AICCRA
Accelerating Impacts of CGIAR Climate Research for Africa

ICARDA
Science for resilient livelihoods in dry areas

Transforming the sheep and goat industry through dispersed community-based breeding and centralized management

30th ESAP Conference, 15 to 17 September, Hawassa

Tesfaye Getachew, Barbara Rischkowsky, Mourad Rekik, Bruno Santos, Girma Tesfahun, Berhanu Belay and Aynalem Haile

Outline

- Animal breeding
- Community-based breeding
- Achievements in Ethiopia CBBP
- Expansion of CBBPs
- Framework for up/out scaling
- Sustainability
- Home take messages

Animal breeding

- Breeding is about predicting the future
- It is intended to develop animals that will produce more effectively under production conditions
- Mate the **best** to the **best** and go this as quick as possible

Accuracy

Intensity **Genetic variation**

Gain per year (predicted) $\rightarrow \triangle G = \frac{i\, r\, \sigma_a}{L} = \frac{\mathbf{b}(\bar{y}-\mu)}{L}$

Generation interval

, Jay L. Lush 1941

- When information source is own performance

$$\mathbf{r} = \sqrt{\mathbf{h^2}} = \mathbf{h} = \frac{\sigma_a}{\sigma_y} \text{ . and } \mathbf{b} = \frac{\mathbf{cov(a,y)}}{\mathbf{var\ (y)}} = \frac{\mathbf{cov(a,a+e)}}{\mathbf{var\ (y)}} = \mathbf{h^2}$$

$$\mathrm{i} = \frac{S}{\sigma_y} = \frac{(\bar{y}-\mu)}{\sigma_y}$$

Selection intensity depends on mating strategy, available candidates for selection

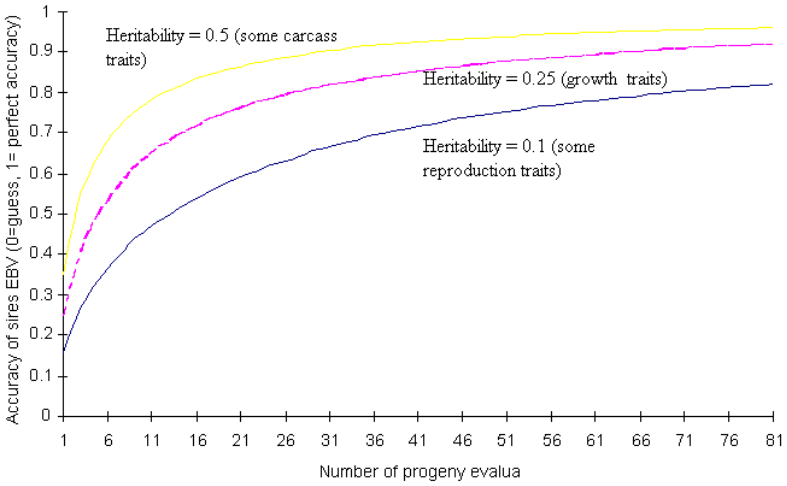
Accuracy depends on heritability, source of information and amount of information

When many information source and different traits, b in matrix form will be

$$\mathbf{b} = \mathbf{P^{-1}G}$$

Then index calculated as

$$\mathbf{I} = \mathbf{b}\,(\bar{y} - \mu) = \mathbf{P^{-1}G}\,(\bar{y} - \mu)$$



$$\mathbf{I} = \mathbf{P^{-1}G\,W}(\bar{y} - \mu)$$

Economic value depends on cost of production and sale value

Sheep and goat breeding in Ethiopia




Crossbreeding – since 1940s

- Adaptation
- Objective mismatch
- High starting and running cost
- Disease
- Lack of proper breeding program



Selective breeding – since 1970s

- High running cost
- Disease
- Objective mismatch


CBBP – since 2009

- Small flock size
- Limited resource
- Poor infrastructure
- Short term benefit
- Less access to improved technologies
- Poor access to market

Alternative approach - Community-based breeding approach

- A three-year ICARDA-ILRI-BOKU project “Designing community-based breeding strategies for indigenous sheep breeds of smallholders in Ethiopia”, funded by the Austrian Development Agency, was launched on 12th March 2007
- Four sheep breeds (Menz, Afar, Bonga and Horro)

Aim:

Improve the livelihoods of resource-poor farmers; contribute to better market supply and food security; and provide a framework for genetic improvement that can be replicated elsewhere in and outside of Ethiopia

Alternative approach - Community-based breeding approach

Goat & Sheep

CBBP

100 hhs and 500 breeding female

Farmer organized into breeder cooperatives and mating group within the cooperative

Breeding goal and design
- Participatory
- Few traits

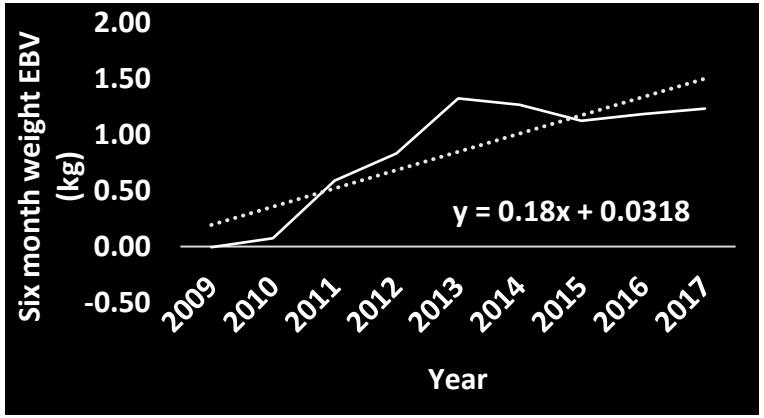
Data collection
- Handled by enumerators

Selection, mating and culling
- Breeding value estimation
- Farmers approval

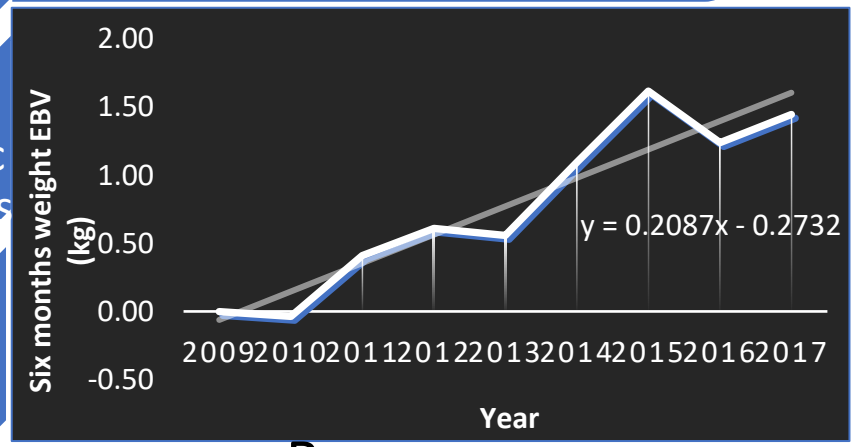
Genetic progress

Product

- Digital data base DTREO
- Low-cost AI
- Capacity development
- Sire certification
- Market linkage and infrastructure
- Feed and health interventions



Horro



Bonga

Improved genotype developed

$$y = Xb + Za + e,$$

Henderson's BLUP

Genetic gain, economic benefit, and attitude change

- Traits under selection have been improved over the years in all the breeds evaluated (Menz, Horro, Bonga, Abera, Dyogena sheep and Abergelle goat)
- Higher levels of household income, meat consumption, and market engagement
- Farmers' understanding of adopting technology had also improved


animal

Community-based sheep breeding programs generated substantial genetic gains and socioeconomic benefits

A. Haile[1†], T. Getachew[1], T. Mirkena[2], G. Duguma[3], S. Gizaw[4], M. Wurzinger[5], J. Soelkner[5], O. Mwai[6], T. Dessie[4], A. Abebe[7], Z. Abate[8], T. Jembere[9], M. Rekik[1], R. N. B. Lobo[10], J. M. Mwacharo[1], Z. G. Terfa[1], G. T. Kassie[1], J. P. Mueller[11] and B. Rischkowsky[1]


Heliyon

Analysis of genetic parameters and genetic trends for early growth and reproductive traits of Doyogena sheep managed under community-based breeding program

Kebede Habtegiorgis[a,*], Aynalem Haile[c], Tesfaye Getachew[c], Manzoor Ahmed Kirmani[b], Deribe Gemiyo[a]


frontiers in Veterinary Science

Welfare Impact of Community-Based Veterinary and Breeding Services on Small Ruminant Keepers

Girma Tesfahun Kassie[1*], Woinishet Asnake[2], Aynalem Haile[2], Tesfaye Getachew Mengistu[2], Solomon Gizaw[3] and Barbara Rischkowsky[3]


ORIGINAL ARTICLE

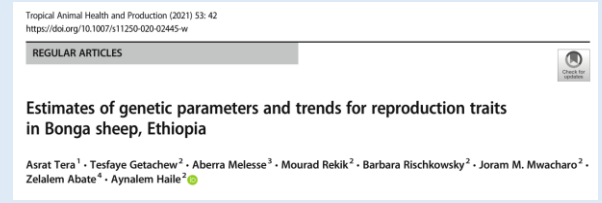
Increased number of large non-atretic follicles and co-dominance effects account for high litter sizes in Bonga sheep

Asrat Tera Dolebo[1] | Aberra Melesse[1] | Cristian Porcu[2] | Tesfaye Getachew[3] | Aynalem Haile[3] | Mariem Rouatbi[4] | Zelalem Abate[5] | Muluken Zeleke[5] | Barbara Rischkowsky[3] | Joram M. Mwacharo[3] | Mourad Rekik[6]


ORIGINAL ARTICLE

Community-based breeding programmes are a viable solution for Ethiopian small ruminant genetic improvement but require public and private investments

Aynalem Haile[1] | Solomon Gizaw[2] | Tesfaye Getachew[1] | Joaquín P. Mueller[3] | Peter Amer[4] | Mourad Rekik[5] | Barbara Rischkowsky[1]


REGULAR ARTICLES

Estimates of genetic parameters and trends for reproduction traits in Bonga sheep, Ethiopia

Asrat Tera[1] · Tesfaye Getachew[2] · Aberra Melesse[3] · Mourad Rekik[2] · Barbara Rischkowsky[2] · Joram M. Mwacharo[2] · Zelalem Abate[4] · Aynalem Haile[2]


Animal

The international journal of animal biosciences

Estimation of (co)variance components, genetic parameters, and genetic trends of growth traits in community-based breeding programs of Bonga sheep

E. Areb[a,*], T. Getachew[b], M.A. Kirmani[c], Z. Abate[d], A. Haile[b]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Anim Biosci

Vol. 34, No. 9:1451-1459 September 2021

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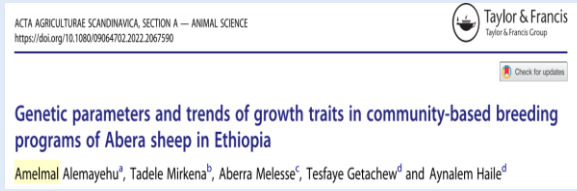
pISSN 2765-0189 eISSN 2765-0235

ANIMAL BIOSCIENCE

Estimation of co-variance components, genetic parameters, and genetic trends of reproductive traits in community-based breeding program of Bonga sheep in Ethiopia

Ebadu Areb[1,*], Tesfaye Getachew[2], MA Kirmani[3], Tegbaru G.silase[1], and Aynalem Haile[2]


ACTA AGRICULTURAE SCANDINAVICA, SECTION A — ANIMAL SCIENCE

https://doi.org/10.1080/09064702.2022.2067590

Taylor & Francis

Genetic parameters and trends of growth traits in community-based breeding programs of Abera sheep in Ethiopia

Amelmal Alemayehu[a], Tadele Mirkena[b], Aberra Melesse[c], Tesfaye Getachew[d] and Aynalem Haile[d]


Mammalian Genome (2019) 30:339–352

https://doi.org/10.1007/s00335-019-09820-5

Genome-wide scans identify known and novel regions associated with prolificacy and reproduction traits in a sub-Saharan African indigenous sheep (*Ovis aries*)

Asrat Tera Dolebo[1,2] · Negar Khayatzadeh[3] · Aberra Melesse[2] · David Wragg[4] · Mourad Rekik[5] · Aynalem Haile[5] · Barbara Rischkowsky[5] · Max F. Rothschild[6] · Joram M. Mwacharo[5]

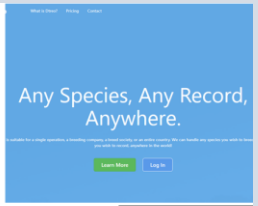
Adding value through database

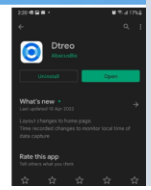
- Dtreo – A cloud-based genetic database platform
- Easy, flexible, works offline, provide quick feedback for users

Guide in using DTREO

- Available in two types
  - DTREO Online https://dtreo.io/
  - DETRO mobile: downloaded from google play store
- Log in account is mandatory in both cases - need to be created by the developer
- Use below information for this exercise

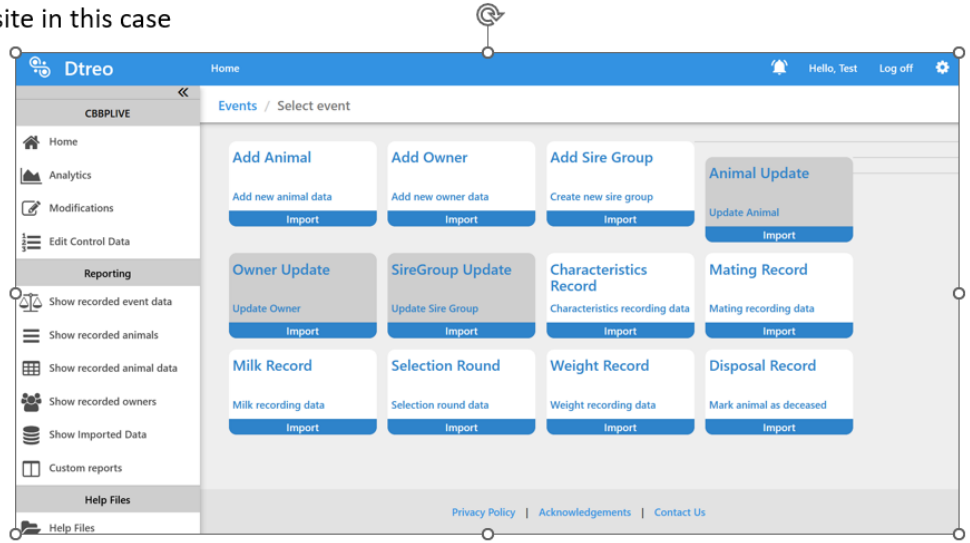
Username: testsite@dtreo.io
Password: KhR16416





Steps

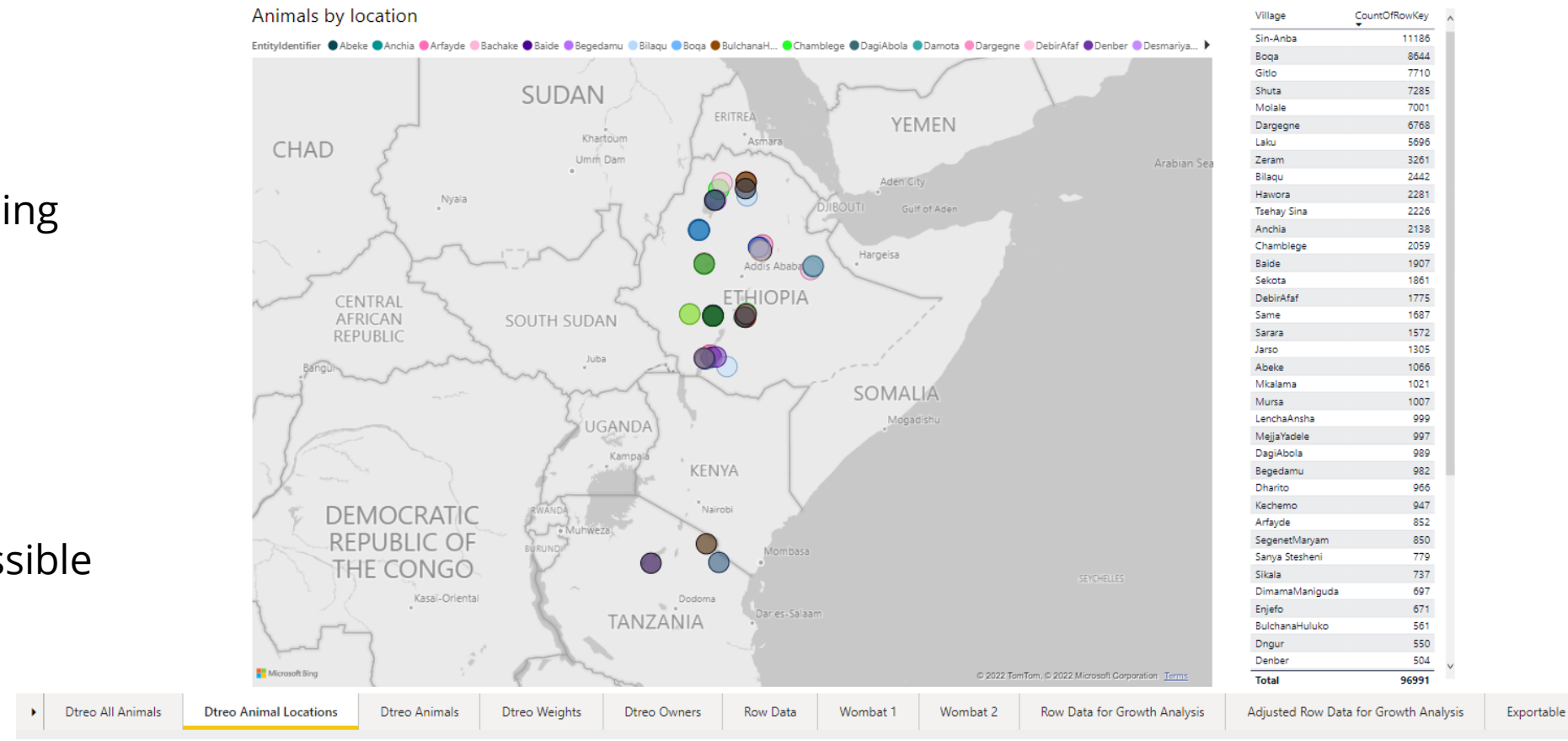
- Create village name: test site in this case
- Add owner
- Add animal
  - Add sire group
  - Add weight
  - Characteristic record
  - Mating record
  - Milk record
  - Selection round
  - Weight record
  - Disposal record
  - **Animal update**
  - **Owner update**
  - **SireGroup update**



Dtreo holds:

- **108,000** lambing/kidding
- **200,000** live weight
- **23,000** milk records
- **40** CBBPs

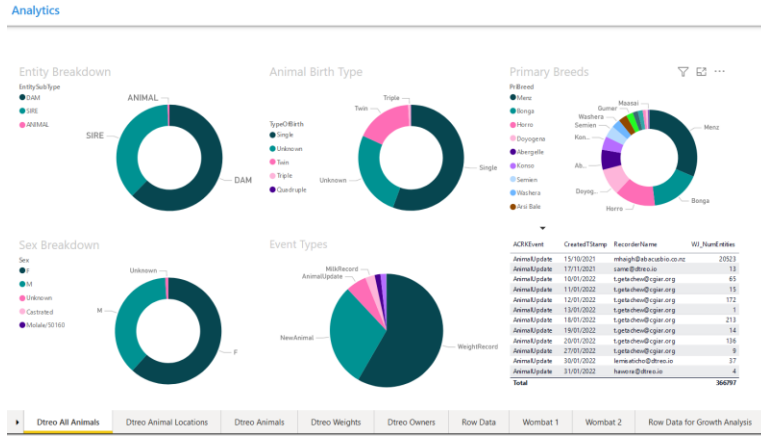
- The data can be accessible by users for genetic evaluation



Village	CountOfRowKey
Sin-Anba	11186
Boqa	8644
Gitlo	7710
Shuta	7285
Molale	7001
Dargegne	6768
Laku	5696
Zeram	3261
Bilaqu	2442
Hawora	2281
Tsehay Sina	2226
Anchia	2138
Chamblege	2059
Baide	1907
Sekota	1861
DebirAfaf	1775
Same	1687
Sarara	1572
Jarso	1305
Abeke	1066
Mkalama	1021
Mursa	1007
LenchaAnsha	999
MejjaYadele	997
DagiAbola	989
Begedamu	982
Dharito	966
Kechemo	947
Arfayde	852
SegenetMaryam	850
Sanya Stesheni	779
Sikala	737
DimamaManiguda	697
Enjefo	671
BulchanaHuluko	561
Dngur	550
Denber	504
Total	**96991**

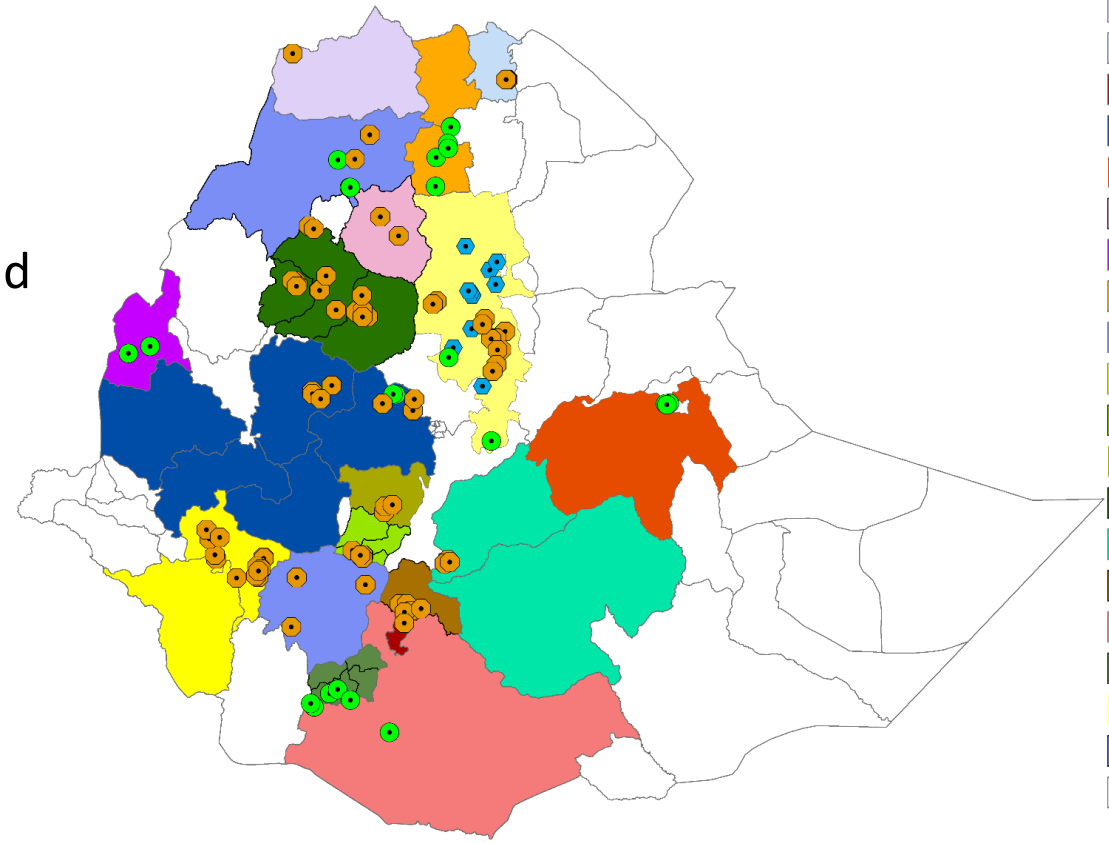
Dtreo All Animals | Dtreo Animal Locations | Dtreo Animals | Dtreo Weights | Dtreo Owners | Row Data | Wombat 1 | Wombat 2 | Row Data for Growth Analysis | Adjusted Row Data for Growth Analysis | Exportable

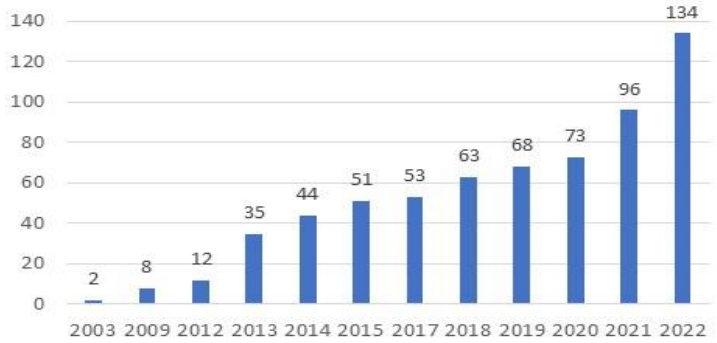
- Provide input files for programs like WOMBAT and SAS
- Working to integrate feed, health, market information
- Ultimate goal - calculating EBV with just one click



Expansion of CBBPs – Scaling out

- Initially 8 CBBPs with mean size of 100 hhs and 500 breeding females
- Replicated into 134 CBBPs
  - Equivalent to 67,000 breeding females and
- Engaged in production of genetically superior animals
- **Universities**, LFSDP, Research Centers, ICARDA, ILRI, LWRC, CCAFS, USDA, EBI involved





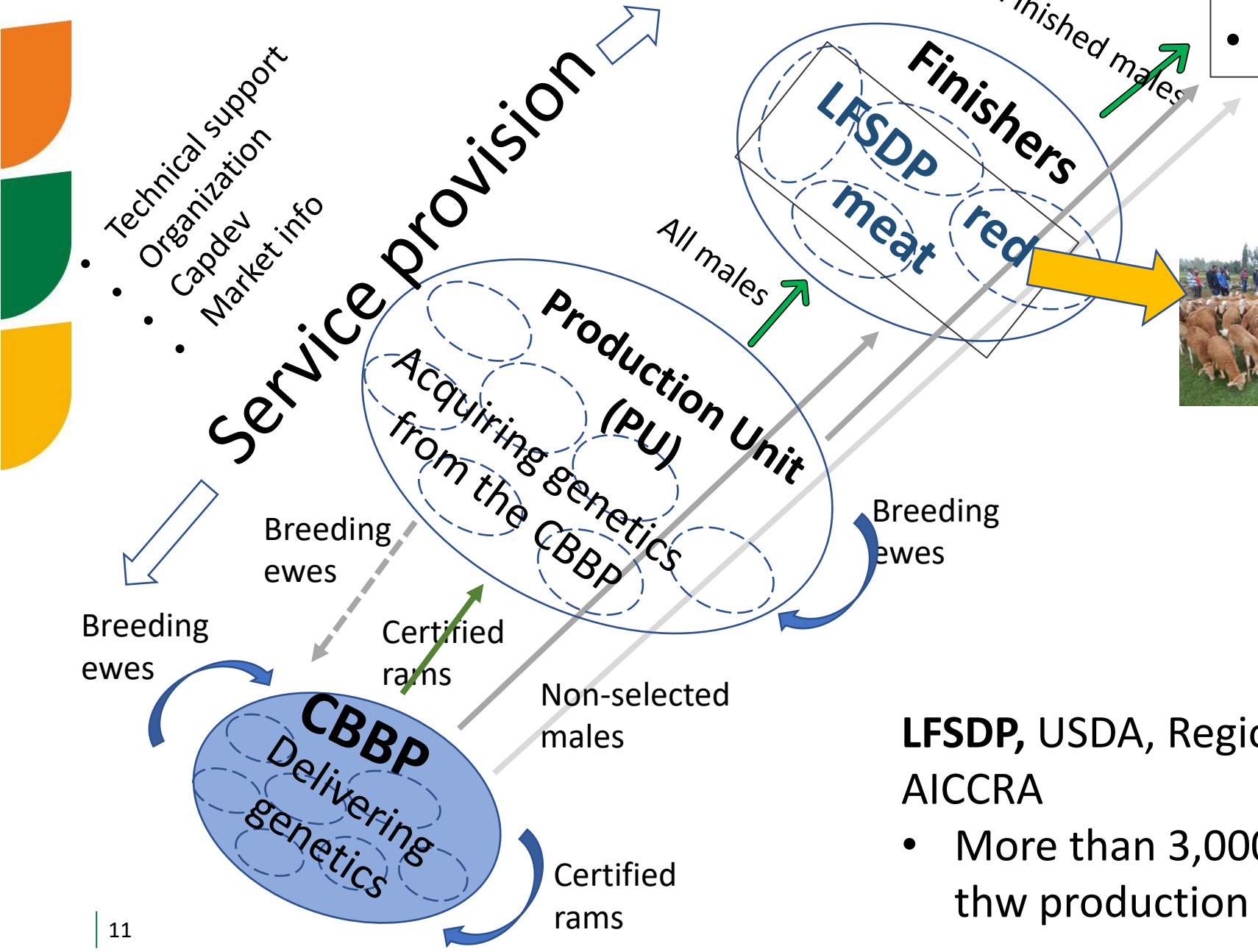
Tanzania
Sudan
Iran
Malawi
Uganda
Mongolia

Expansion of CBBPs – Scaling up

Market

- Local, Big cities and export





LFSDP, USDA, Regional extension, NGOs, ICARDA, AICCRA

- More than 3,000 breeding sires disseminated to thw production units – more than 50 villages

Scaling framework – up/out scaling

- Developing working structure
- Different out and up scaling strategies were evaluated
- 40 rams selected from available 150, however about 1000 breeding ewes can produce more (600)

Strategies were

1. Replicate existing CBBPs
2. Increase the number of breeding males produced and disseminated per CBBP
3. More intense use of CBBP rams in nucleus and base

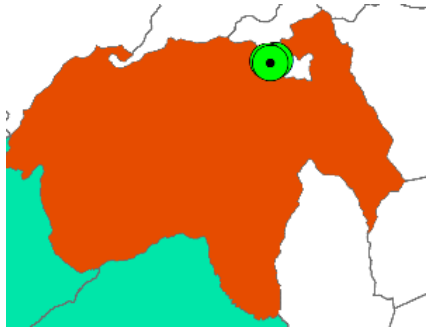
Contents lists available at ScienceDirect

Small Ruminant Research

journal homepage: www.elsevier.com/locate/smallrumres

Genetic progress and economic benefit of community-based breeding programs for sheep out- and upscaling options in Ethiopia

J.P. Mueller[a,*], A. Haile[b], T. Getachew[b], M. Rekik[c], B. Rischkowsky[b]



- Strategy 1 and 2 resulted in accumulated benefit of **USD187,607 and** (H= 20) with a return on investment of USD9.1

- Results should motivate policymakers and development agencies to invest in the establishment of new CBBPs and in conditions enabling distribution of more CBBP rams to general flocks

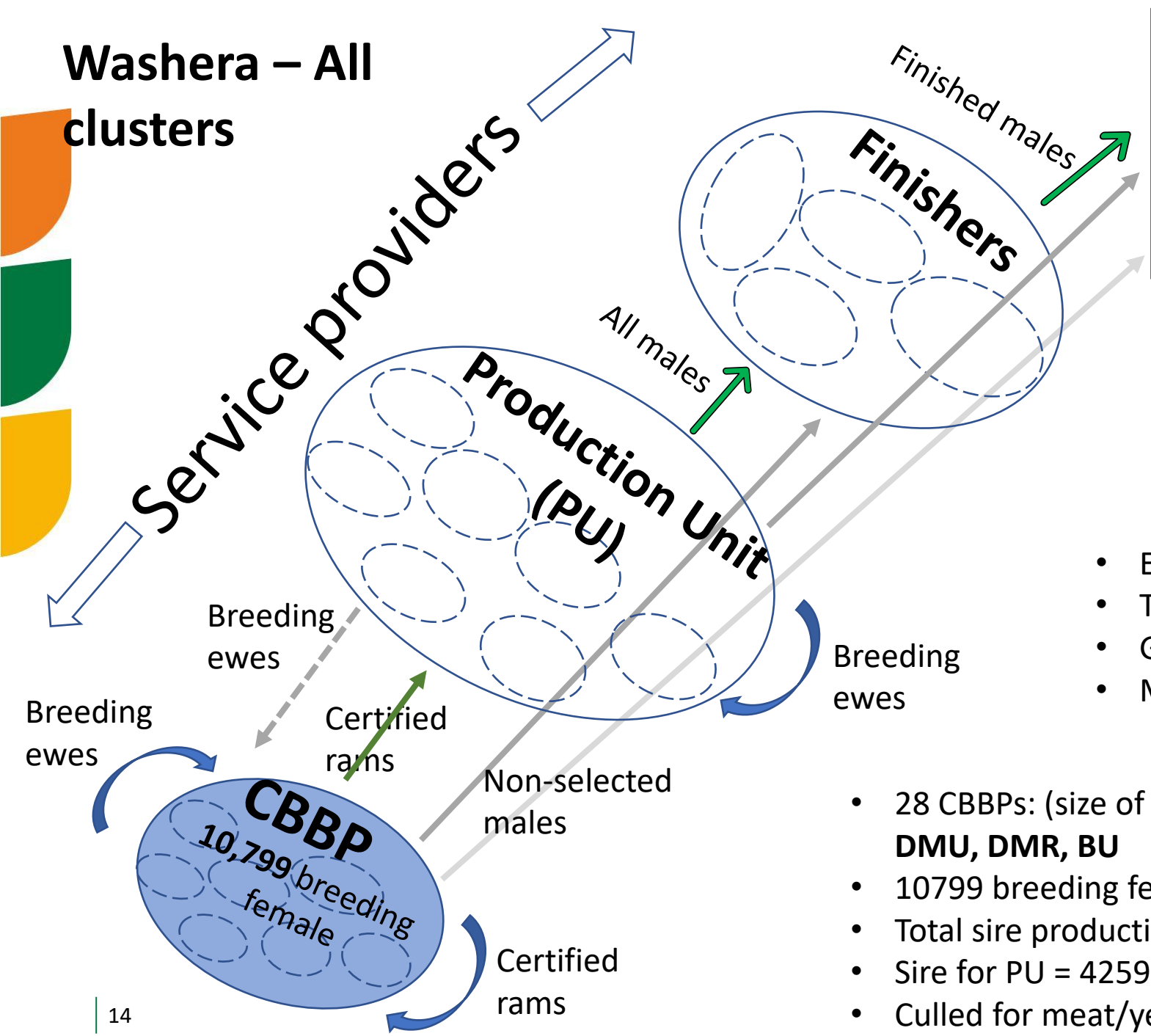
Scaling up/out Washera sheep

- Having the framework we have to challenge ourselves how to cover the whole population
- WAWO initiative initiated by ARARI – April 2022
- Washera among the widely distributed and well-known sheep breeds of Ethiopia
- A total of 28 CBBPs have been initiated by 8 institutions

Purpose:

- To develop dispersal breeding program that delivers better genetics to a wider population (targets 4 million sheep)
- To developing a central scheme that coordinates the scattered CBBP villages

Washera – All clusters



Market

- Local
- Big cities
- export

- Lamb for fattening = 197,086 expected
- Finished lamb/year = **187,231**

- Ewe in PU = **266,247**
- Targeted ewes in the cluster = 1,952,615
- Gap = 1,685,821 ewes ¬ 168 CBBP
- Meat lambs/year = 194,094

- 28 CBBPs: (size of a CBBP = 385 ewes), **IU, ALRC, EBI, WLRC, Bure, DMU, DMR, BU**
- 10799 breeding female, about 3233 hhs
- Total sire production capacity/year = **4487**
- Sire for PU = 4259
- Culled for meat/year = 2991 lambs

10-year CBBP celebration - Bonga

Our work has been awarded

Gold medal and Certificate in 2015

By Ministry of Science, Technology and Innovation of Ethiopia for the achievements in participatory improvement of Menz sheep breed through community-based approach


AFRICAN UNION
INTERAFRICAN BUREAU FOR ANIMAL RESOURCES

Live2Africa

EUROPEAN UNION

Certificate of Award

CALL FOR SUCCESS STORIES ON INCLUSIVE INNOVATIONS FOR LIVESTOCK BASED FOOD SYSTEMS

This is to certify that

International Center for Agricultural Research in the Dry Areas (ICARDA) – Ethiopia

has been awarded the 2nd Prize for the article

"Community-based sheep and goat breeding programs in low input African livestock systems are providing sustainable solutions for genetic improvement that lead to greater incomes for smallholder farmers -
Sustainable solutions for genetic improvement of sheep and goat"

Dr. Nick Nwankpa
Acting Director
AU-IBAR


Certificate

To: International Center for Agricultural Research in the Dry Areas (ICARDA)
Small Ruminant Team
Addis Ababa

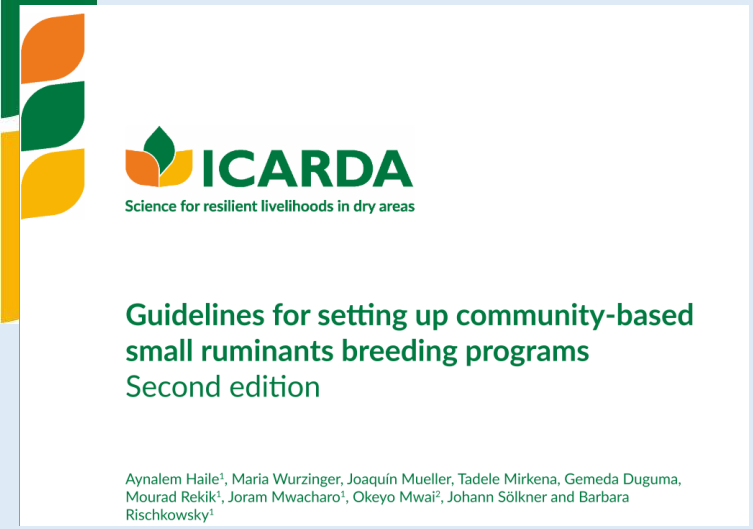
In recognition of your long-term exemplary partnership and your contributions towards improving the livelihood of our community via implementation of a successful collaborative action research on sheep and goat community-based breeding programs.

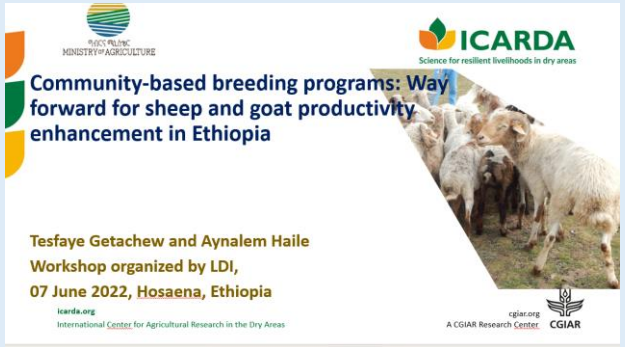
Director, Livestock Research

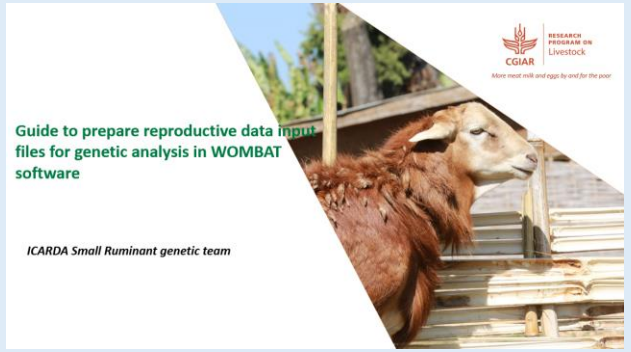
DG, Amhara Agricultural Research Institute

Capacity development

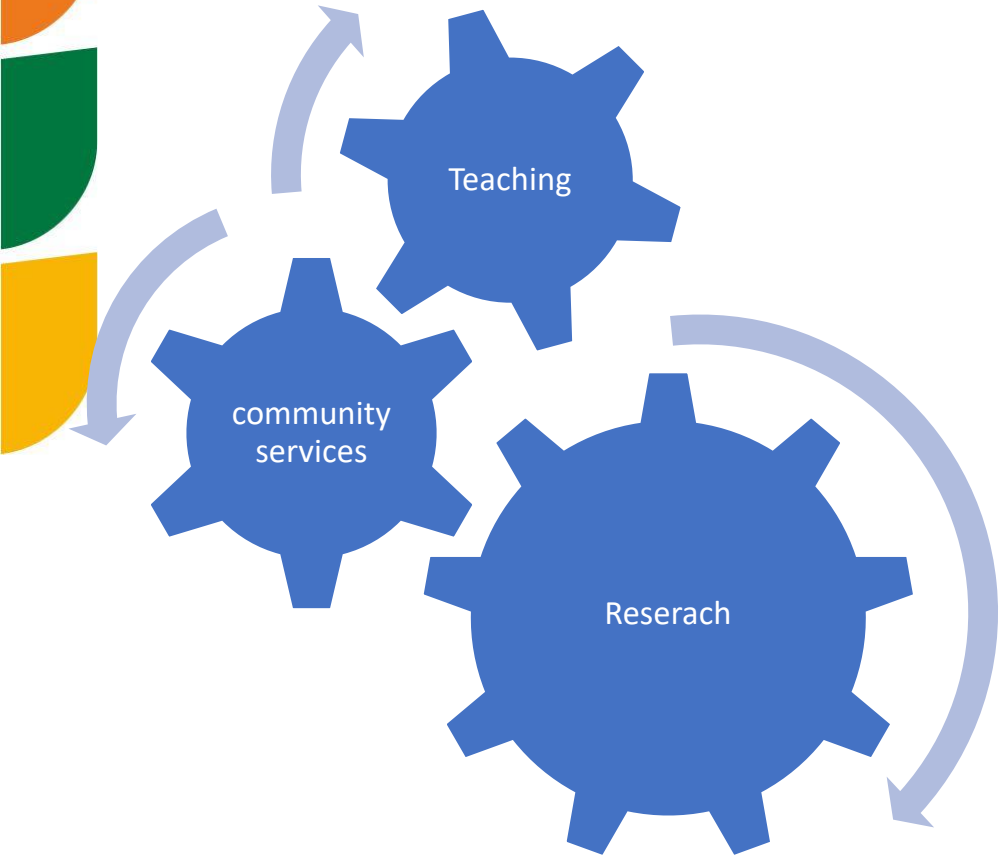
- Several trainings: Focused on establishment of breeding sites, genetic evaluation, reproductive data management, optimization, DTREO
- Guidelines and training materials are available







CBBP : Synergize triple mandates of HLI



Curriculum integration of CBBP

22 Universities signed MoU to run CBBP and CSA

26 Universities included CBBP UG program

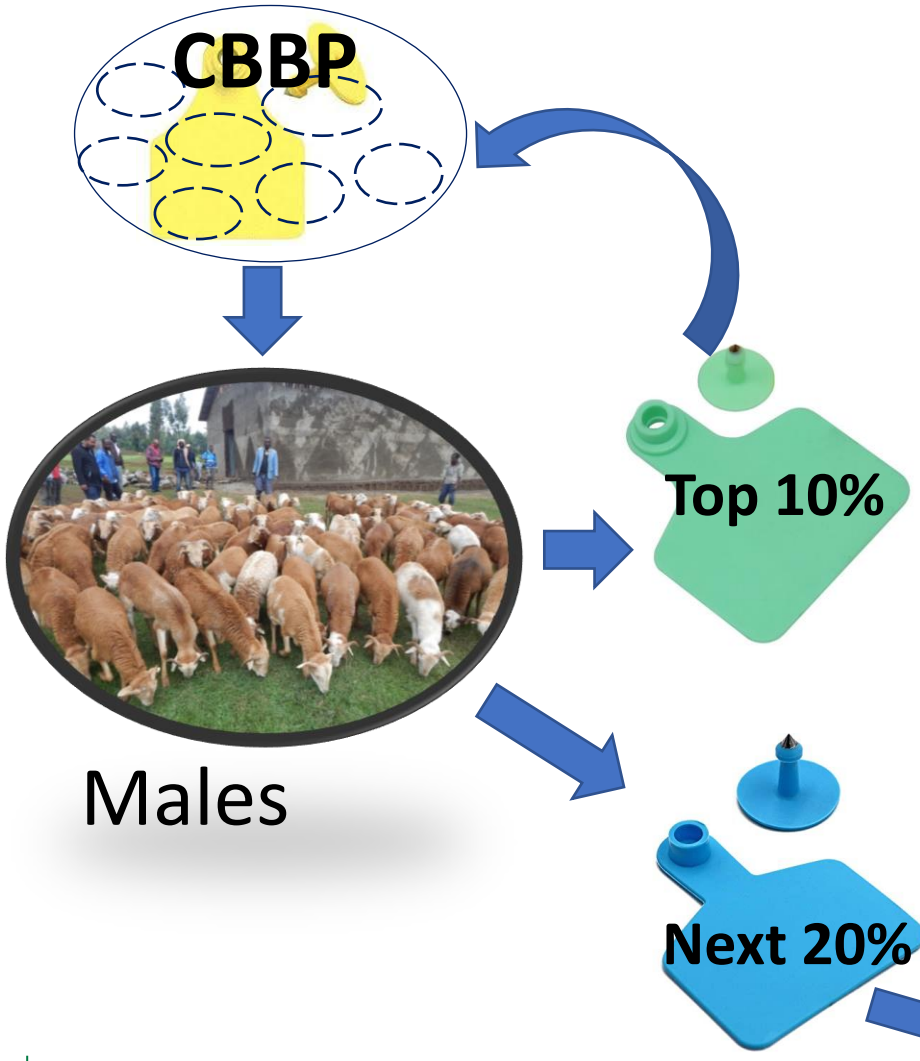
17 Universities under way to included in PG

University budgeted CBBP in university proximity

- 15 Universities engaged in running CBBP
- 42 CBBP villages supported by Universities
- Universities Budgeted , 40 Million Birr to run CBBP

Home take message

Sustainability- Long term goal



System

- Best sire only for breeding
- Integrate CBBPs and related interventions in the extension system

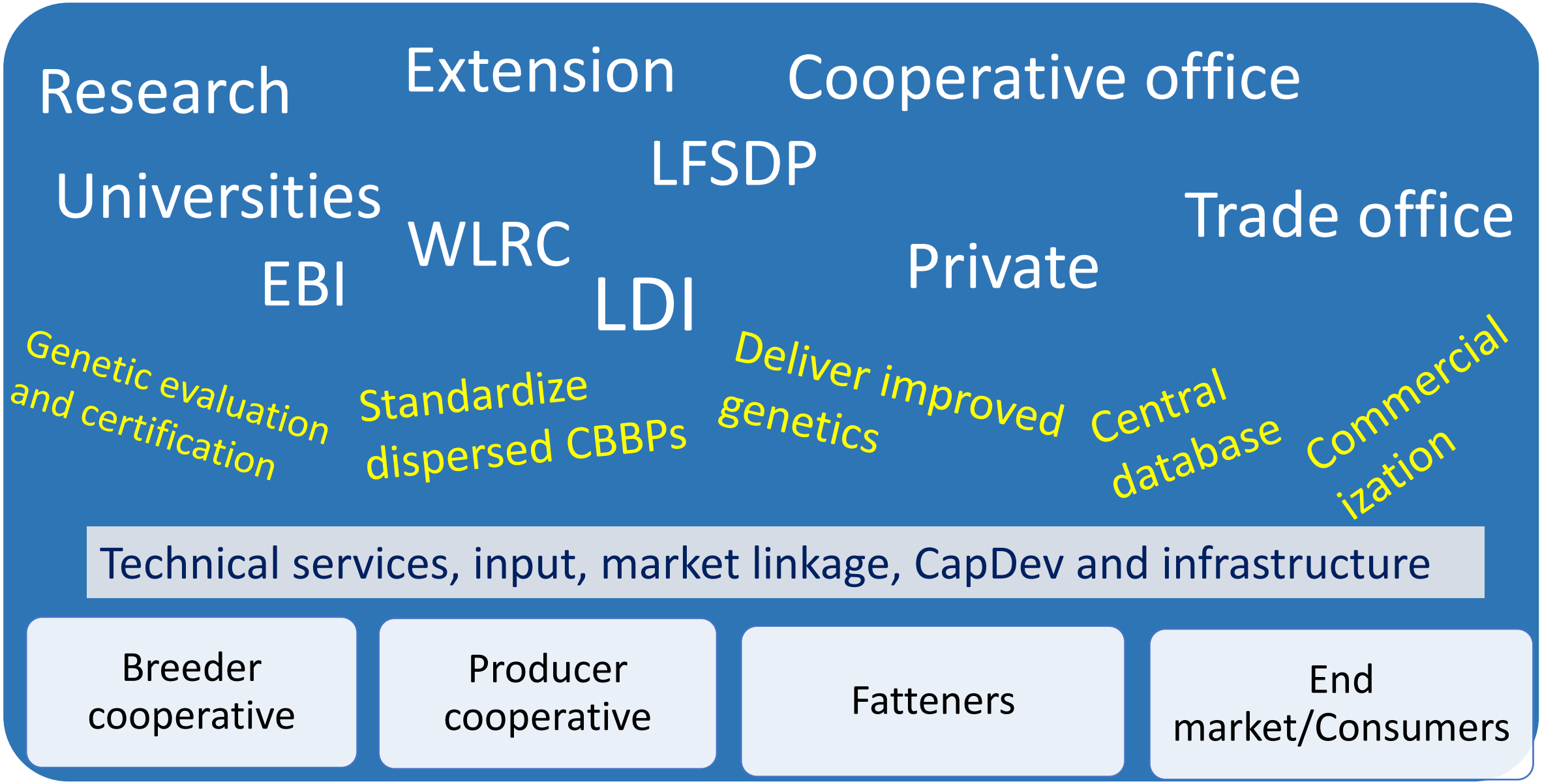
Ownership:

- Central database and central coordination

Commercialization

- Organize and capacitate breeder and producer cooperatives and youth groups

Sustainability - Partners engagement plan



Acknowledgements

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ICARDA
Science for resilient livelihoods in dry areas

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

AUSTRIAN DEVELOPMENT AGENCY

BOKU
Universität für Bo

MINISTRY OF AGRICULTURE

EIAR
ETHIOPIAN INSTITUTE OF AGRICULTURE RESEARCH

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Thank you!!!