence 2:

Multispecies FMD Weighted Density Distribution



Proportion Maximum Country Score * Summed density



Measures of Incidence and Prevalence 3:

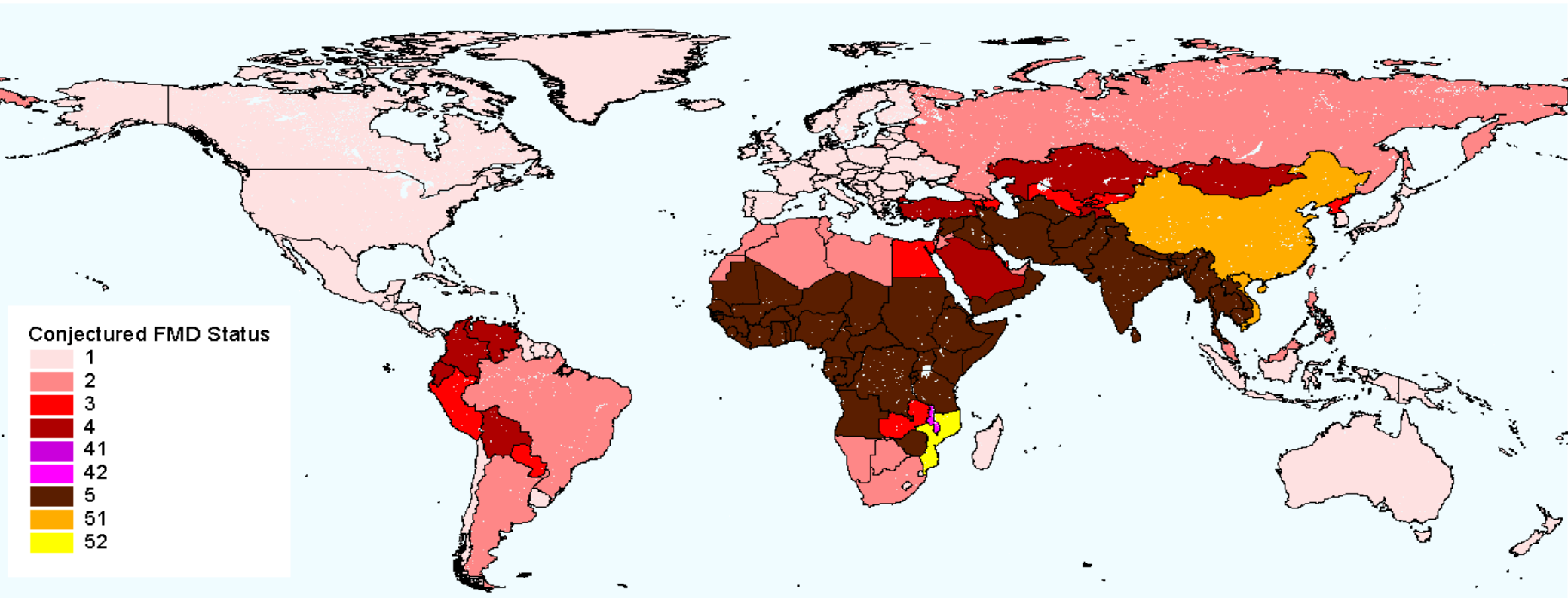
Incidence often measures patchy or unreliable:

=> ranking by expert opinion, with mean incidence assigned as representative of the ranking category (#/1000hd/Yr)

'Conjectured FMD Categories'	Cattle	Pigs	SR
Whole country free 1	0	0	0
Low sporadic incidence with effective reporting 2	0.047	0.002	0.037
Apparently low sporadic incidence with ineffective reporting 3	0.047	0.002	0.037
Disease expected every year (seasonal and/or restricted) 4	0.884	0.044	0.445
High incidence with outbreaks throughout the year 5	3.388	0.168	1.720
As 4, but involving the <i>Cathay topotype</i> of type O in pigs 41	0.884	6.408	0.445
As 4 but involving only <i>SAT</i> virus types 42	0.884	0.044	0.090
As 5, but involving the <i>Cathay topotype</i> of type O in pigs 51	3.388	24.560	1.720
As 5 but involving only <i>SAT</i> virus types 52	3.388	0.168	0.344

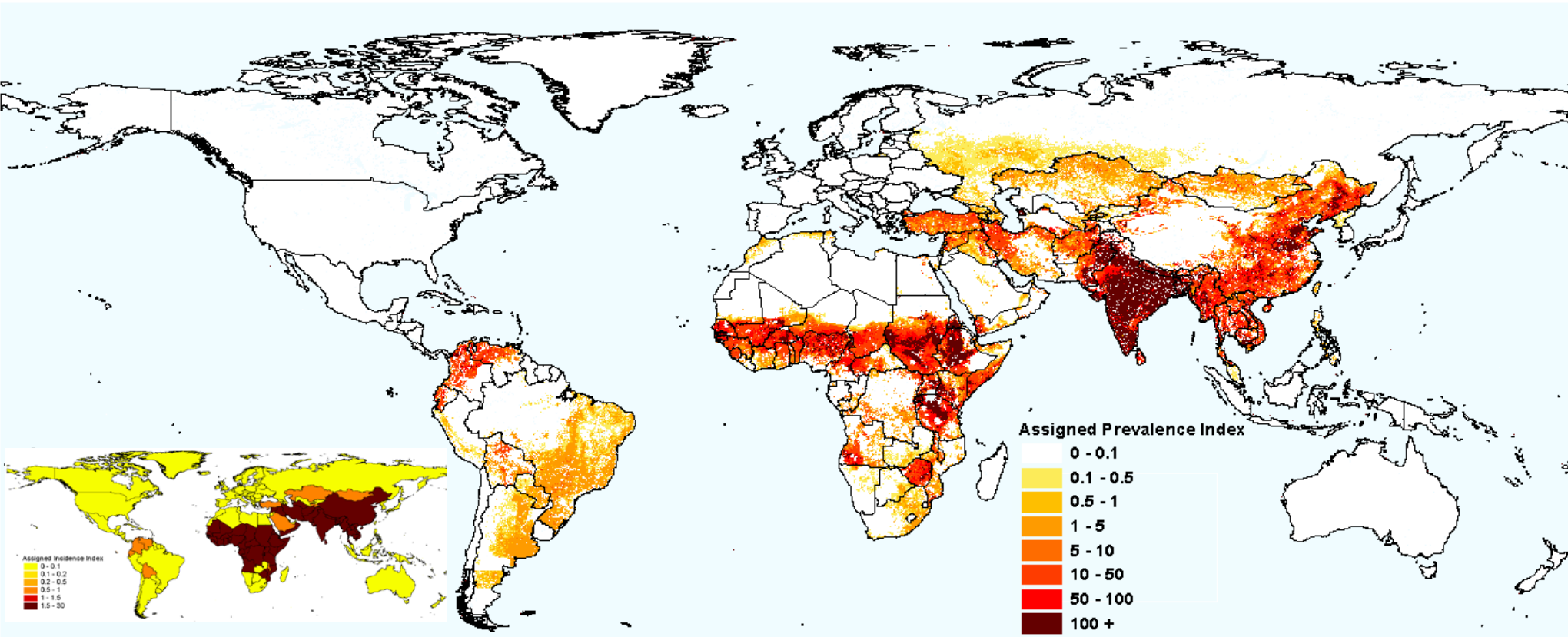


Measures of Incidence and Prevalence 3:



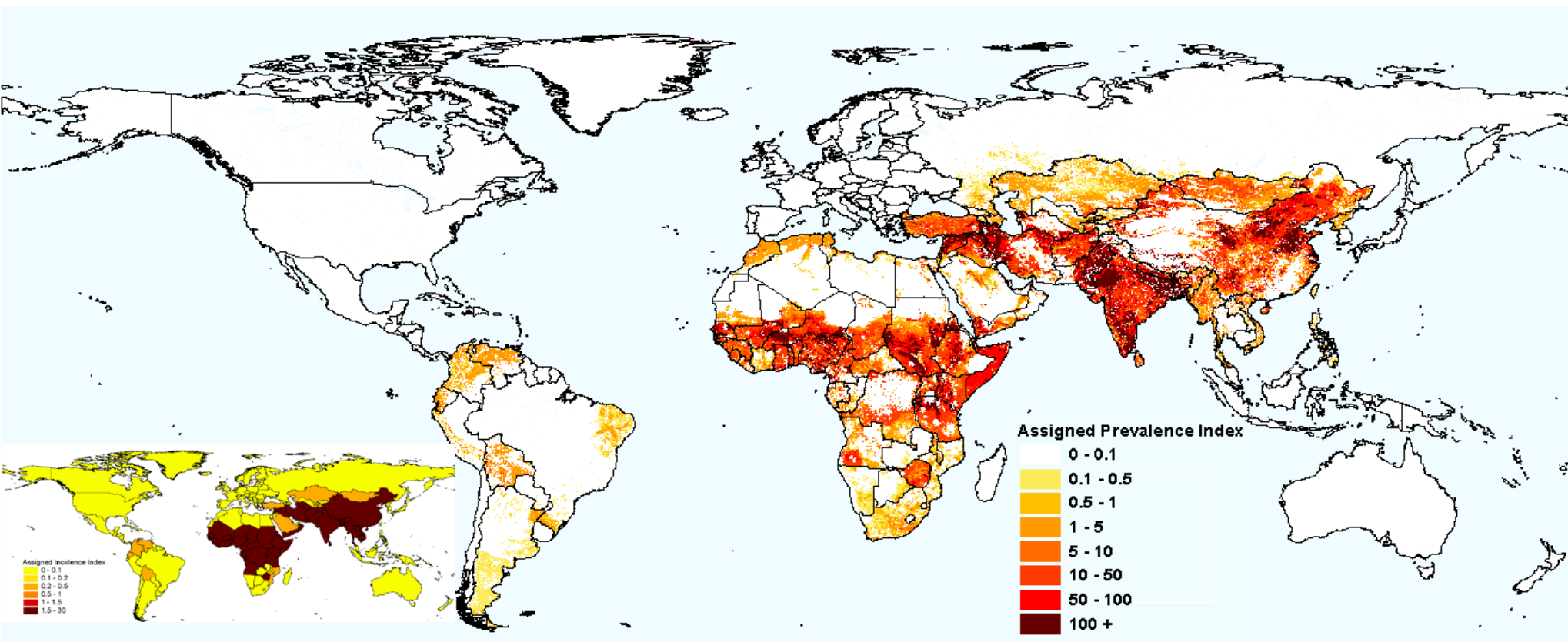
Measures of Incidence and Prevalence 4:

Assigned Prevalence Index - Cattle

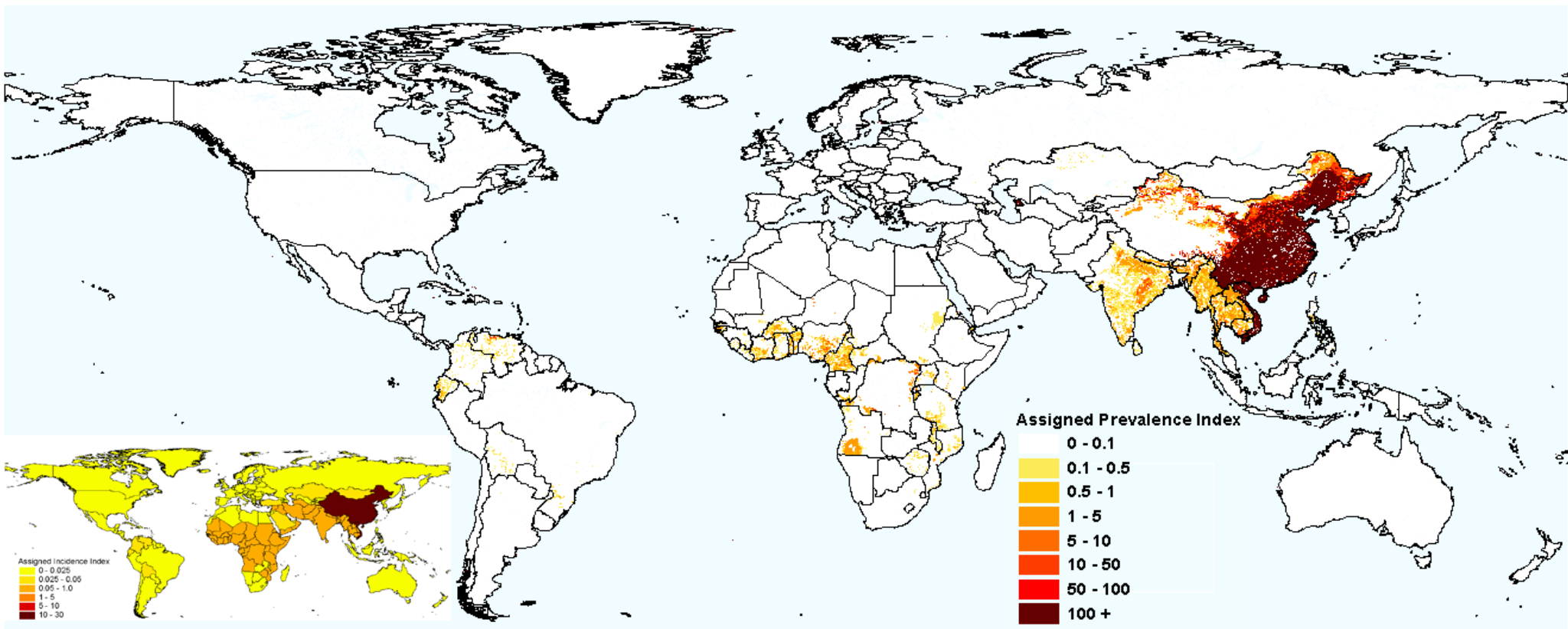


Assigned incidence * animal density





Assigned Prevalence Index – Small Ruminants



Assigned Prevalence Index – Pigs



Main Recommendations

The **techniques assessed** can be significantly improved by:

Making the rankings used more robust by introducing additional parameters and evaluating alternative weighting regimes

Using more sophisticated spatial analysis tools such as watershed analysis, classification and segmentation and iterative spread modelling to identify 'self contained' disease systems and define limits to likely spread

The **data** and expert opinion underlying the analyses must also be validated and if possible extended specifically by:

Ground truthing assigned incidence levels in critical countries, particularly those with high disease burdens that share borders or trade livestock with currently FMD free nations

Evaluating key indicators such as sero-conversion rates in selected age groups



Inputs needed

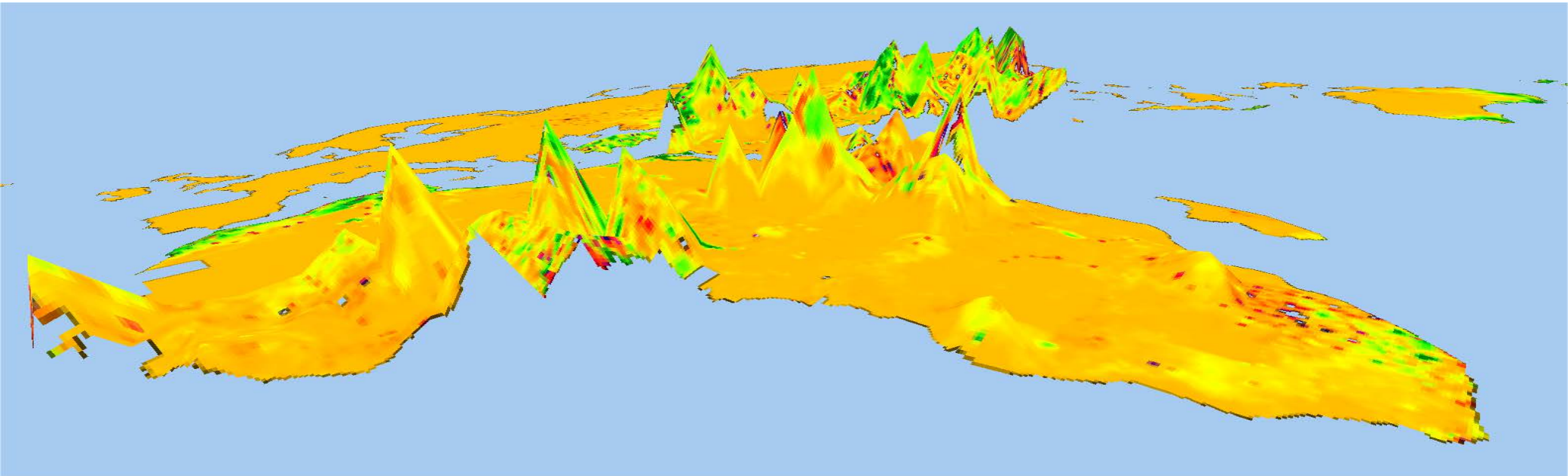
Resources from and collaboration between:

Potential users;

Agencies, institutions, national bodies, commercial entities, farmers

Continuous peer review

Fact or Fiction?



Fly thru – small ruminants,

surface= assigned prevalence ($s_{rassprevrclfilt}$),

palette = production surplus ($s_{rsurpfiltrcl}$)

