Centre for Tropical Livestock Genetics and Health

Science-based opportunities for small scale farmers in sub Saharan Africa

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Building Global Partnerships for Global Challenges Symposium, Bristol, 11-13 April

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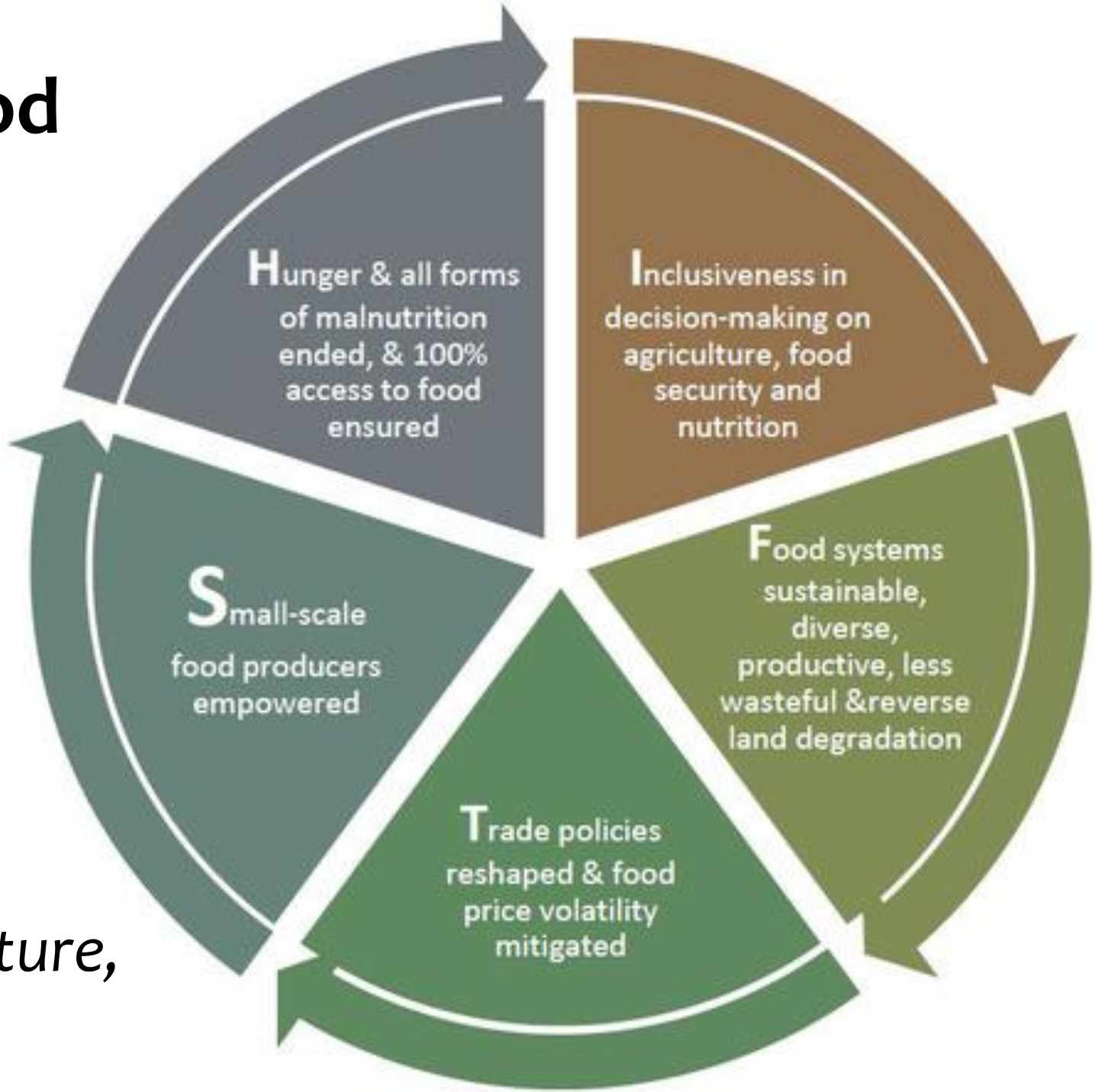
Outline

1. Food production systems
2. Small scale livestock farmers in SSA (Livestock and the SDGs)
3. Small ruminants
4. CTLGH

Agriculture:

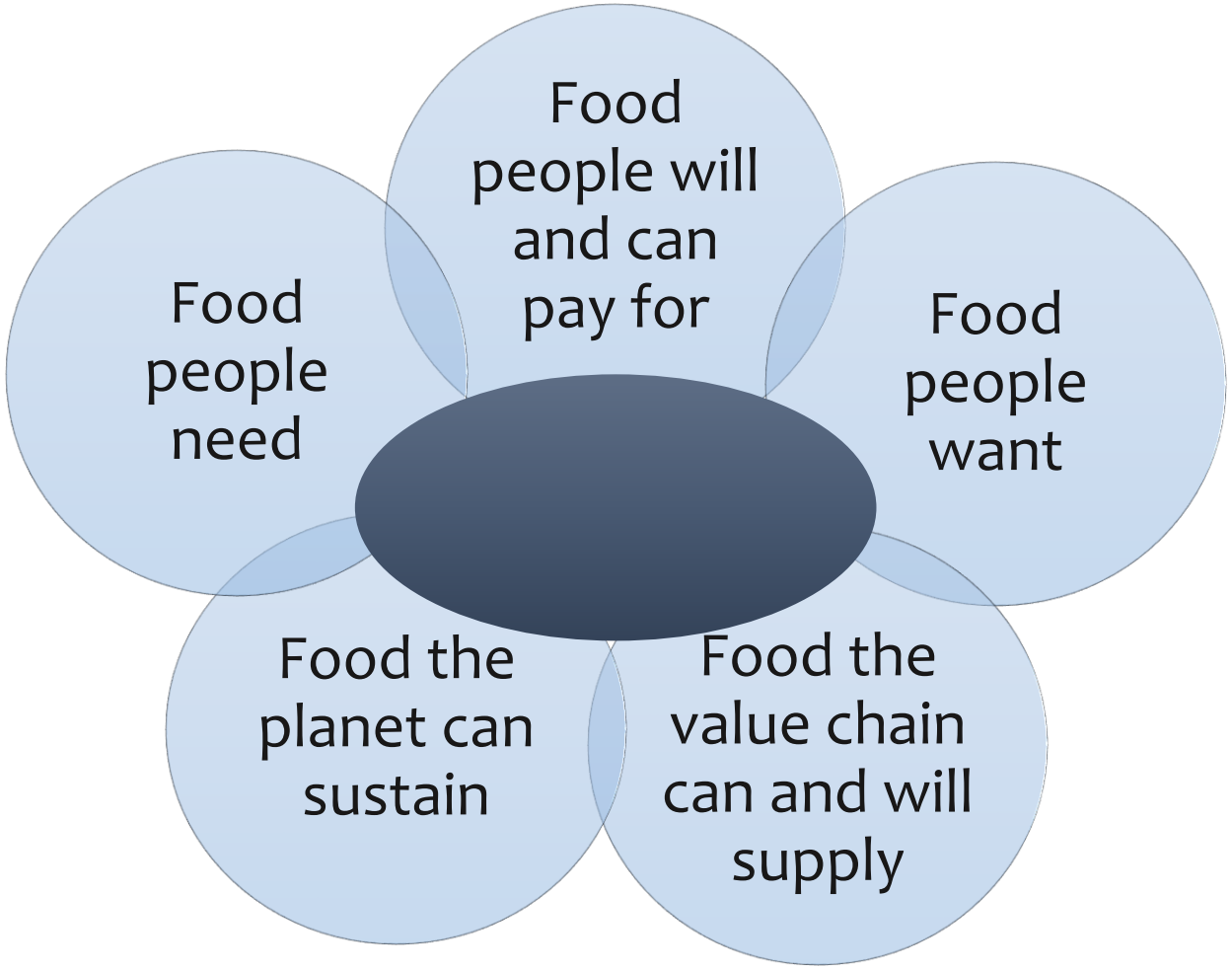
Food, Health, Wealth

Complexity of the food production system …



A call for Sustainable Agriculture, Food Security and Nutrition

Production and access to food



Where is the food coming from?

70% of the hungry and poor are also those producing food

In low income economies at least 70% of meat and milk is from smallholder farms

90% of the meat, milk and eggs produced are consumed in the same country

In many rural economies, women constitute over half the farm work force

Over half the meat and milk and almost half the cereals are from mixed crop livestock farms

Adapted from Susan McMillan ILRI, Kenya

1. Small scale agriculture supports 2.5 billion people
2. 70% of the world's food is produced by small scale farmers
3. 80% of Africa's food is produced by small scale farmers

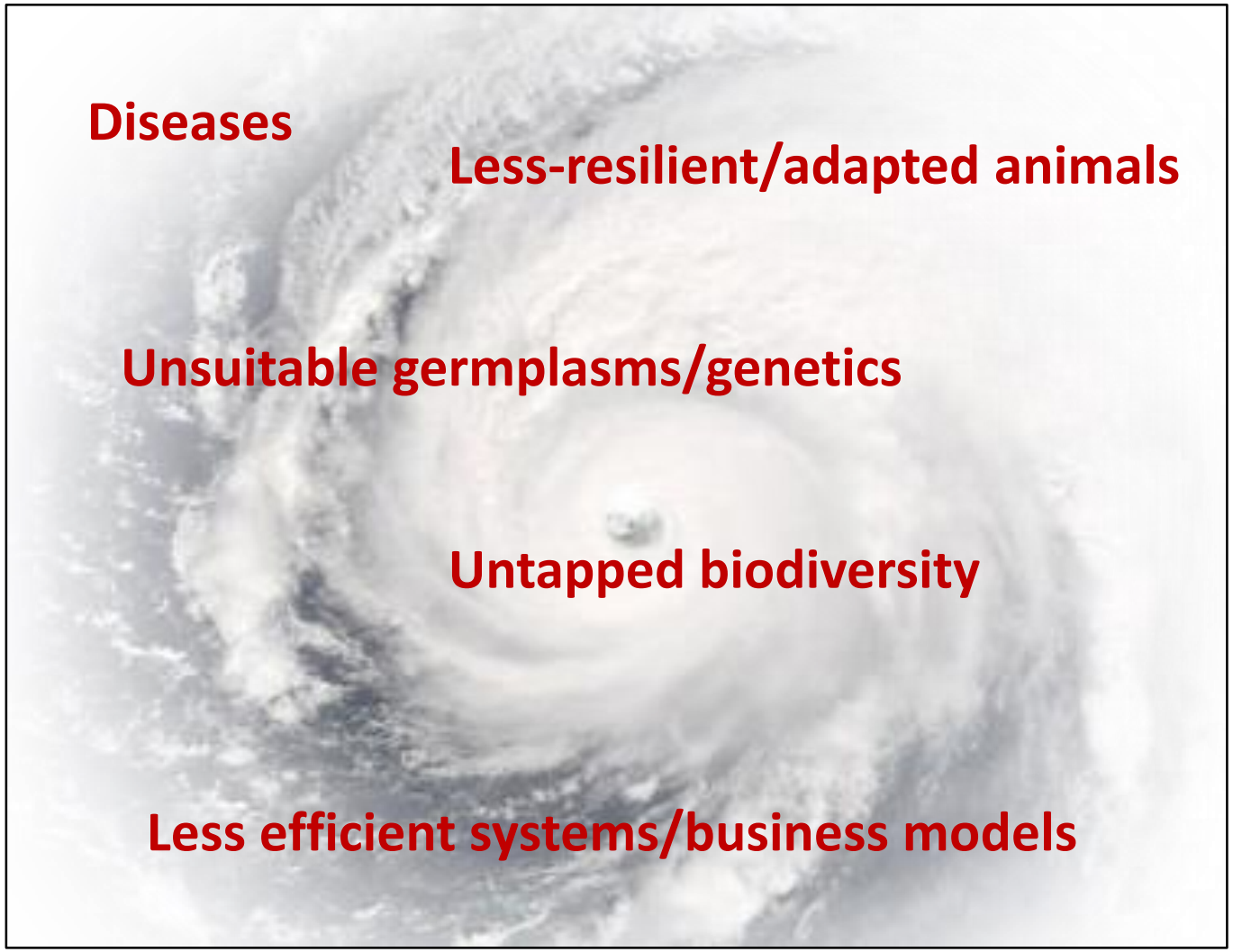
Who are the small scale farmers?

Who are the small scale farmers?

Small scale farmers face a myriad of challenges (livestock play a key role)

Categorization of small scale farmers

- Business orientated
- Transitional
- Subsistence

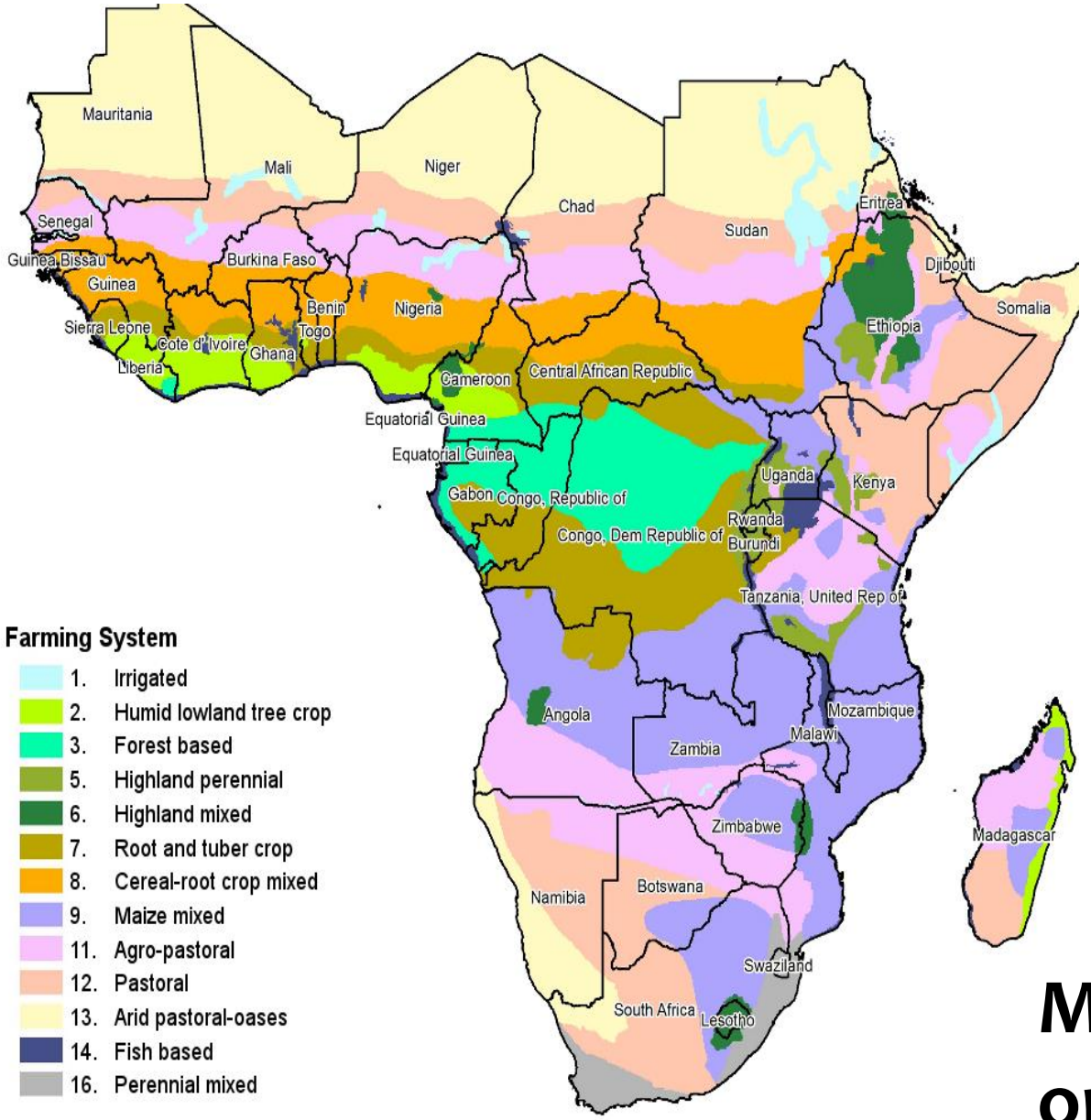


Livestock and the SDGs

The livestock puzzle in sub Saharan Africa

Differences in

- Ecologies
- Culture
- Uses
- Local economies



Multiple solutions/ options required

A rich biodiversity

Kenya Boran – Efficient utilizers of low quality forages

Ndama – Trypanotolerant

Ankole Cattle – Meat reputed to be low in cholesterol

Diverse indigenous cattle germplasms

Kuri – Bulbous horns

Nguni –best hide for leather jackets and shoes

A rich biodiversity

Bonga sheep and West African Dwarf goat – High prolificacy

Barki sheep and goats: Excellent adaptation to hot arid environments

Diverse indigenous small ruminant germplasms

Djallonke: Trypanotolerant

Red Maasai sheep: Resists heavy worm burden and are drought tolerant

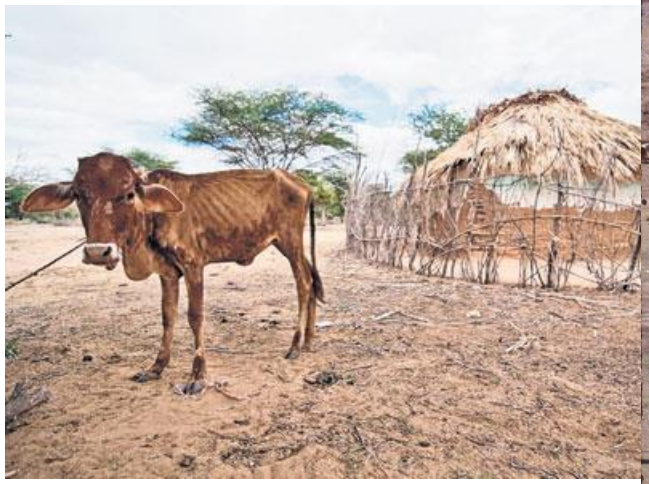
A rich biodiversity

Diverse indigenous chicken germplasms

Best adapted to scavenging

Tropical livestock development challenges

Health Feed/Nutrition **Genetics** Others



Science-based opportunities to support small scale livestock farming

- What is the model livestock for small scale farmers
- Can a ***"fit for purpose/environment/"*** be developed?
- Tropically adapted animals etc …

Highlights of some of past work on small ruminants (Ethiopia, Cameroon)

- Identification of traits that matter to farmers
- Community breeding programs to deliver and maintain important genetics/germplasms
- +++ Opportunities

AFRICAN GOAT DIVERSITY ATLAS: ETHIOPIA

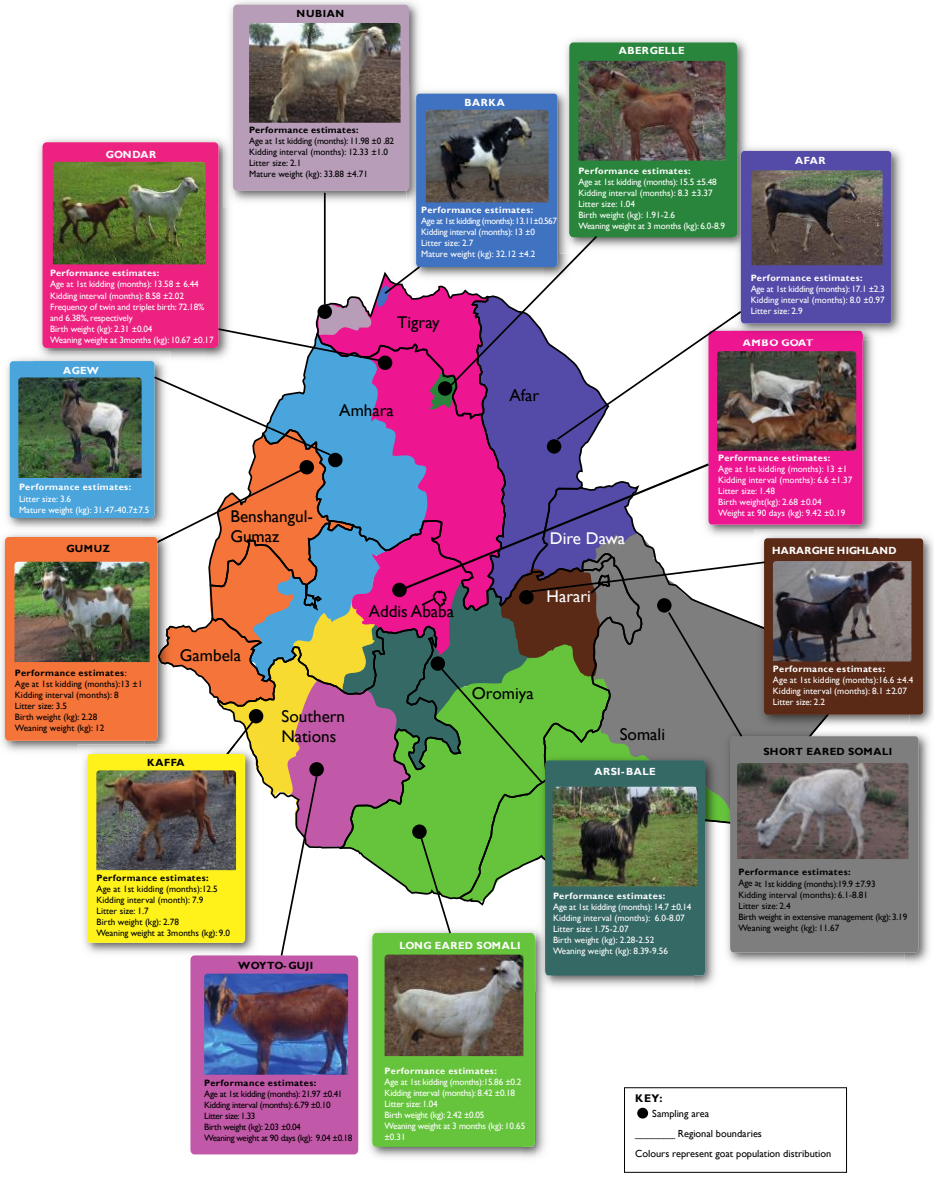
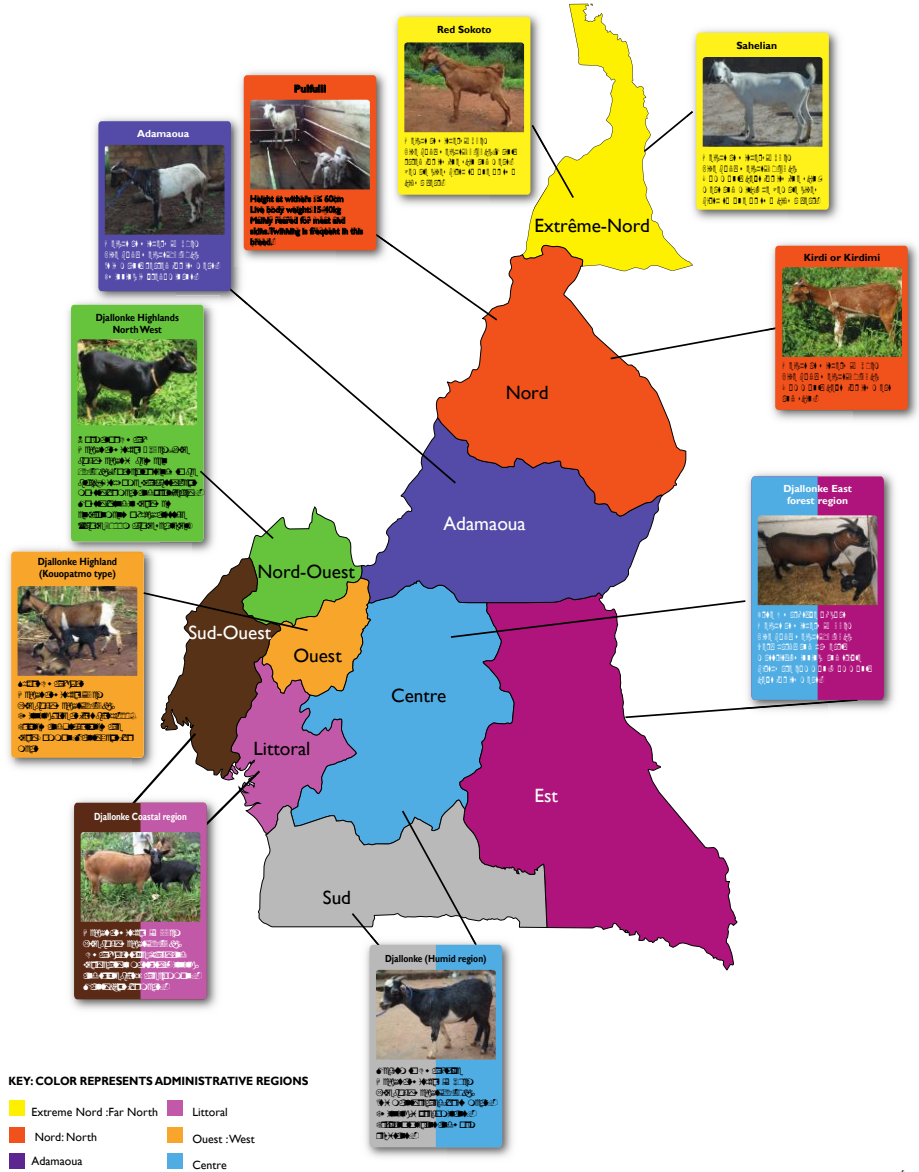


Photo credit and data: Getinet Tarekegn, Bahir Dar University, Ethiopia email yafetgetinet@gmail.com

AFRICAN GOAT DIVERSITY ATLAS: CAMEROON



CGIAR ILRI biosciences eastern and central africa NEPAD TRANSFORMING AFRICA University of Dschang

Community-based breeding programme (CBBP)

CBBPs attempt to achieve genetic improvement of livestock populations by direct involvement of farmers from the design to actual breeding actions

The breeding goal of the goat farmers may be summarised as:
Profit = Behaviour traits + Fitness traits + Productive traits + Reproductive traits

USDA: Curt Van Tassell
AUSTRIA: Johann Sölkner

AFRICA:

Ethiopia (Aynale Haile)
Malawi (Timothy Gondwe)
Uganda (Henry Mulindwa)
Tanzania (Eligy J. Mussa Shirima)
South Africa (Farai Muchadeyi)

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A research partnership to develop genetic tools to address tropical livestock productivity and resilience challenges

CTLGH operations (Edinburgh and Nairobi nodes)

development and application

tools & resources

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Global challenge: Inclusive agricultural (livestock) transformation

Possible solutions:

- Technologies for harness the potential of **genetic gains** in tropical livestock production systems
- Improve national breeding programs and application of novel technologies to increase genetic gains

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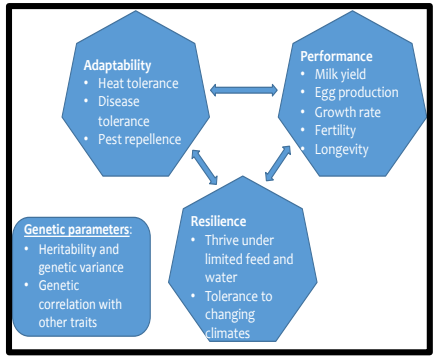
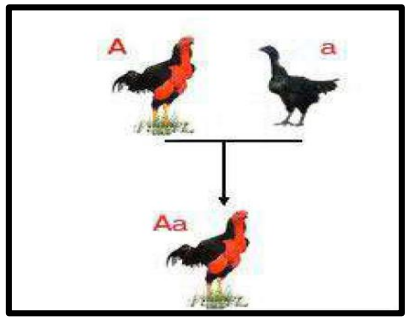
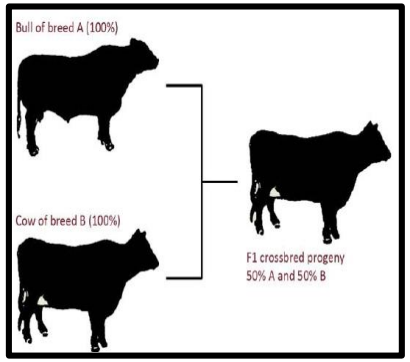
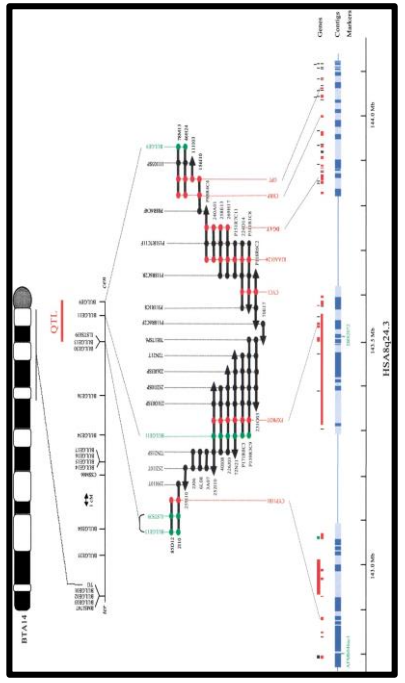
Delivering Genetic Gains for Tropical Livestock Development









On-farm phenotype recording

DNA/tissue sampling

Data and biorepository

Management information

Genetic profiling (host genome and microbiome)

Definition and characterization of traits

Matching breeds to ecology/environment

Breeding/Selection (exotic and locally adapted animals)

Tools and Algorithms (breeding values)

Breeding information and decisions

Identification of putative QTLs, genes, SNPs with effects key traits

Fine-mapping, identification of putative causal alleles affecting each trait

Markers for selection

Promotion of multiple favorable causal alleles impacting tropical adaptability and resilience including genome editing

Application and utilization of markers

Systems for selecting and introducing tropically-adapted parent stock back into the genetic gain and multiplication system

Accelerated and sustained genetic gains

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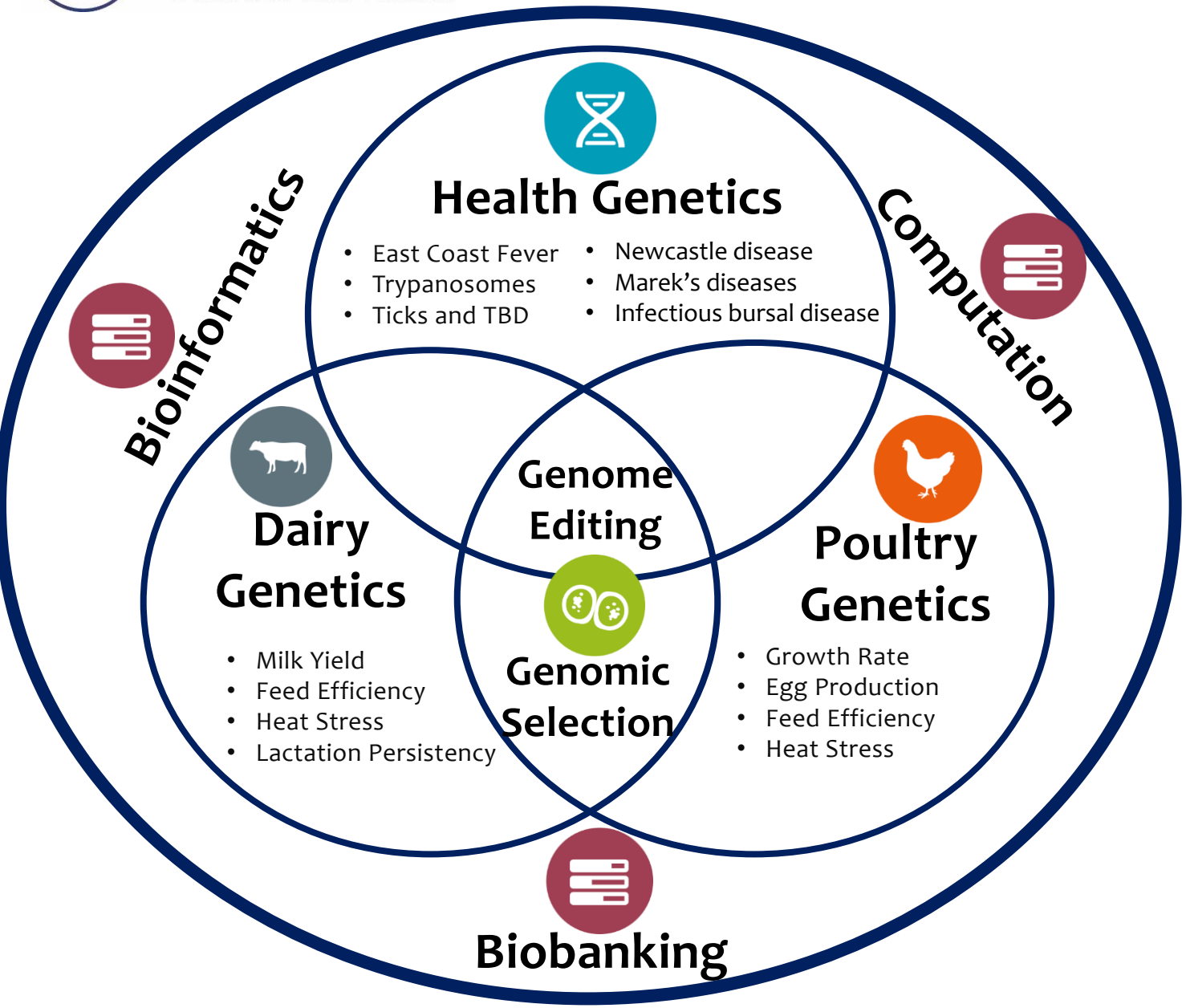
Current programs



Main Goal – Develop and apply genomic and advanced reproductive technology tools to address tropical livestock development challenges:

- Productivity
- Resilience
- Adaptability
- Efficiency
- Capacity in national livestock development systems

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UKaid from the British people

BBSRC bioscience for the future

Short term strategy

1. Develop and deliver genomics and metagenomics based technologies to optimize existing potential and transform future potential of tropical dairy cattle

2. Develop and deliver genomics and metagenomics based technologies to optimize existing potential and transform future potential of tropical poultry

3. Establish CTLGH (tropical livestock R&D programs and partnerships) equipped with Informatics, Data and Bioresources capabilities

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Long term strategy

	Large Ruminants Genetics/ Genomics	Small Ruminants Genetics/Genomics	Poultry Genetics/ Genomics	Pigs Genetics/ Genomics
Functional Genomics and Advanced Breeding Tools, Technologies and Systems (Productivity traits)	• Milk production • Meat • Growth	• Milk production • Meat • Growth	• Egg production • Growth	• Growth
Functional Genomics and Advanced Breeding Tools, Technologies and Systems (Resilience traits)	• Diseases (ECF/TBDs, Ticks, Tryps,..) • Heat stress • Protracted nutrition • Climate change	• Diseases (PPR, gastrointestinal worms) • Heat stress • Protracted nutrition • Climate change	• Diseases (NCD, Marek IBD, …) • Heat stress • Protracted nutrition • Climate change	• Diseases (ASF, CSF, …) • Heat stress • Protracted nutrition • Climate change
Tropical Livestock Informatics, Data Science & Bioresources	Tropical livestock reference genomes, databases and data systems Genotypes data Phenotypes/performance data, GWAS data, Metadata (GPS, …) Computational tools			
Capacity building and partnerships	North – South & South – South Collaborations African NARS (people and institutions) Technologies, breeding systems, Data			

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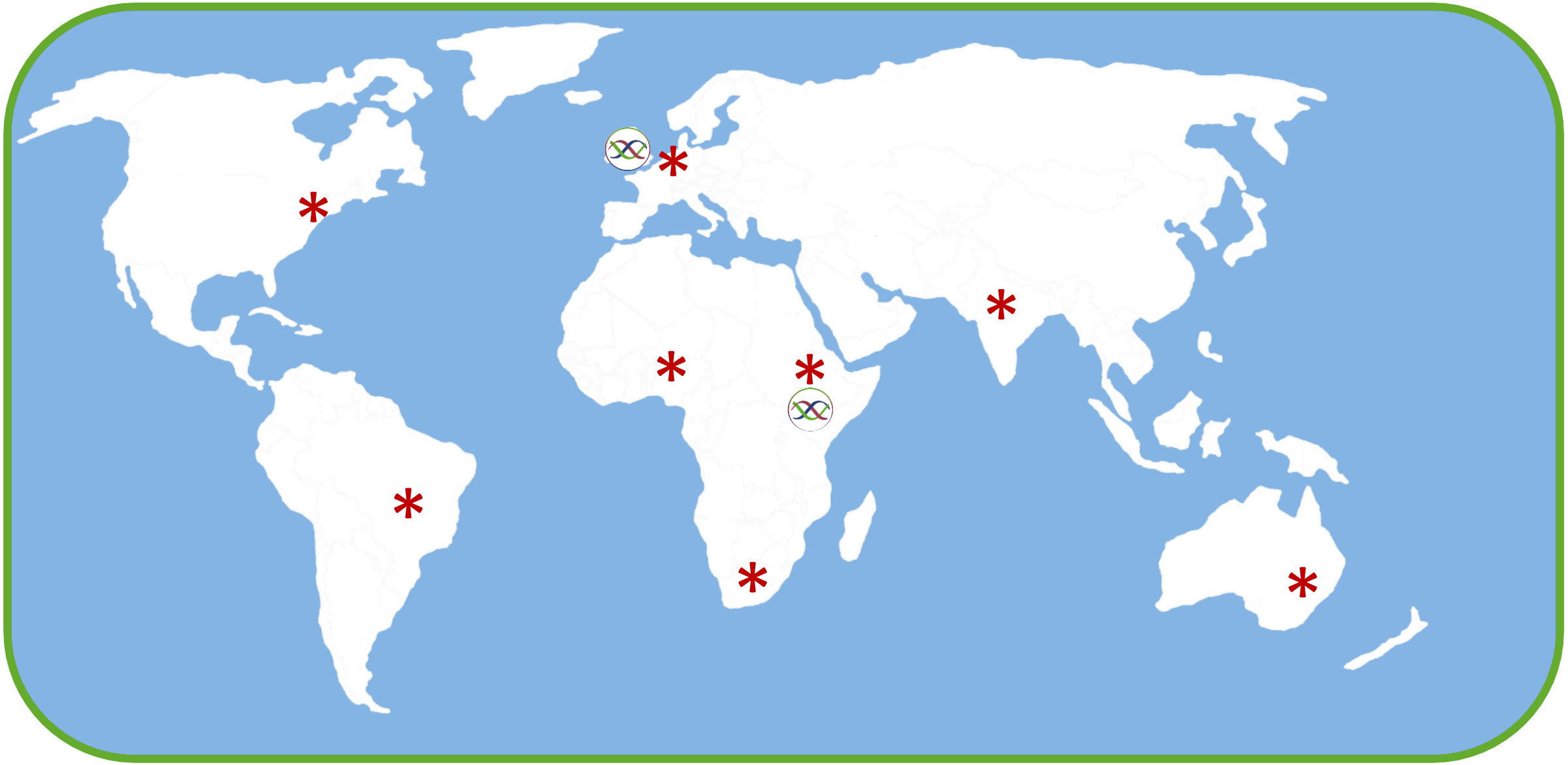
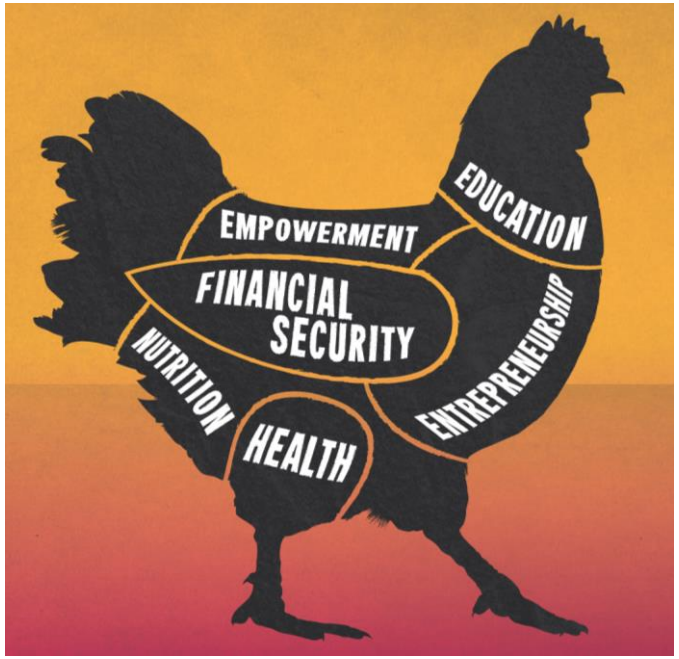
A global reach …





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