Securing the future of cattle production in Africa

March 16 2017

Boran cattle in Africa. Credit: Camille Hanotte/ILRI

A 'world-first' study of the genomes of indigenous cattle in Africa has revealed vital clues that will help secure the future of cattle production on the continent.

Cattle are an increasingly important resource in Africa as sustainable sources of food, milk, traction and manure. With its human population growing and the economy and subsequent wealth predicted to expand greatly, there will also be a huge increase in demand for livestock.

Now Professor Olivier Hanotte from The University of Nottingham and the International Livestock Research Institute (ILRI) in Ethiopia, with Professor Heebal Kim from Seoul National University, have mapped the

genomes of five breeds of African cattle and discovered some unique genetic adaptations that could inform and improve future breeding programs. The research is published in the journal *Genome Biology*.

Scaling up livestock production is a big challenge in Africa partly because of the varying climates but also because of infectious and parasitic diseases. Since their introduction to the continent thousands of years ago from their centres of origins in the Near East and the North of the Indian subcontinent, African cattle breeds have gradually become genetically adapted to cope with their varying environments from the Sahelian desert to the sub-humid tropical forest and it is these useful adaptations that the team has identified.

Professor Hanotte said: "This paper is important because it is the first time that the genome of African cattle has been studied in detail. The results will better inform breeding and crossbreeding programmes to improve cattle productivity and resilience in sub-Saharan Africa and crucially preserve the genetic diversity of the species. The African continent is now witnessing major transformations of its agricultural systems and rapid loss of indigenous livestock. Unfortunately, the opportunity to explore this treasure trove of diversity may not last for very much longer as current random breeding programmes mean some of that diversity will be lost."

For Dr Jaemin Kim, joint first author of the paper, sequencing and analysing the genome of these African breeds has been a unique journey of discovery: "For the first time we have been able to pinpoint at fine scale genome regions involved in the unique adaptation of African cattle."

There are around 150 breeds of cattle in Africa so the research team chose five distinct breeds that represent the genetic diversity of the species over a wide geographical area. Professor Hanotte said: "We

analysed the genome of each animal and looked for what they were good at (e.g. coping with hot weather, infectious disease resistance). We then generated a catalogue of genetic variants in our five breeds and identified the unique regions in the genome of each breed that gives them an advantage."

The team analysed DNA samples from 48 animals from the five breeds - the West African taurine N'Dama, the long-horned sanga Ankole from Central Africa and three zebu breeds (Boran, Ogaden and Kenana) from East Africa. Genes were identified linking feeding behaviour to control of parasitic infection in N'Dama, horn development and coat colour in the Ankole and thermo-regulation (heat tolerance) in the three zebu breeds. Genes associated with tick resistance were identified in all five breeds.

The wider aim of the research team is to catalogue all 10,000 breeds of domestic livestock in the world in 'The 10,000 Livestock Genome Project'. Professor Hanotte said: "We want to document the diversity of global livestock before that diversity disappears forever, so we can compile a catalogue of genetic information for future sustainable breeding improvement programmes. We estimate this would cost around $70 million - a small investment for such a large global public good."

An earlier paper by Professor Hanotte published in *Science* documented the fascinating history of cattle in Africa and traced their arrival to the continent from the 'fertile crescent' in Turkey and Iraq, and from India.

Provided by University of Nottingham