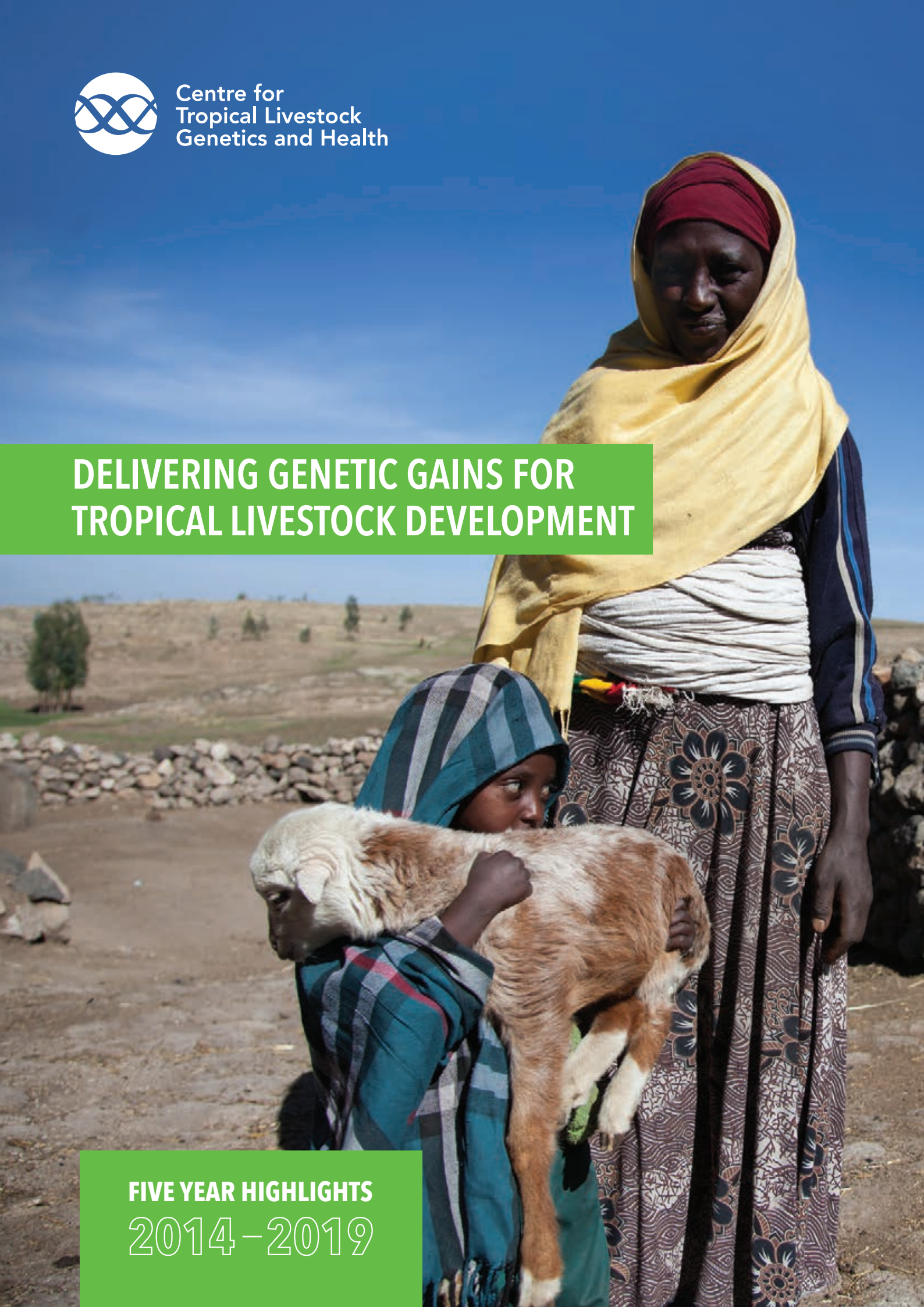
Centre for
Tropical Livestock
Genetics and Health

DELIVERING GENETIC GAINS FOR TROPICAL LIVESTOCK DEVELOPMENT



FIVE YEAR HIGHLIGHTS
2014–2019

OUR MISSION: TO ENHANCE PRODUCTIVITY, ADAPTABILITY, AND SUSTAINABILITY OF LIVESTOCK IN TROPICAL PRODUCTION SYSTEMS THROUGH GENETIC IMPROVEMENT

The Centre for Tropical Livestock Genetics and Health (CTLGH) provides a platform for

- **Tropical livestock research and development for genetic improvement**
- **Collaboration, engagement and partnership**
- **Expertise sharing and networking**
- **Resource sharing and capacity development**

MESSAGE FROM THE DIRECTOR

I am delighted to share the initial five year highlights of the Centre for Tropical Livestock Genetics and Health (CTLGH) with you.

Established jointly by the University of Edinburgh/Roslin Institute, Scotland's Rural College (SRUC) and the Africa–based International Livestock Research Institute (ILRI), the implementation of the Centre's vision was initiated by former Roslin Director Professor David Hume, who served as CTLGH's interim Director between 2014-2016.

CTLGH is a strategic alliance operating through its main physical nodes (Edinburgh, Addis Ababa and Nairobi) as a flagship livestock research and development centre with the mission to enhance the productivity, adaptability and sustainability of livestock in tropical production systems through genetic improvement.

Leveraging initial activities and outputs highlighted in this publication, CTLGH is strengthening its ability to deliver tools, resources and other innovations in genetics, genomics, animal breeding and data science and to establish a wide range of partnerships globally to support tropical livestock genetic improvement.

With generous support from the Bill & Melinda Gates Foundation, the UK Department for International Development (DFID), the Biotechnology and Biological Sciences Research Council (BBRSC) and Jersey Overseas Aid (JOA), the Centre conducts and co-ordinates research, forms strategic alliances and facilitates collaborations in the areas of tropical livestock genetics and health.

Over the past five years, CTLGH has focused on the development of tools, technologies and associated resources to optimise the existing and transform the future potential of tropical dairy cattle and tropical poultry production. CTLGH has also created comprehensive tropical livestock genomics, informatics, bioresources and metadata for the benefit of small-scale livestock keepers in Sub-Saharan Africa and other low- and middle- income countries (LMICs).

I would like to thank all CTLGH programme leaders, scientists, students, collaborators, our generous funders and dedicated advisors and Principals, all of whom believe in the potential of livestock genetic improvement.

Appolinaire Djikeng
Director
Centre for Tropical Livestock Genetics and Health

CLTGH'S WORK CONTRIBUTES TO SEVERAL OF THE UNITED NATION'S

Enhancing livestock adaptability for more equitable livelihoods and economic growth

Harnessing genetic potential to improve livestock productivity for better human nutrition and health

Tropically adapted and more productive livestock for sustainable agri-systems and ecosystems

Catalysing partnerships and programs for research and development

WHY LIVESTOCK MATTER

People in developing countries know that livestock are critical for sustainable development. The world's cows, sheep, goats, pigs, poultry and other farm animals are the mainstay of livelihoods across the developing world. And the energy and nutrient-dense milk, meat and eggs these animals produce provide people with basic livelihoods, incomes, food and nutrition.

The Livestock sector contributes to 40 percent of agricultural GDP and provide livelihoods and incomes for at least 1.3 billion people worldwide.

Globally, livestock are becoming agricultures most economically sub-sector, with demand in developing countries for animal foods projected to double over the next 20 years.

40% GDP

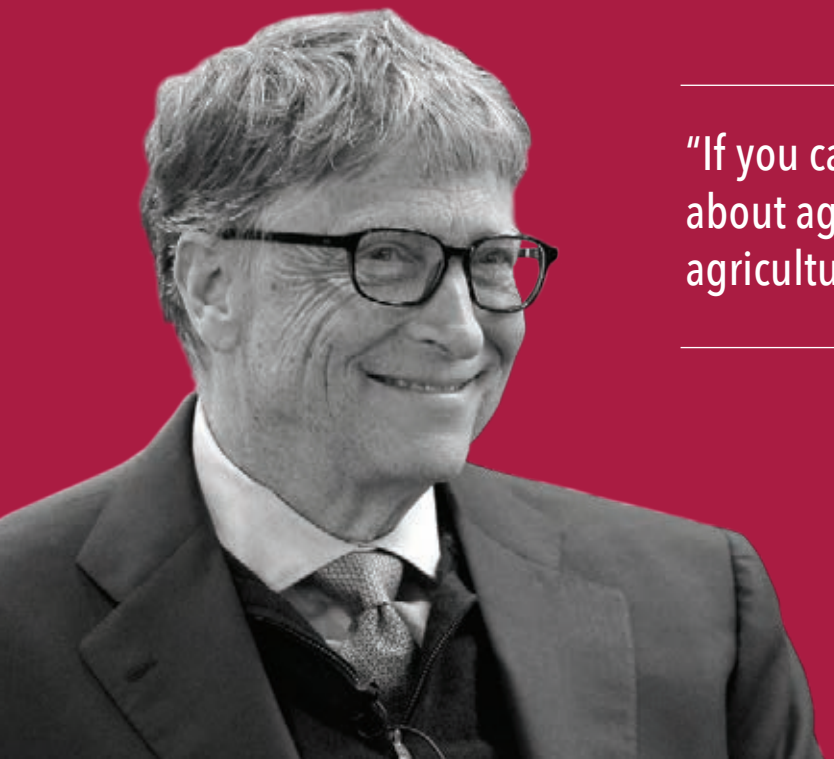
The livestock sector contributes an average of 40% of the agricultural GDP worldwide and that percentage is increasing.

$151 BILLION

The market value of animal-source foods in Africa in 2050 is anticipated to reach USD 151 billion.

PROVIDE JOBS

Livestock value chains provide large numbers of jobs in all economies.



"If you care about the poor, you should care about agriculture. And if you care about agriculture, you should care about livestock."

Bill Gates
January 2018

But the productivity of livestock in Sub-Saharan Africa, South East Asia and other tropical countries is relatively low compared to production in high-income countries.

Livestock farmed in tropical production systems face unique challenges that require their own specific solutions.

SOME OF THE CHALLENGES OF TROPICAL LIVESTOCK DEVELOPMENT

DISEASE THREATS

CHALLENGING CLIMATE AND PRODUCTION SYSTEMS

FEED AND NUTRITIONAL DEFICIENCIES

LIMITED PERFORMANCE DATA AND RECORDING

LOW PRODUCTIVITY

CTLGH is committed, through its focus on research and development for discovery and innovations in genetics, genomics, animal breeding and data science, to address these challenges.

Working collaboratively with other scientists across the globe, CTLGH researchers are striving to develop more resilient and profitable livestock systems in the tropics and reduce poverty in small-scale farmers in developing countries.

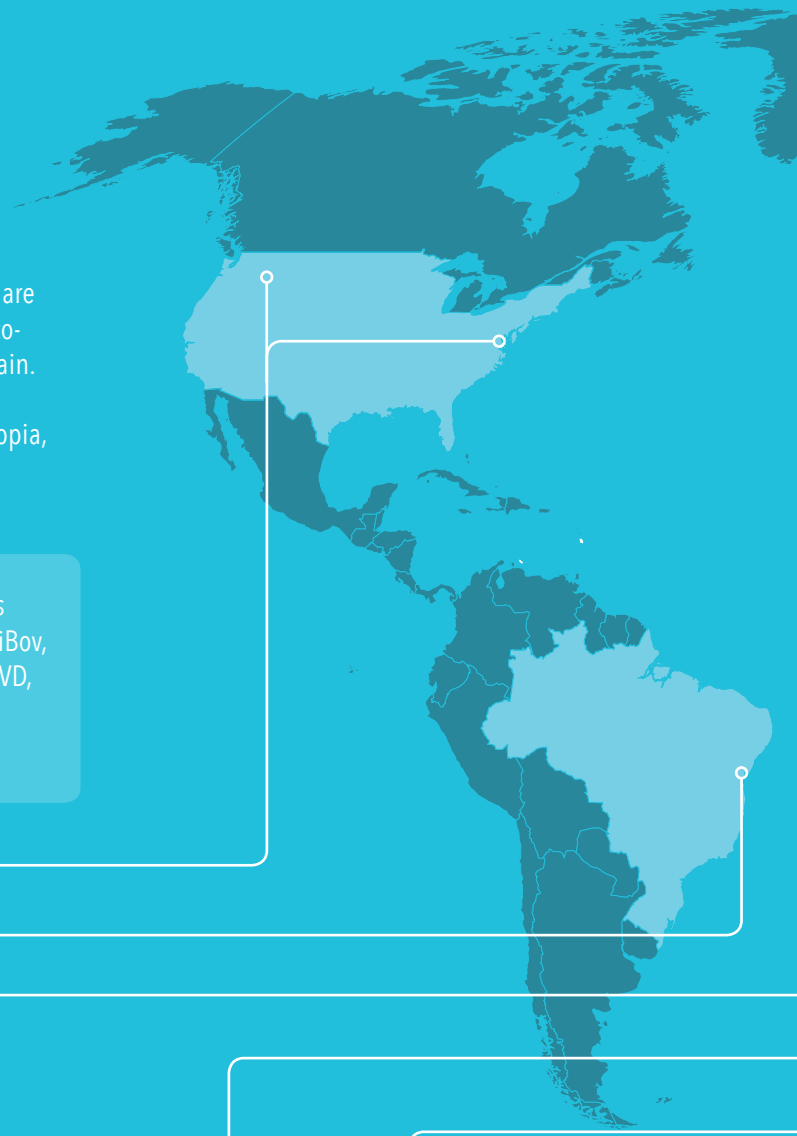
GLOBAL PARTNERSHIP

CTLGH is a global research and development partnership that leverages innovations that have transformed livestock development in high-income countries to support tropical livestock development in low- and middle-income countries.

CTLGH has already established key partnerships and strategic alliances with collaborators around the world. Such partnerships are crucial to mobilise CTLGH research and resources to deliver end-to-end interventions in the tropical livestock development value chain.

CTLGH currently operates three nodes, in the UK, Kenya and Ethiopia, which form the basis of an expanding network of research and delivery partners around the globe.

CTLGH also works in collaboration with many other organisations and projects including ACGG, ADGG, SEBI, GAAFS, LiveGene, OptiBov, FAANG, AGIN, AWARD, EISMV, NM-AIST, INSTA, NABDA, INERA, LCVD, CIRDES Cobb Vantress, The University of Lome, The University of Khartoum and the University of Ghana.



SOME OF OUR COLLABORATORS

USA
- University of Maryland
- Washington State University

Brazil
- Brazilian Agricultural Development Corporation (EMBRAPA)

UK
- University of Nottingham
- Earlham Institute
- Rothamsted Research

Netherlands
- Hendrix Genetics

KENYA
- AU-IBAR
- Egerton University

Rwanda
- Rwanda Agriculture and Animal Resources Development Board (RAB)

NODES

UK Nodes

The Roslin Institute, University of Edinburgh

The Roslin Institute, part of the University of Edinburgh, aims to enhance the lives of animals and humans through world class research in animal science

Scotland's Rural College (SRUC), Edinburgh

SRUC's research addresses health and productivity in animals, animal welfare and crops, promotes low carbon farming and increases farm output through efficiency and innovation

Ethiopia Node

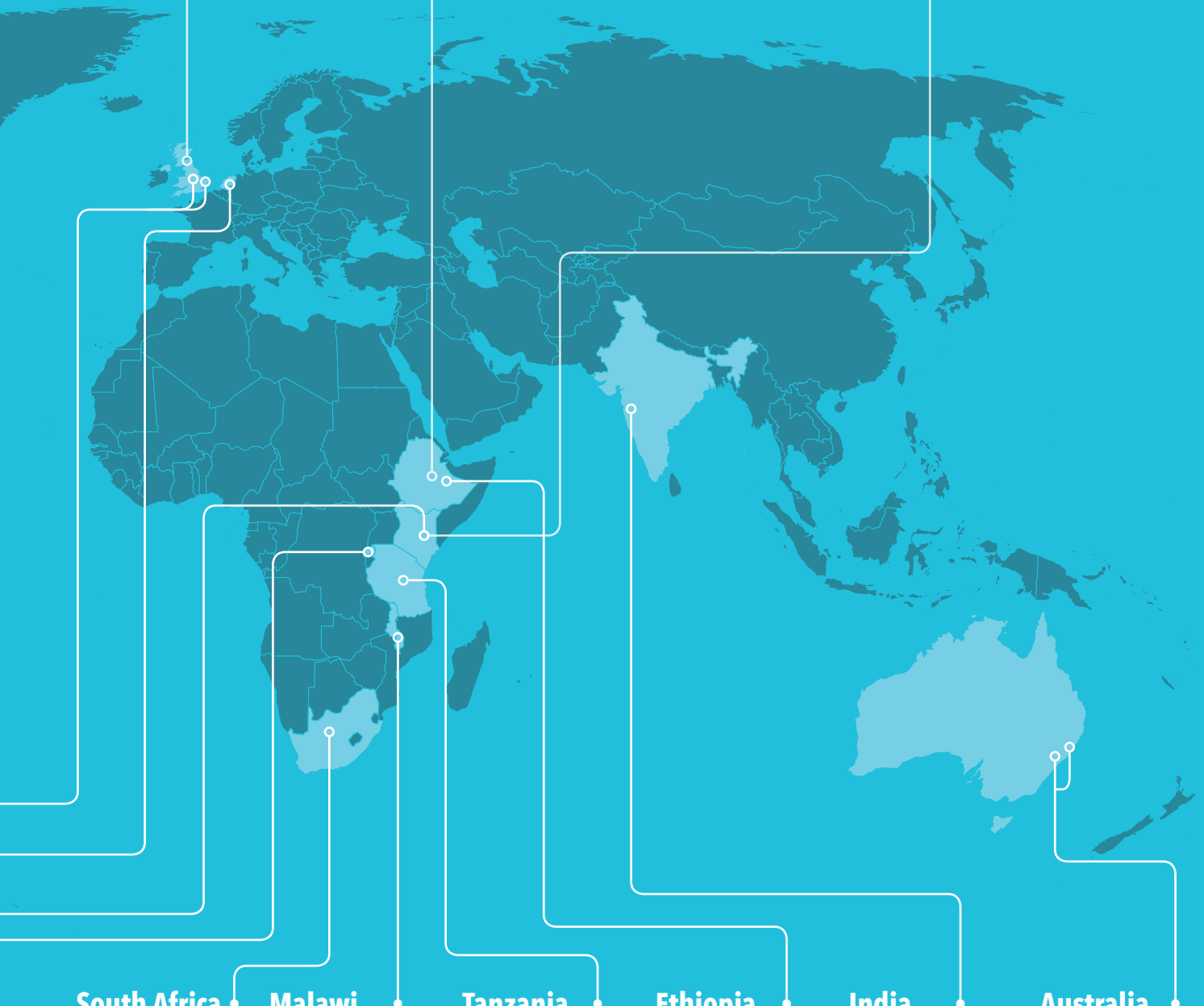
International Livestock Research Institute (ILRI), Addis Ababa

ILRI works with partners worldwide to enhance the roles that livestock play in food security and poverty alleviation, principally in Africa and Asia

Kenya Node

International Livestock Research Institute (ILRI), Nairobi

ILRI works with partners worldwide to enhance the roles that livestock play in food security and poverty alleviation, principally in Africa and Asia



South Africa

Agricultural Research Council (ARC)

Clinvet International

Malawi

Lilongwe University of Agriculture and Natural Resources (LUANAR)

Tanzania

Tanzania Livestock Research Institute (TALIRI)

Ethiopia

Ethiopian Institute of Agricultural Research (EIAR)

India

BAIF Development Research Foundation

Australia

University of Queensland (Centre for Animal Science)

University of New England (UNE)

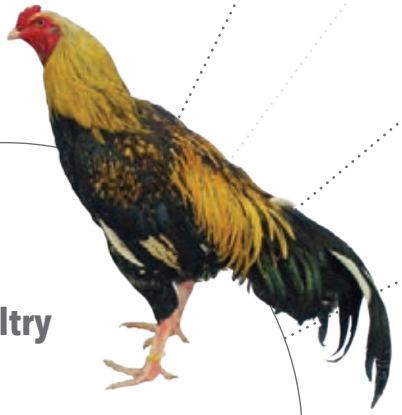
RESEARCH PRIORITIES

CTLGH works with collaborators worldwide to conduct research that focuses on the application of recent advances in modern genetics, genomics, animal breeding and data science to develop new tools for genetic improvement of livestock, combining tropical climate adaptation, feed efficiency and disease tolerance with improved productivity.

The centre's science strategy is implemented through a series of R&D programmes and cross cutting themes.

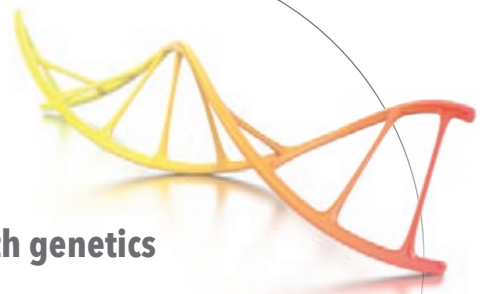
Tropical dairy genomics

Identifying key applications of genomics to dairy production in the tropics and advocating their use; supporting the development of tools and methodological approaches to facilitate the identified applications.



Tropical poultry genomics

Development of genomic and cutting edge breeding tools to improve the productivity, adaptation and flock dynamics of poultry in the tropics. Genomic predictions are used to optimise the resilience and productivity of locally adapted chickens, tropically adapted improved line and hybrids.



Health genetics

Understanding the genetics and genomics of adaptation (disease tolerance) for better control of livestock diseases

Precision breeding and reproductive technologies

Development of new precision breeding technologies and strategies to harness, conserve and accelerate the use and impact of tropical livestock genetics.

Small ruminants development

Generation of genomic resources of tropical goats and sheep to assess genetic diversity, study key productivity and resilience traits and to drive the development of tools for use in genomic-driven small ruminant improvement.

Informatics and bioresources

Generation and curation of data and bioresources to maximise the impact of new and existing knowledge on tropical livestock genetics and health.

CTLGH research is positioned for discovery. However, by establishing partnerships with industry and farmer facing programmes and institutions, innovations and technologies in genetics, genomics, animal breeding and data science generated by CTLGH can be translated, adopted and applied in the field for the direct benefit of small-scale livestock producers living in the tropics.

TIMELINE

2014

APRIL

Professor David Hume, interim Director of CTLGH 2014-2016 with Bill Gates and Roslin scientist Professor David Burt, during Bill Gates' visit to Edinburgh for initial discussions about the potential funding for tropical livestock genetics research.

JULY

Collaborative Framework Agreement between the Roslin Institute/University of Edinburgh, SRUC and ILRI signed and CTLGH established.

Centre for Tropical Livestock Genetics and Health

2015

OCTOBER

£10 million funding for CTLGH announced by the Bill & Melinda Gates Foundation (BMGF).

DECEMBER

Official Launch of CTLGH in Nairobi.

2016

SEPTEMBER

First CTLGH Annual Meeting in Naivasha, Kenya.

Research projects funded by BMGF begin.

2017

APRIL

Appolinaire Djikeng appointed as Centre Director.

SEPTEMBER

Second CTLGH Annual Meeting in Edinburgh.

2018

JANUARY

Joint visit of Bill Gates and DFID Minister (Secretary of State, The RH Penny Mordaunt) to CTLGH Edinburgh node and £4M funding for CTLGH announced by DfID.

APRIL

Opening of Poultry facility in Addis Ababa supported by BBSRC, The Roslin Foundation & CGIAR Livestock CRP.

JUNE

Research projects funded by DfID begin.

SEPTEMBER

Third CTLGH Annual Meeting and first scientific conference in Kenya.

2019

JULY

Funding secured from Jersey Overseas Aid (JOA) to support Rwanda's National Dairy Development Programme.

Discussions begin to establish long term partnership with Australia to tackle the challenges of ticks and immune fitness on tropical livestock development.

AUGUST

Third CTLGH summer masterclass held in Kenya under the GCRF-STARS.

SEPTEMBER

Second Collaborative Framework Agreement signed to guide CTLGH strategic orientation and operations for 2019 – 2024.

CAPTURING GENETIC DIVERSITY IN AFRICAN LIVESTOCK

A collaboration between CTLGH and numerous African partners has established one of the largest genomic reference resources for African cattle to date. Through a wide ranging collaborative network, multiple indigenous cattle breeds from Eastern, Western, Central and Southern Africa have been sampled and are in the process of being sequenced. This unique resource augments global availability and access to additional genomic resources on important cattle breeds and aids the identification of regions of the genomes that underpin tropical adaptation and resilience.

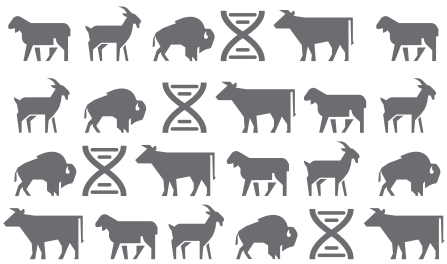
CTLGH researchers are comparing genomic information from two divergent African breeds (N'dama *Bos taurus* and Boran *Bos indicus*) to test whether the currently available SNP array that has been developed using European *Bos taurus* cattle, accurately captures the genetic diversity of indigenous African cattle populations.

An online bovine omics atlas (BOmAs) has also been created and is freely accessible to scientists to support future tropical cattle research.

In addition to the sequencing of multiple tropical cattle breeds, CTLGH researchers at the Roslin Institute have also secured £1.2 million from BBSRC's Global Challenges Research Fund (GCRF) to capture and record the genomic diversity of several other tropical livestock species. Working with collaborators across Africa, they have successfully sequenced the genomes of several African breeds of sheep, goats, cattle, wild pigs and buffalo to produce reference genomes for genomic and phenotypic analysis.

£1.2 MILLION

TO CAPTURE AND RECORD THE GENOMIC DIVERSITY OF LIVESTOCK IN AFRICA



DEVELOPING AFFORDABLE TESTS FOR BREED COMPOSITION OF CATTLE

Indigenous cattle crossed with exotic dairy breeds are the backbone of smallholder dairy systems, which dominate milk production in many African countries and bring improved livelihoods to millions of poor farmers.

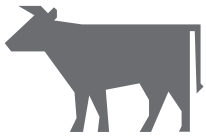
When breeding crossbred cows, the breed composition of the cow and the bull must be known in order to produce the right breed composition of progeny. Existing high density genomic assays based on 50,000 to 700,000 genetic markers can be used to determine an animal's breed composition. Although they have high accuracy, they are too expensive to use routinely.

CTLGH researchers are therefore investigating whether a low density and cost effective genetic assay can be developed that would work across Africa in the field. A comprehensive assessment of African cattle has highlighted that there is a great diversity among breeds within a group, some overlap between groups and some significant misclassification of indigenous breeds. There is also a big difference between countries and regions related to the genetics of the indigenous populations.

The team has developed a new method for choosing an optimum set of genetic markers to form a small assay for breed composition. Although only 300-400 markers are used, it gives a high level of accuracy in all cattle populations tested across West and East Africa. Having a single assay that works across Africa will allow assay costs to be reduced significantly and encourage use in the field.

"The team has developed a new method for choosing an optimum set of genetic markers to form a small assay for breed composition."

EXPLORING TOLERANCE OF CATTLE IN AFRICA TO PARASITIC INFECTIONS



Parasitic diseases caused by haemoparasites such as *Theileria, Babesia* and *Trypanosoma ssp*, as well as gut nematodes are globally important causes of production loss in cattle. Some of these parasites are also zoonotic and can cause disease in both animals and humans. Selection for improved tolerance in the livestock hosts of these parasites will help reduce use of current drugs as well as directly improve productivity in tropical livestock populations.

CTLGH researchers in the UK and Africa are developing high-throughput, next-generation, deep sequencing technologies to quantify the species composition of parasitic nematode and trematode co-infections in cattle populations in East Africa, as a tool to inform sustainable control strategies.

The data collected will also enable researchers to generate high-resolution phenotypes for cattle helminth infections and be a foundation for identifying novel genomic markers for genetic tolerance to diseases caused by helminths in cattle in the future.

"The data collected will also enable researchers to generate high-resolution phenotypes for cattle helminth infections."

TICK TOLERANCE – LINKING GENOTYPE TO DISEASE PHENOTYPE IN AFRICAN CATTLE

CTLGH researchers, in collaboration with Clinvet, a contract research organisation based in Africa, have extensively phenotyped and genotyped a large cohort of African cattle, to help identify genes and genomic markers that underpin susceptibility or tolerance to pathogens in the field.

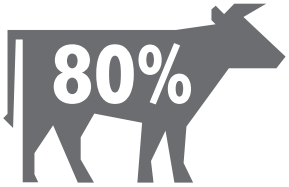
In a project funded by the Bill & Melinda Gates Foundation (BMGF), Clinvet collected over 6,000 cattle samples in seven different countries in Africa over four different timepoints to capture the seasonality of disease. The cows sampled were a diverse mix of breeds, including indigenous breeds and those crossed with high performance European breeds. Clinvet generated a detailed phenotype profile for each cow they sampled, including tick genus and burden, haemoparasite presence and relevant clinical metadata.

Over 5,000 animals have been genotyped and CTLGH researchers are analysing the combination of genotypes and phenotypes. This will enable the identification of areas of the bovine genome that are associated with key phenotypes such as tolerance to high tick burdens. Such traits are potentially valuable, and if the genetic basis is understood then it can be exploited to improve resilience to ticks and other important diseases.

COLLABORATION SUPPORTS RESEARCH INTO TICK TOLERANCE IN CATTLE

Ticks are a huge problem globally. It is thought that about 80% of the world's cattle are affected by ticks and tick-borne diseases, with losses estimated at USD 20-30 billion a year. Previous observations suggest that some cattle have developed a natural tolerance to ticks.

CTLGH has established a collaboration engaging Brazilian, South African and Australian partners to initiate a multi-breed, multi country genomic evaluations scheme to support genetic improvement for tolerance to ticks in cattle. Low to moderate heritability of tolerance to ticks has been established across cattle populations in Australia, Brazil and South Africa and could be validated for use to generate estimated breeding values to support global breeding programmes. This sets the stage to explore the possibility for Multiple Across Country Evaluation (MACE) involving data on breeds that are important for African production systems.



OF THE WORLD'S CATTLE AFFECTED BY TICKS AND TICK-BORNE DISEASES

TOWARDS *T.PARVA* TOLERANCE IN AFRICAN CATTLE

East Coast Fever (ECF) is the biggest killer of cattle in eastern and southern Africa. It is caused by the parasite *Theileria parva* and is spread by ticks. Over one million cattle die of ECF each year and it is thought to cost local farmers USD 596 million annually in mortality and loss of production.

Leveraging long term investments and collaborations led by ILRI scientists, CTLGH researchers in Kenya and the UK have identified and characterized a unique genotype of indigenous cattle with a heritable ability to tolerate *T.parva* infection. This suggests that robust breeding programmes could be developed to establish herds enriched with markers for tolerance to ECF that are less likely to succumb to the disease.

1 MILLION
CATTLE DIE OF ECF EACH YEAR

$596 MILLION
ANNUAL COST TO EAST AFRICAN FARMERS

INTEGRATING WITH INTERNATIONAL GENOMIC EVALUATION PIPELINES

Over the years, the semen from international diary bulls have been used in many crossbred African dairy cows, resulting in an influx of exotic genetics. CTLGH researchers have successfully extended the UK national genomic evaluation pipeline to incorporate genotypes and animal information from many crossbred dairy cows in Africa.

Initial data from the Dairy Genetic East African programme was tested and compared to data held on the UK national genetic and genomic evaluation system, which includes genotypes from thousands of animals, including many influential bulls whose semen has been exported internationally and therefore may have been used in Africa.

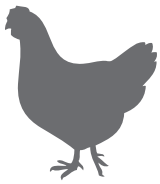
These genotypes are linked to detailed pedigree information, so researchers were able to use information based from genomic predictions and also from information from relatives. As detailed pedigree records are not commonly kept in African dairy systems, being able to utilise potential additional information sources could improve the genomic evaluation based on performance records and genotypes from African dairy cows alone.

CTLGH researchers have shown that key contributions in African crossbred dairy cows from a range of international bulls (sires and/or grandsires) can be identified. The predominant breed is Holstein – numerically the largest breed in the world – along with the Jersey. Much of the genetics originate from US or Canadian breeding programmes.

They are now looking at "building" pedigrees and associated data into the genomic prediction for African dairy cattle to establish if genomic prediction for traits on UK dairy cows are related to those based on African dairy cows.

"CTLGH researchers have shown that key contributions in African crossbred dairy cows from a range of international bulls (sires and/or grandsires) can be identified."

NOVEL APPROACH TO STUDY TROPICAL ADAPTATION IN AFRICAN POULTRY



Indigenous livestock populations that show unique adaptation to their local agro-climatic conditions are often referred to as ecotypes. These ecotypes, particularly those from tropical environmental conditions, are valuable resources. Characterisation of these ecotypes, and identification of the environmental and genetic drivers of local adaptation plays a crucial role in the preservation of important genetic stocks and the future of poultry farming in the tropics.

CTLGH scientists have applied a novel approach by integrating ecological niche modelling with genomics to identify distinct ecotypes and to help unravel the genetic basis of their adaptation. Pilot application of this approach on indigenous poultry in Ethiopia has identified a number of potential ecotypes.

"Pilot application of this approach on indigenous poultry in Ethiopia has identified a number of potential ecotypes. "

AFRICAN POULTRY GENOMICS: UNLOCKING THE POTENTIAL FOR IMPROVED PRODUCTION

It has been consistently observed that indigenous poultry breeds in Africa tend to be more resilient to disease and environmental stresses such as high temperatures, compared to Western commercial breeds. However these tropically adapted poultry breeds show lower production traits, for example growth and egg laying.

CTLGH researchers and collaborators have established the largest tropical poultry genomic resource in the world, through the generation of over 580 full genomes representing 60 different indigenous African poultry populations. Robust data analysis strategies have now begun to help identify key regions, genes and variants within the genomes to underpin tropical adaptation, resilience and productivity.

Research at the interphase of poultry genetics, nutrition and health are being conducted at facilities in the UK and Ethiopia in order to identify the main constraints to poultry productivity.

DIFFERENT POULTRY POPULATIONS

NEW TECHNOLOGY HELPS PRESERVATION OF AFRICAN POULTRY GENETIC DIVERSITY

The diversity of poultry (and indeed other livestock commodities) in Africa is an enormous untapped resource and will be an excellent resource for selecting resilient breeds for climatic changes. However, indigenous African chicken breeds were in danger of being lost as cryopreservation had previously not been possible.

A stem cell technology established by CTLGH researchers in the UK at the Roslin Institute is now being routinely used to preserve African bio-diversity. A workshop was held at the CLTGH node in Nairobi in 2019 to train scientists across Africa on the potential of this technology and its adoption.

Leveraging this technology, CTLGH at ILRI have established a long term collaboration with the African Union – Interafrican Bureau for Animal Resources (AU-IBAR) and selected African NARS to preserve hundreds of African chicken genotypes.

INCREASING PRODUCTIVITY AND HEALTH OF POULTRY THROUGH GENOME EDITING

Genome editing offers a technology to rapidly introduce productivity and disease resistance or tolerance genes into both indigenous and improved chicken flocks. In a project led by Roslin scientists, the first genome edits to repair a defective feather colour trait were introduced into a breed of chicken containing the white feather mutation. Purebreed coloured feather offspring chickens were hatched containing the corrected gene product. This technology can now be applied in any chicken breed to remove deleterious mutations or introduce disease resistant alleles.

THE POWER OF DATA IN LIVESTOCK IMPROVEMENT

CTLGH researchers have successfully developed a knowledge and data driven portal which provides an infrastructure to support and integrate data and sample management and analytics for the Centre. This biological, informatics and sample resource, that can be accessed globally, will support research into the generic improvement of tropical livestock improvement going forward.

To date, the portal gives researchers access to over 1,000 data samples taken from sheep, cattle and poultry across Africa. This resource is freely available to all and allows sharing of knowledge, data and results, therefore underpinning future research.

CTLGH researchers are now working towards incorporating near real-time animal performance data from collaborating programmes and linking this with environmental data sources to allow analysis of genotype performance under different circumstances. In addition, the bio-repository database of samples and associated phenotypes and metadata will be linked to the other data resources in the future.

1,000 DATA SAMPLES

OTHER ACHIEVEMENTS

COMMITMENT TO STRENGTHENING LIVESTOCK RESEARCH AND SKILLS

CTLGH is committed to sharing the latest technology and knowledge in genetic research with young scientists and those working in low- to middle-income countries. Over the past five years, CTLGH has trained over 50 scientists from Eastern, Central, West and Southern Africa in animal breeding, genome technologies, bioinformatics, mathematical modeling and data in agriculture, and hosted several visits in each of its three nodes from international scientists keen to learn about specific research techniques.

Participants from the third CTLGH masterclass under GCRF-STARS held at Kenya node in August 2019.

CTLGH ON A GLOBAL STAGE

Over the last five years CTLGH have organised and taken part in major international scientific conferences and workshops to communicate the highlights and achievements of CTLGH and establish networks of like-minded scientists keen to collaborate in the future.

CTLGH researchers presented at the International Tropical Agriculture Conference, the world's leading science conference in tropical and sub-tropical agriculture and food production, in Brisbane in 2017. CTLGH also helped organise a keystone symposia conference which focused on 'Leveraging Genomic Diversity to Promote Animal and Human Health' held in Uganda in 2018. CTLGH researchers also presented at the Seventh All Africa Conference on Animal Agriculture (AACAA), which was held in Ghana in 2019.

MOVING FORWARD

The Centre for Tropical Livestock Genetics and Health (CTLGH) has achieved much in its first five years of existence. The activities highlighted in this publication represent just some of CTLGH's achievements during this time. However, the Centre has enormous potential for future growth, and is working to establish other new partnerships and secure additional funding to further its work.

CTLGH is committed to further extending the global reach and impact of tropical livestock genetics and health research by continually identifying, highlighting and collaborating with other relevant programmes and organisations focused on diverse livestock species, systems and regions.

As well as developing strong connections with research organisations worldwide with complementary remits, CTLGH is forging strategic alliances with organisations and initiatives to ensure the translation and adoption of genetics, genomics, animal breeding and data sciences innovations that support tropical livestock development through genetic improvement. Leveraging earlier successes, CTLGH has begun to expand its portfolio to include other key tropical livestock commodities (sheep, goat and pigs) and cross-cutting technical capabilities to drive and sustain tropical livestock genetic improvement in the future. CTLGH has also prioritised key productivity and resilience traits to guide research and development, and capacity building efforts within the next 5 – 10 years.

The Centre's focus on livestock genetics will help the world's tropical (small-scale) livestock keepers meet the growing demand for animal-source foods, improve both their livelihoods and their food security, and meet our contributions to environmental sustainability and efficient use of natural resources.

DEVELOPING

relevant management information systems to collate, store and analyse data and biological resources

MATCHING

livestock breeds to environment and production systems and conducting genetic profiling to identify key productivity and resilience traits

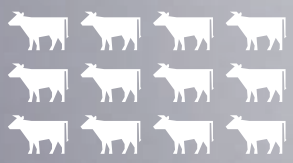
DELIVERING

robust breeding information and decision support systems

IDENTIFYING

molecular determinants associated with productivity and resilience traits

CLTGH is committed to enhancing the productivity, adaptability, and sustainability of livestock in tropical production systems through genetic improvement. The Centre remains mindful of the grand challenges that livestock development poses to the environment and to the global food systems in general.
By delivering genetic gains for tropical livestock development, CTLGH hopes to make livestock part of the solution for human global development, mitigation of climate change and efficient use natural resources in the future.



PROMOTING

key markers for breeding and genomic selection

ESTABLISHING

systems, partnerships and initiatives for livestock producers to adopt these suitable livestock breeds

CENTRE PARTNERS

THE UNIVERSITY of EDINBURGH

ROSLIN

SRUC

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

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