

Improving Asian buffalo breeds with genomics

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Water buffalo in Sri Lanka. A new study says that selective breeding of water buffalo and cattle with the help of genomics could help increase livestock productivity. Credit: Eleleleven (CC BY-SA 2.0)

Selective breeding of water buffalo (*Bubalus bubalis*) and cattle with the help of genomics could help increase livestock productivity, thereby improving food security, nutrition and incomes for millions of smallholder farmers in Asia, says a new study.

The study is one of the first to examine multiple water [buffalo](#) genomes. A genome is an animal or organism's complete set of DNA. The study was published in *Nature Communications* on 21 September by The Roslin Institute, University of Edinburgh, UK, with collaborators from Asia and Africa.

The researchers found that improvement via domestication in a species' key traits, including milk production, coat color, body size and disease resistance, leaves detectable signals in their genomes. This paves the way for improved farm animal health and production for smallholders through selective breeding.

"Now that we know the key genomic loci that are linked to important traits, it will be easier to target them in marker-assisted breeding to develop more productive breeds for local farmers," Prasun Dutta, co-lead author and research fellow at the Roslin Institute, tells SciDev.Net.

"For example, we identified a genomic region linked to the differences in milk fat content observed between water buffalo breeds. Knowing this, it should be easier to develop breeds with a better milk fat content by targeting this locus," says Dutta.

Researchers compared the genomes of 79 water buffaloes across seven Indian breeds to those of 294 domestic cattle (*Bos taurus taurus*, *Bos taurus indicus*) genomes representing 13 breeds from across the globe, including Asia, Africa and Europe; and other domesticated species, such as dogs, from around the world.

The study shows that characterizing functional variants associated with desired traits in one species may provide [potential candidates](#) for introduction into other species. These findings have the potential to not only accelerate improved buffalo breeding programs using genomic approaches, but also show that some selective sweeps are relevant across

diverse domesticated species.

"Genes that are strongly linked to body size do seem to have been targeted by domestication across species. The genomic locations showing the biggest differences between cattle breeds were found to be most often linked to [body size](#); loci linked to coat color and milk traits were observed in the water buffalo analysis," James Prendergast, a study author and senior research fellow at the Center for Tropical Livestock Genetics and Health, tells SciDev.Net.

"The DNA change that causes a black coat color in German Shepherd dogs was also found in some water buffaloes, which have been selected for coat color," adds Prendergast.

More [smallholder farmers](#) in Asia depend on buffaloes than any other domesticated species. Buffalo milk has twice the calorific content of cow's milk and is rich in calcium and minerals.

South Asia is home to most of the world's 200 million water buffaloes, according to the Food and Agriculture Organization Statistical Database of 2017. The river buffalo is found primarily in India and the swamp buffalo in East Asia. Imports and migration have made water buffalo an important commercial source of milk production in the Middle East and Mediterranean countries.

"This research highlights extensive genetic diversity within Indian River buffalo population and provides the basis for future genomic selection which can help the producers to select more productive animals at younger age and with more accuracy to accelerate the rate of genetic gain," Surinder Singh Chauhan, lecturer at the University of Melbourne's Faculty of Veterinary and Agricultural Sciences, tells SciDev.Net.

The challenge for Asian countries is a growing number of unproductive

cattle and growing demand for food. "This research highlights the potential for future genomic selection of [water](#) buffaloes for sustainable, efficient and improved production which would reduce the burden on resources and promote sustainability," says Chauhan.

More information: Prasun Dutta et al. Whole genome analysis of water buffalo and global cattle breeds highlights convergent signatures of domestication, *Nature Communications* (2020). [DOI: 10.1038/s41467-020-18550-1](#)

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