Dwindling genetic diversity of farm animals is a threat to livestock production

October 16 2015, by Jan Overney

It is hard to overestimate the importance of global livestock production to society and the economy. It constitutes the main source of income for 1.3 billion farmers, providing vital food for 800 million subsistence farmers, and making up 40% of global agricultural GDP. But overbreeding and dwindling genetic diversity could limit the ability of livestock populations to adapt the environmental changes, such as global warming and related new diseases. Currently on the sidelines, lesser-known livestock breeds and the DNA they carry could become key to securing the future of livestock farming.

For four years leading up to 2014, a European research project chaired by EPFL took stock of the past, present, and future of farm animal

genetic resources and outlined the questions of highest priority for research, infrastructure and policy development for the coming decade. A selection of the project's scientific output has now been published by the open access journal *Frontiers in Genetics*, and is available online in the form of 31 research papers.

A shrinking genetic reservoir

Over the past 100 years, many local breeds have gone extinct, as more productive industrial breeds have taken over. Even within these breeds, the genetic diversity between individuals is shrinking. So why does this matter? "A reduction of genetic diversity goes hand with hand with a reduction of the species' capacity to adapt to new diseases, warmer temperatures, or new food sources," says Stéphane Joost, the project's chair.

"Studying 1,200 sheep from 32 old, native breeds from around the world, we previously identified a specific gene involved in regulating their metabolism, whose presence correlated strongly with the amount of incident solar radiation – a genetic trait that made them better adapted to their environment than cosmopolitan breeds that are more productive in the short term," says Joost. If breeds carrying such specific adaptations disappear, so too will the coping strategies they acquired throughout evolution.

The better choice?

Joost's advice to farmers: "Farmers should keep their local, well adapted breeds," he urges. They may be less productive than their industrially bred cousins, but in developing countries with extreme climates sticking to them is often the wiser choice – a lesson that many farmers learn the hard way. After investing their savings to crossbreed a species of cow

local to West Africa with an industrial breed, farmers in Burkina Faso first reaped the fruits of their investment, until they realized that all of the mixed breed's offspring were poorly adapted to their climate and eventually died. "Only local breeds are adapted to resist to such harsh environments and withstand diseases such as trypanosomiasis, spread by the tsetse fly," says Joost.

An archive of adaptation

Understanding the genetic history of today's breeds could help us find ways of adapting in the future, says Joost. "What ancestral animals conferred the species with a specific trait? And what can we do today to recover that same trait?" he asks. Knowing, for example, exactly which native species were crossbred to produce today's breeds could help pinpoint certain well-adapted genes present in the native species that may have been lost. In the same way, well-adapted local breeds that were abandoned to the point of extinction could be recreated by cross-breeding the ancestral species they emerged from.

To ensure that the research carried out in this project finds its way into the agricultural community, the 31 studies will be compiled into an e-book, which will also be made available in print and distributed to stakeholders in developing countries by the FAO. But changing habits will be an uphill battle, as it involves sacrificing short-term profits for long-term sustainability – a problem that Joost and the co-organizers of the research project are well aware of. "Throughout this project, we emphasized the need to work with social scientists to effectively influence the habits of the breeders associations and other stakeholders. This is one front on which we still have much to do," he concludes.

More information: The 31 research papers are available online: journal.frontiersin.org/resear … al-genomic-resources

Provided by Ecole Polytechnique Federale de Lausanne