



Photo ICARDA/Estaye Getachew

## LIVESTOCK GENETICS | DTREO: A DIGITAL GENETIC PLATFORM PROVIDES ACCURATE AND TIMELY DATA FOR IMPROVED COMMUNITY-BASED SHEEP AND GOAT BREEDING

### KEY MESSAGES

- Lack of automated data capture systems affects timely feedback and accuracy of information for breeding decisions.
- CGIAR researchers and national research partners have adopted a digital genetic database, Dtreo, that is enhancing genetic improvement by providing timely and accurate animal ranking information to communities.
- Dtreo is a digital genetic database that is flexible and easy to use, that allows users to capture and save data offline. Data is uploaded to the database once an internet connection has been established.
- Dtreo creates a permanent multi-breed source of information that can be used to inform the breeding of high genetic merit animals, provide information to policymakers and support long-term breeding strategies.
- The digital database enables the use of more complicated evaluation models, which can improve the accuracy of breeding value estimations.

### INTRODUCTION

In 2010, sheep and goat community-based breeding programs (CBBPs) were initiated jointly by the International Center for Agricultural Research in the Dry Areas (ICARDA), International Livestock Research Institute (ILRI) and University of Natural Resources and Life Sciences in Austria (BOKU) in partnership with Ethiopia's National Agricultural Research Systems (NARS).

Breed improvement requires continuous genetic evaluations and the ranking of animals based on their genetic merit. Pedigree and performance recording is crucial and is an important component of genetic evaluation. Until recently, common practice in Ethiopia had been to collect data manually in herd books, which do not offer an effective means of providing quick and reliable feedback to communities.

Manual data collection is prone to data loss and errors, which reduces the accuracy and limits the use of complex models to improve the accuracy of animal ranking and genetic parameter estimations. Moreover, as data size increases, the manual data entry tasks become more complex, thereby necessitating the development of a central and automated digital database system to facilitate data capture, analysis, and timely feedback on animal rankings to communities.

*A flock of improved Menz sheep grazing on wheat stubble in Molale community-based breeding program site.*

## THE INNOVATION

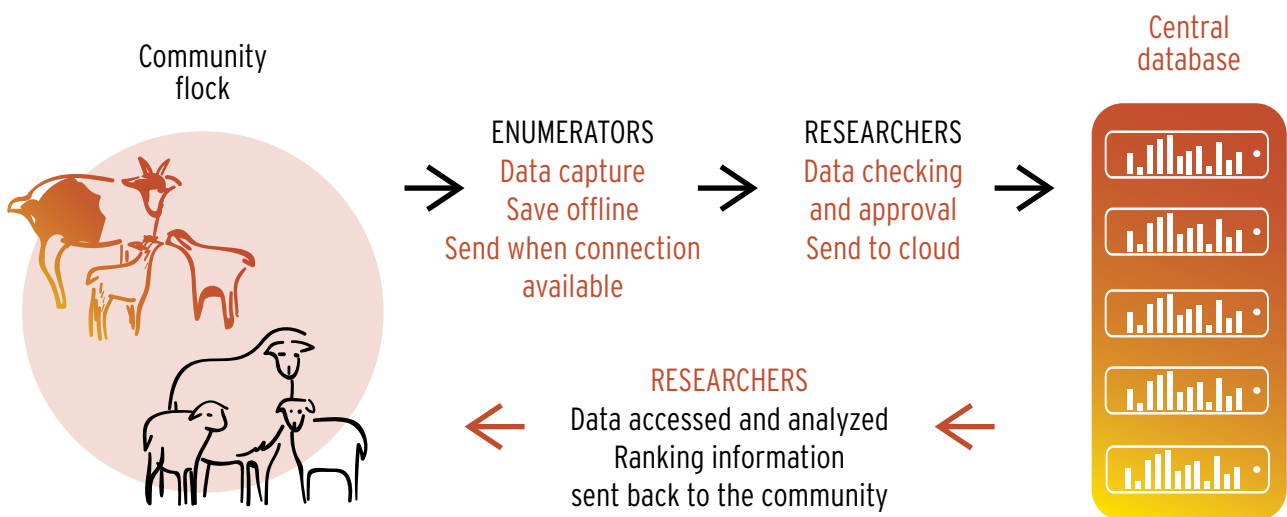
ICARDA and Ethiopia's NARS partnered with AbacusBio, an agribusiness technology firm, to use their cloud-based genetic database platform called Dtreo. The platform is designed to capture data (performance, pedigree, health and environment data), store and analyze it, and then send feedback to targeted communities for breeding and management decisions.

The main purpose of using Dtreo is to avail more accurate estimated breeding values (EBVs) and help provide quick feedback to communities. Higher accuracy of EBVs is expected due to reduced data errors and use of a sufficient data size. The database tool can run complicated models that help increase

accuracy of genetic evaluations. Dtreo can also build reports, provide analysis and create graphics.

Dtreo integrates well with smart device software designed for offline gathering of data in situations where internet connectivity is poor. Trained enumerators can easily choose event types, enter as much data as needed and save it all offline. Once internet connectivity is available, enumerators simply upload the data into the cloud by clicking the "send" button. When needed, the data is accessed by researchers, analyzed and ranking information is sent back to the selected community.

Figure 1. Diagram showing data flow



## THE DRIVERS

- Challenges in handling large amounts of data and delays in feedback provision triggered the need to seek an automated solution.
- Recent advances in computer science, information communication technology and mobile technology have provided greater options for tech-based solutions.

## PROGRESS AND IMPACTS

So far, the database has been developed and tested in Ethiopia (Bonga, Horro, Doyogena, Menz and Abergelle and Konso CBBPs) and in Tanzania (Small East African and Pare goat CBBPs). Details of use and coverage are outlined in figure 3. A total of 19 data

collectors in CBBPs have been trained, equipped with tablets and started data capturing from 2019. All the historic Ethiopian data since 2009 has been uploaded into the digital database.

There is a lot of data in dtreo and the data can be accessible by users for genetic evaluation, including:

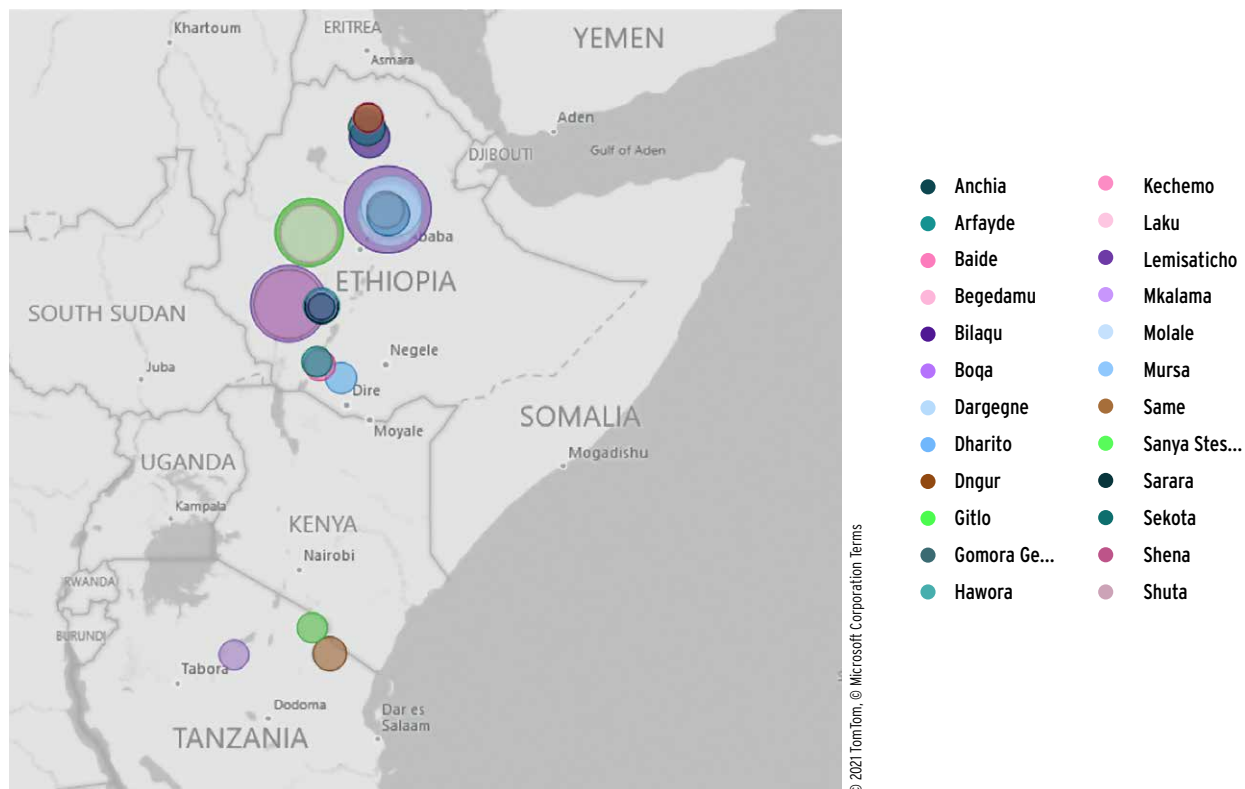
- 67,000 plus records of lambing/kidding.
- 125,500 plus live weight records at different ages.
- 23,000 plus milk records.

Data collections is ongoing in 27 CBBP sites across Ethiopia and Tanzania, and the database system holds who have access to the data.

The up-to-date information generated from the platforms has been used for estimated breeding values and animal rankings that are directly channeled to breeder organizations to inform breeding decisions.

**Figure 2. Map showing number of animals by location**

Source: <https://www.dtreo.io/App/Analytics>



## Increasing data collection efficiencies

Since 2019, research centers in Ethiopia have adopted a digital database platform called Dtreo to capture, manage and analyze their community-based breeding data.

Shenkute is a researcher at Debre Berhan Agricultural Research Center (BARC) overseeing five community-based breeding (CBBP) sites in Menz, in the Amhara region. Previously, Shenkute and his research team would travel every fortnight to project sites about 160 kilometers away to monitor data collection activities and retrieve a copy of the data from enumerators. Thanks to the functionality of Dtreo, however, Shenkute can now monitor and access recent data from all five sites from his office. He can also easily create summary reports and access more refined data for analysis.

Testimonials received from seasoned enumerators such as Adise from Menz and Asabu in Tamiru, Bonga, are likewise benefiting from the efficiencies provided by the digital platform. Whereas previously enumerators traveled with and entered data into herd books, enumerators are inputting data into digital tablets, which is making data collection easier. Retrieving farmer and animal information is much quicker and drop-down selections in data fields are helping reduce

errors significantly. Researchers are also appreciating the security afforded by data stored in the cloud. Floods that affected the Arba Minch Research Center and ongoing war in the northern part of Ethiopia have damaged herd books and computers.



**An enumerator captures data on sheep at the community-based breeding program site in Menz, Ethiopia.**

Photo: CARDA/Estfaye Getachew

## CRITICAL FACTORS OF SUCCESS OF THE PROGRAM

- Efficient partnership among NARS and international partners is the main factor for establishing a digital database.
- Tremendous effort from committed researchers in NARS resulted in essential accumulated historic data being loaded onto the system.
- High levels of motivation to use an automated system.
- Ease and flexibility of the database system to accommodate any analytic system
- Long-term technical support, capacity development, follow-up and monitoring in the data capture, analysis and feedback system

## IMPLICATIONS AND RECOMMENDATIONS

In order to provide a more accurate picture of the genetic evaluation of small ruminants in the country, the database reach would need to be expanded to include more CBBP sites, particularly those established by national research institutions, universities, and the biodiversity institute in Ethiopia. To achieve this:

- A responsible national institution needs to take the role of coordination and ownership of the database system.
- All sheep and goat data in the national system needs to be moved to the central database system.

### Related publications

Getachew, T., Haile, A., Rekik, M., and Rischkowsky, B. 2020. A genetic database tool for data capture in small ruminant community-based breeding programs[tools]. <https://hdl.handle.net/20.500.11766/12699>

Getachew, T., Haile, A. and Rischkowsky, B. 2020. Digital platform enhances genetic progress in community-based sheep and goat breeding programs in Ethiopia. Poster prepared for the Virtual Livestock CRP Planning Meeting, 8-17 June 2020. Addis Ababa: ICARDA. <https://hdl.handle.net/10568/109778>

Getachew, T., and Haile, A. A Digital Platform for Better Community-Based Sheep and Goat Breeding. <https://www.icarda.org/research/innovations/digital-platform-better-community-based-sheep-and-goat-breeding>

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The database tool also needs to be refined to include additional features, which could generate breed level information reports, breed-specific prediction equations and animal rankings.

## CONCLUSION

A digitized database for small ruminant breeding can contribute to enhanced genetic improvement in Ethiopia through the provision of timely feedback and accurate information to breeders. It also provides the basis to identify and promote more productive, resilient breeds as well as to share information among researchers and policymakers.



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**An enumerator captures data in Menz sheep community-based breeding program.**

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### Partners

The SmaRT-Ethiopia project is led by ICARDA in close collaboration with ILRI, Ethiopian NARS and other international partners.



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