

# Genetic evaluation in Sweden and Interbeef

*World Charolais Congress 2018*  
*Emma Carlén*



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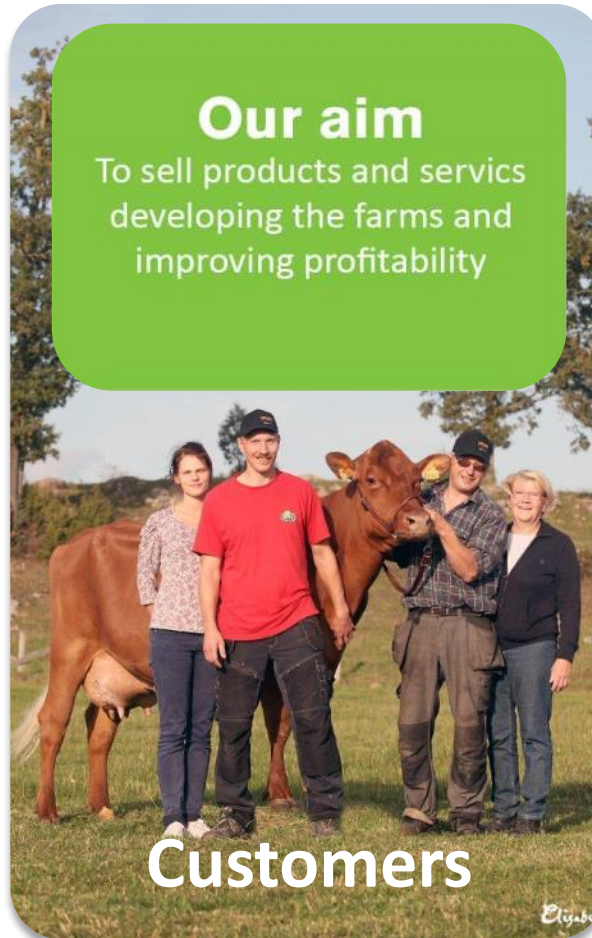
**VÄXA**  
S V E R I G E

# Outline

- Short about Växa Sverige and our responsibility within beef cattle breeding
- Swedish beef breeding programs with emphasis on the national genetic evaluation
- Nordic and international cooperation with focus on status in Interbeef

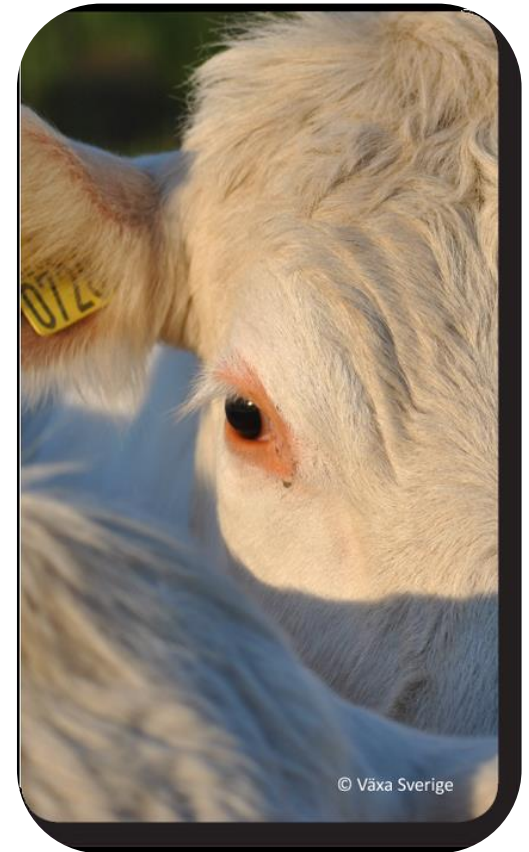


# Växa vision: contribute to a sustainable, competitive agricultural production....



# Services for beef producers

- Fertility: AI service and pregnancy test
- Collect registrations: calvings, weights, conformation, horn status etc.
- Advice to plan/follow-up production and breeding
- Statistics and bench-marking
- Pedigree verifications and herd books
- Cattle data base and breeding values





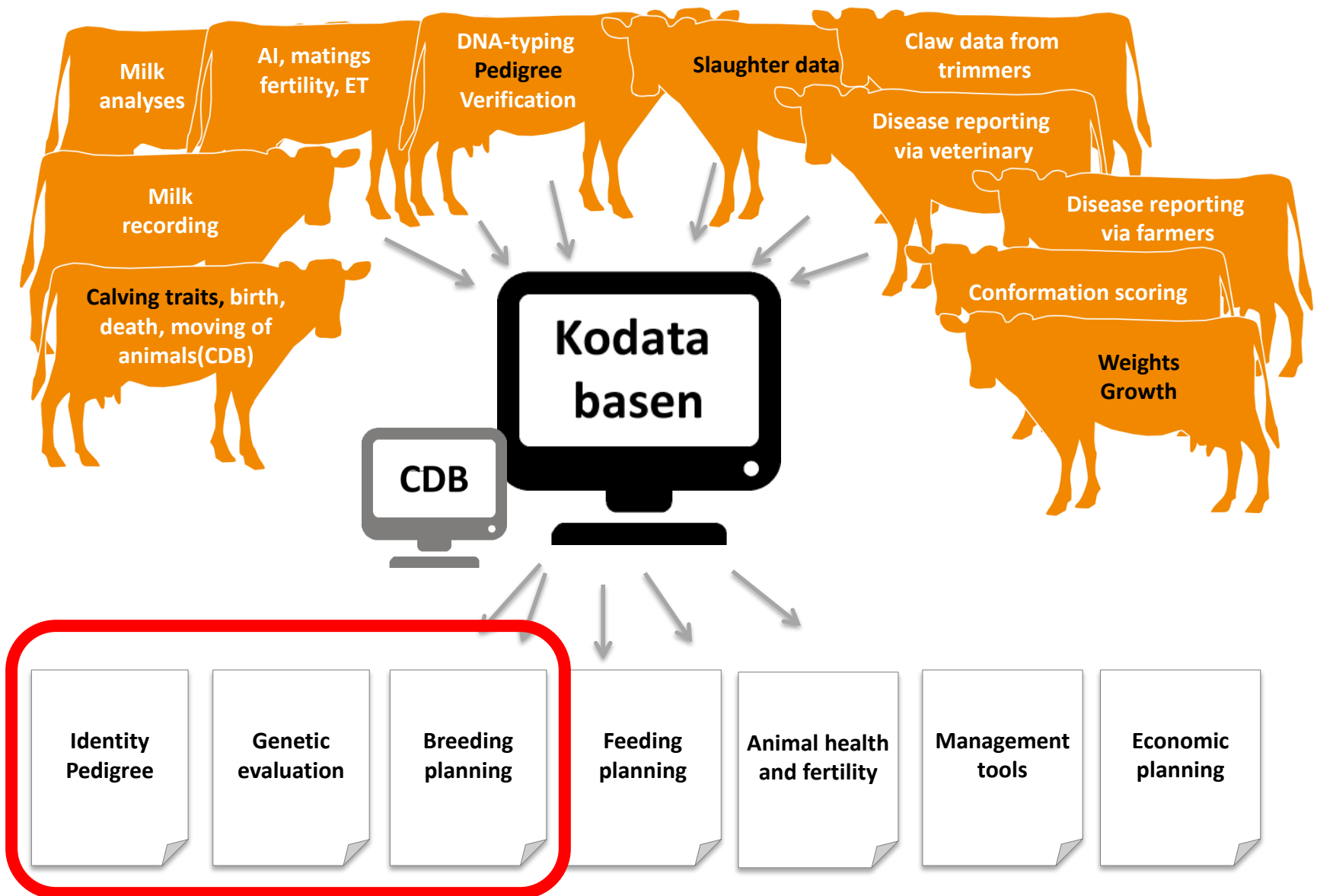
# Växa: role and responsibility within breeding

- Official national breeding organization for Swedish cattle breeds
  - 7 dairy breeds and 7 beef breeds
- Responsible for:
  - Breeding goals
  - Breeding values
  - Herd book and data base



Cooperation on national, Nordic and international level.  
National decision about breeding goals etc. in specific boards.

# Our cattle data base is unique...



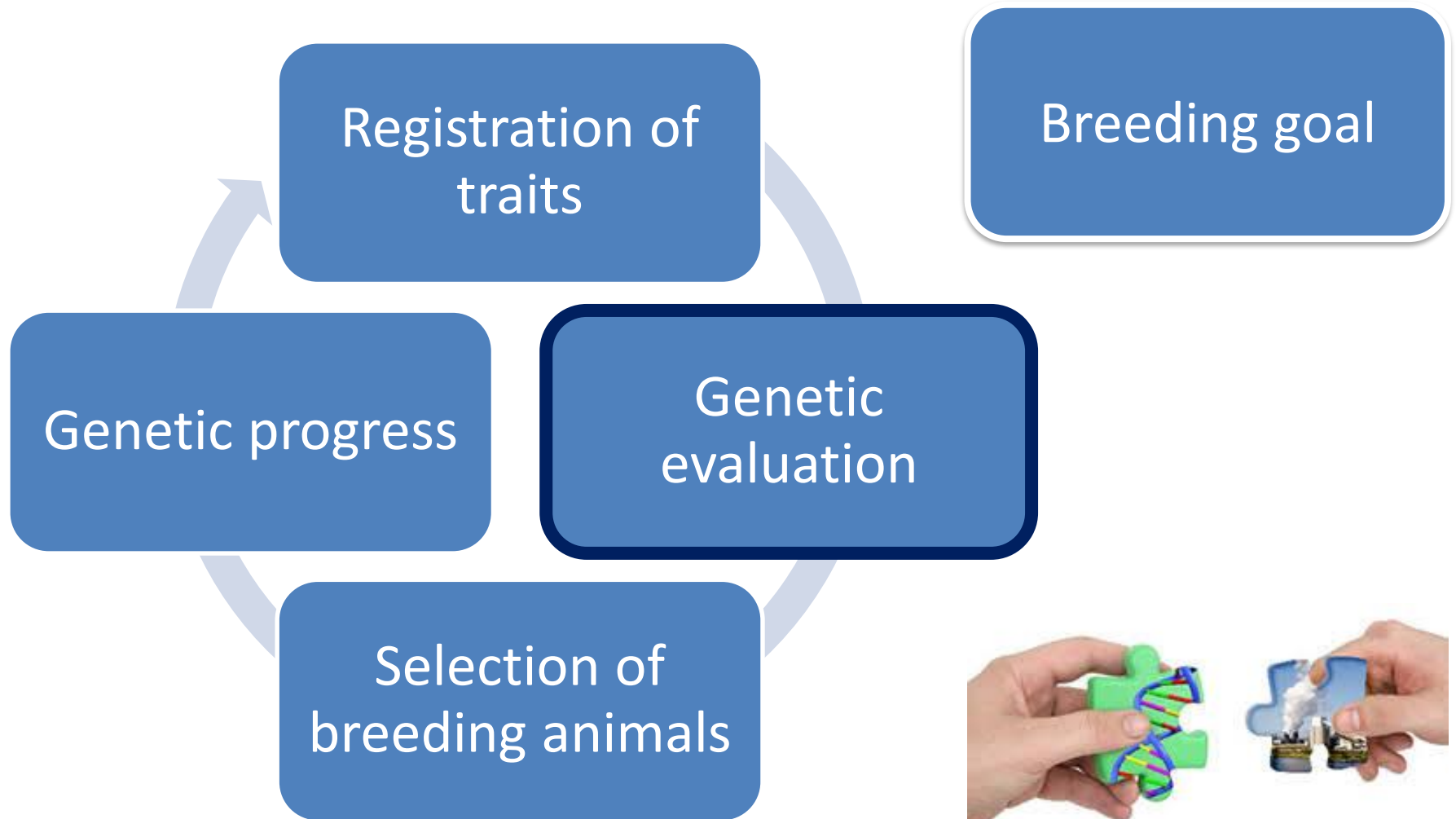
# Beef part of cattle data base: KAP = Kött Avel Produktion



- **KAP- avel (breeding)**
  - Pedigree herds that sell breeding animals with official pedigree, herdbook and breeding values
  - Birth, weaning (200d) and yearling (365d) weights
  - Calving and slaughter traits
- **KAP-production**
  - Production herds with suckler cows and slaughter animals that wants follow-up on calvings, growth and slaughter results

Approx. 8 % of the total number of Swedish suckler cows participate in beef recording

# Parts of a breeding program





# Breeding goal

- Each breed association has recommendations of how the breed should develop genetically
- For 5 breeds it is expressed by a **Total Merit Index** = combined breeding value based on economic importance of traits
  - Breeding value trait 1 \* economic weight trait 1 +  
Breeding value trait 2 \* economic weight trait 2 ....



# Registration of traits - *Statistics from KAP*

Herds and cows in KAP 2016	No. of herds	No of purebred cows	No. of other cows	Cows/herds
Pedigree herds	646	14390	2781	26,6
Production herds	95	1776	2580	45,9

## Calving results 2016– heifers and cows

Breed	No. of calvings	Age 1st calv. (mo)	% difficult calvings*	% stillbirth
<b>Charolais</b>	<b>4354</b>	<b>26,4</b>	<b>1,4</b>	<b>2,7</b>
Hereford	2852	25,9	1,8	3,4
Simmental	1897	25,0	1,7	2,1
Angus	1443	26,0	1,4	2,3
Limousin	1260	27,6	0,7	1,8
<b>All purebred</b>	<b>13038</b>	<b>26,9</b>	<b>1,5</b>	<b>2,5</b>

\* Trait in genetic evaluation

## Weight results 2016 – example bulls

Breed	# bulls	Birth wt (kg)*	# bulls	200d wt (kg)*	# bulls	365d wt (kg)*
<b>Charolais</b>	<b>1669</b>	<b>49</b>	<b>1438</b>	<b>319</b>	<b>1148</b>	<b>594</b>
Hereford	1266	44	1045	283	764	502
Simmental	822	49	730	355	497	612
Angus	545	40	552	287	353	497
Limousin	503	43	445	291	356	529

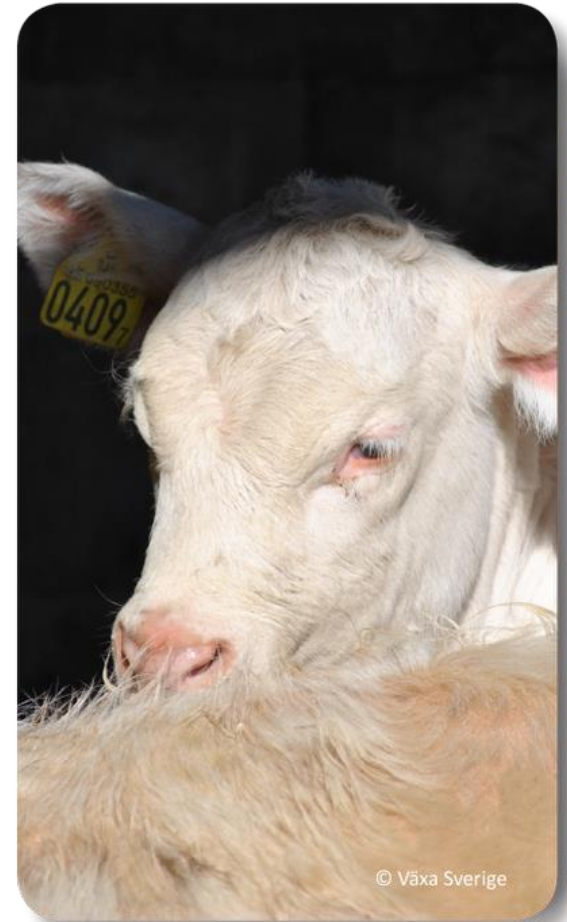
## Slaughter results 2016 – example young bulls

Breed	# bulls	Slaughter wt (kg)*	Carcass conformation (1 poor-15 excellent)*	Carcass fat (1 lean-15 fat)*	Age (mo)	Slaughter growth (g/d)
<b>Charolais</b>	<b>995</b>	<b>389,8</b>	<b>9,7</b>	<b>7,3</b>	<b>15,6</b>	<b>770</b>
Hereford	451	345,1	7,5	8,1	18,4	579
Simmental	357	382,9	9	7,2	15,9	746
Angus	112	344,7	7,7	8	18,8	567
Limousin	216	373,6	11,2	6,7	16,4	705

\* Trait in genetic evaluation

# Official national genetic evaluation beef breeds

- Published 3 times/year
  - Feb/March, Mid-May, Mid-Nov
- BLUP-method
  - 3 multi-trait animal models
- 11 single breeding values (EBVs) based on phenotypes for 7 breeds
  - Aberdeen angus, Blonde d'aquitaine, Charolais, Hereford, Highland cattle, Limousin and Simmental
- 3 sub-indices and 1 total merit index for 5 breeds
  - Not for Blonde and Highland



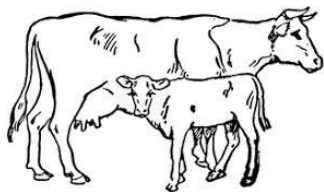
We also participate in international genetic evaluation....

# Model for growth traits (*since 2000*)

- Birth weight
- 200d weight
- 365d weight

## 5 + 1 official EBVs

- BWT direct
- BWT maternal
- 200d direct
- 200d maternal
- 365d
- Total growth



## Maternal EBVs

- based on registrations on calves after a cow
- describes *genetic ability of the cow* to affect the trait expressed in the calf
- 200d mat – cow's genetic capacity for milk production affecting early growth

# Model for carcass traits (*since 2005*)

- Slaughter weight
- Carcass conformation
- Carcass fat

*+ 3 indirect traits:*

*Birth weight, 200d weight,  
365d weight*

## 3 official EBVs

- Carcass gain
- Carcass conformation
- Carcass fat



**Marbling** – a future trait of interest for genetic evaluation?



# Model for calving traits (*since 2005*)

- **Calving ease (1st parity cows)**

*+ 3 indirect traits:*

*Calving ease (later parities), Birth weight (first and later parities)*

## 2 official EBVs

- CAE direct
- CAE maternal



- Low but unfavorable genetic correlation between direct and maternal effect
- A bigger cow has easier calvings but if her calf is also bigger it might have more difficulties being born...

# Sub-indices and total merit index (*since 2009*)

- Angus, Charolais, Hereford, Limousin, Simmental
- Breed-specific economic weights

3 sub-indices

- **FIX=Födelseindex** (Birth)
- **MIX=Modersindex** (Maternal)
- **PIX=Produktionsindex** (Production)

1 total merit index

- **AIX=Avelsindex** ("the breeding goal")



# Sub-indices for improving trait groups



**Birth index (FIX)** – based on CAE direct

- Describes calf's genetic capacity to be easily born

**Maternal index (MIX)** – based on CAE mat and 200d mat

- Describes the cow's genetic capacity to have easy calvings and give calves with high growth (through high milk production)

**Production index (PIX)** – based on carcass gain, carcass conformation and carcass fat

- Describes the animal's genetic capacity for high growth and carcass quality
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# Total merit index (AIX)

- Describes genetic capacity for profit

Economic weights for Charolais –  
*Expressed on the scale of relative breeding values*

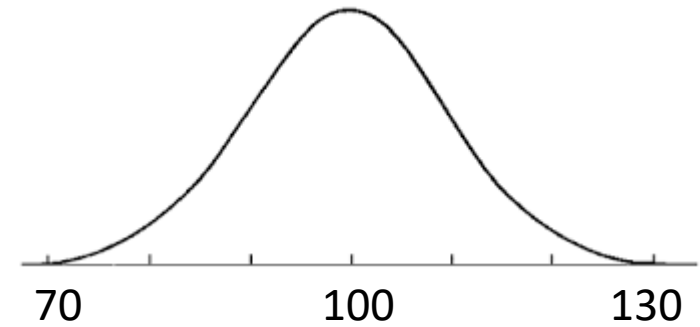
	Weight	Rel. Wt (%)
<b>MIX</b>		
CAE mat	0,1	4
200 mat	0,3	13
<b>PIX</b>		
Carcass gain	0,7	30
Carcass conformation	0,3	13
Carcass fat	0,1	4
<b>FIX</b>		
CAE dir	0,8	35



Weights give an idea but  
not the full picture of the  
effect of a breeding goal

# Presented breeding values

- The genetic capacity...
  - Presented as relative breeding values
  - Can be back-translated into kg, score...
- ...predicted with a certain reliability
  - Depends on heritability and available info
  - Differ a lot between AI bull and a calf



Animals born 5-9 yrs ago have in average EBV=100 (AIX=0)

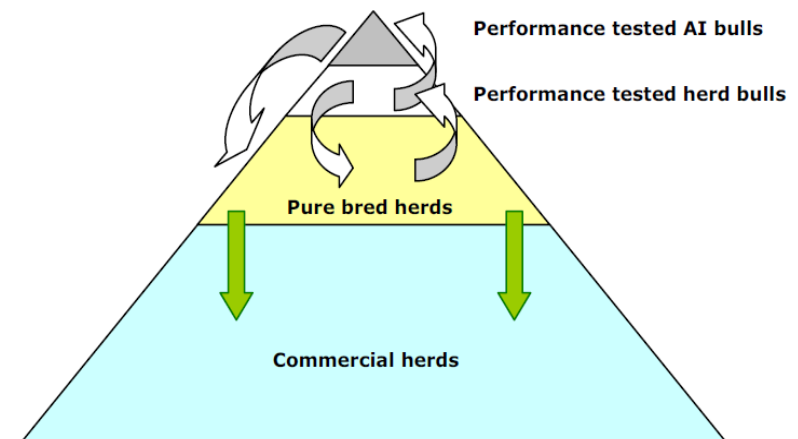


Breeding values of importance in different levels of selection in the breeding program (herd level, test stations, AI company)...

# Breeding program for Charolais

Covered more in previous presentation

- Charolais breeding goal
- Performance test station
  - Registrations
  - Tools for selection:
    - Growth index (T-tal)
    - New index coming combining:
      - Growth, conformation, breeding values etc...
- AI bulls
  - Selected to perform well both in beef and dairy herds



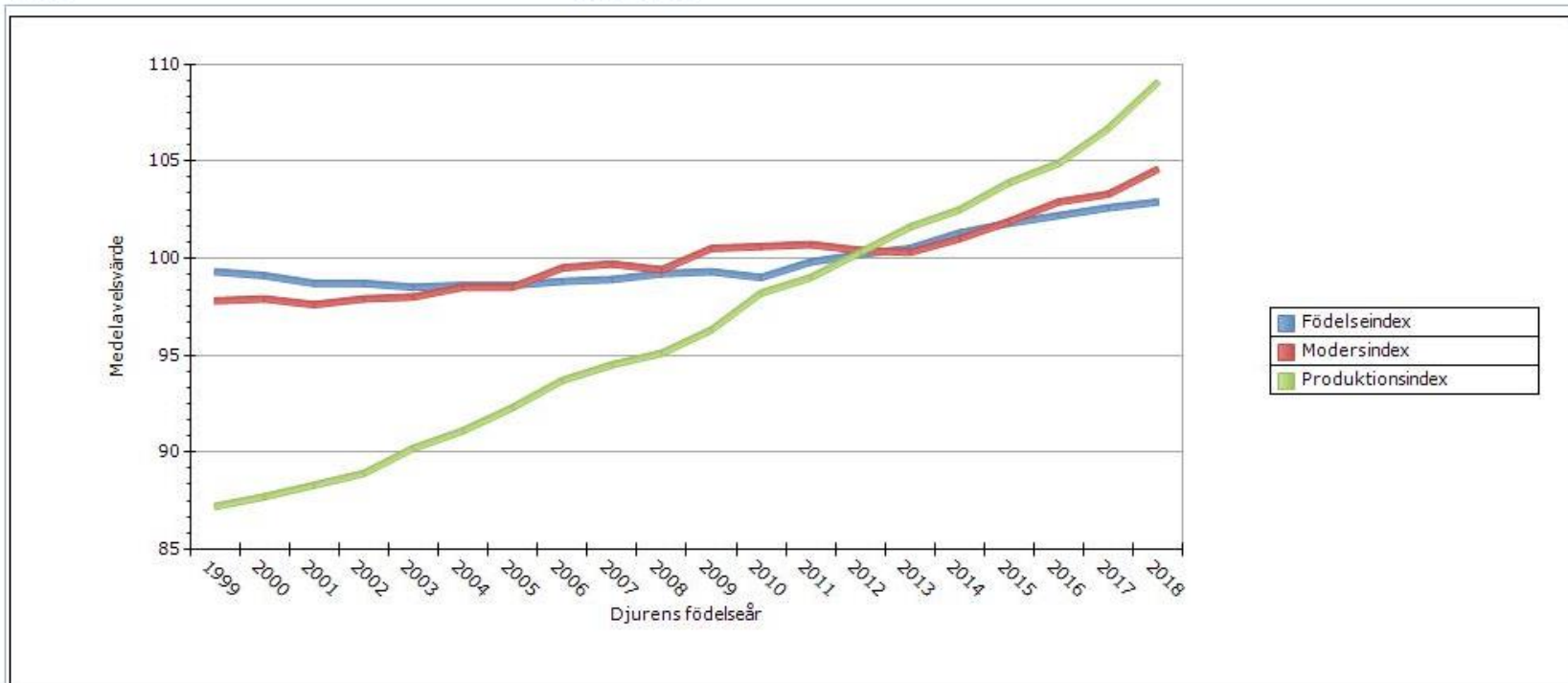


# Genetic progress in Swedish Charolais

- Improved genetics for total profit and sub-indices:
  - **FIX**: calves that are born more easily
  - **MIX**: cows with easy calvings and high milk production
  - **PIX**: animals with high growth and carcass quality

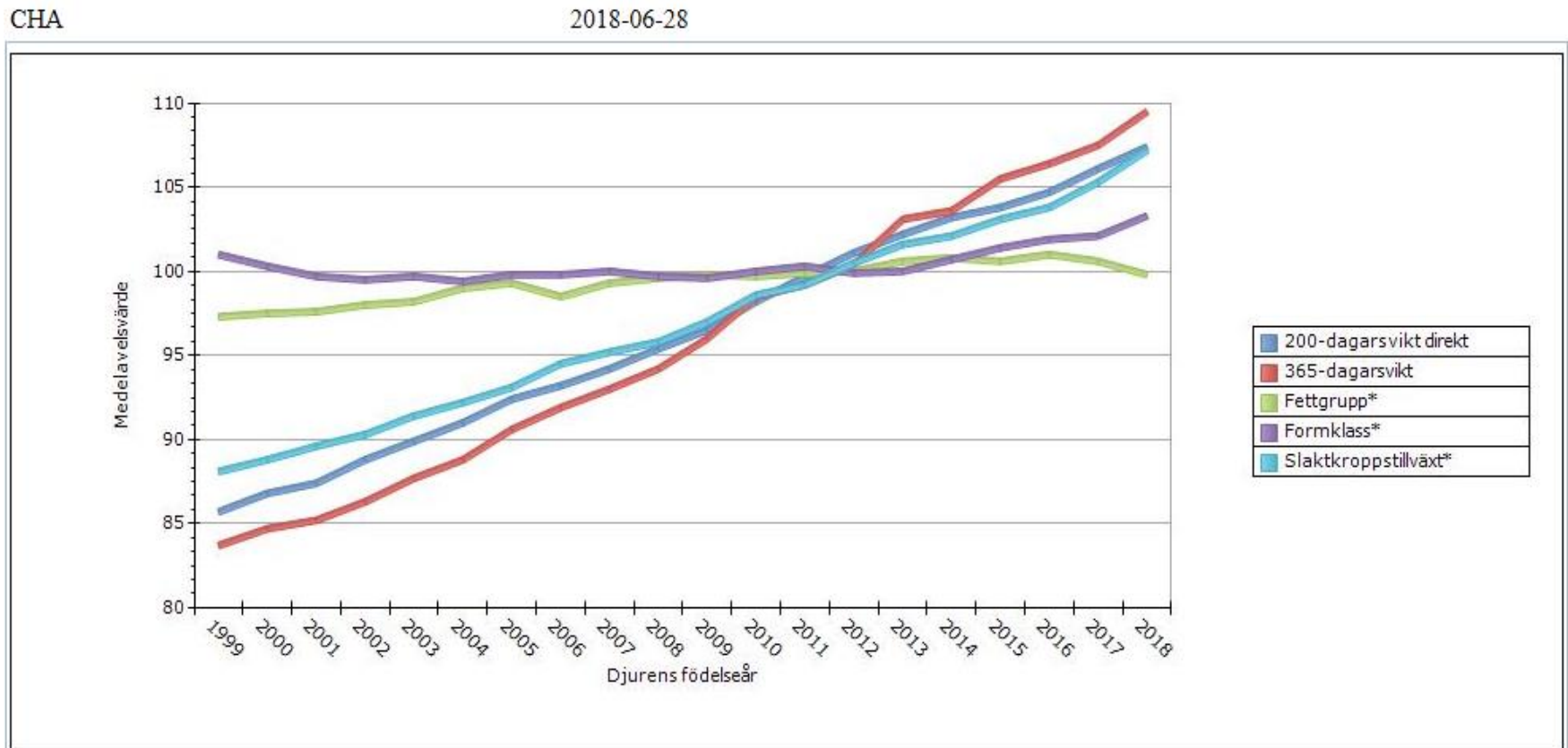
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# Genetic progress in Swedish Charolais

- Example on improved genetics for single EBVs for production:
  - Carcass gain: improved growth rate to slaughter
  - Carcass conformation: improved carcass quality





# Challenges for national beef breeding



- Often small beef breed populations
- Limited with resources
- Weak genetic links (herds, countries)
- Difficult to identify suitable bulls/AI for import

# Nordic and international cooperation is important

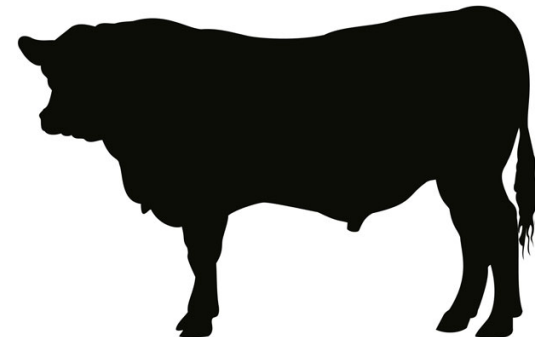
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  - Joint genetic evaluation and TMI for dairy breeds
  - Soon: joint evaluation of AI beef bulls used in dairy herds
  - Board decision for joint genetic evaluation for beef breeds
  - Currently participates jointly in Interbeef for beef breeds
- Interbeef
  - International evaluation for beef breeds



# Nordic evaluation of AI beef breeds used in dairy herds I



- Increased use of beef semen in dairy herds
  - Dairy farmers want to select beef bulls (across breed) giving profitable crossbred calves
- Nordic Breeding values coming (end 2018)
  - Calving traits in first and later parities
  - Carcass traits based on heifers and bulls



# Nordic evaluation of AI beef bulls used in dairy herds II



- Crossbred calves
  - Dam: purebred dairy cow
  - Sire: purebred AI beef bull
- Sire breed used differs between county
  - Proportion crossbred calves →

Sire breed	DNK	FIN	SWE
Angus	1.9	16.9	11.3
Blonde	3.2	22.8	2.2
Danish Blue	66.9	-	-
Simmental (beef)	6.6	9.2	27.1
Charolais	3.6	9.2	26.4
Hereford	0.6	4.2	18.4
Highland	0.0	0.1	0.2
INRA	4.3	-	-
Limousin	12.7	37.7	14.3



# Nordic genetic evaluation of purebred beef breeds



- Will be developed for breeds and traits in current national evaluations
- Work initiated via joint participation in Interbeef

Summed number of animals (expressed in thousands) with records for the most common breeds in the 3 national evaluations (201605)

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	CHA	HER	LIM
<b>Calving ease</b>	<b>301</b>	352	390
<b>Birth wt</b>	275	247	244
<b>200d wt</b>	166	132	94
<b>Carcass wt</b>	128	185	235

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**Future traits of interest:**  
female fertility, longevity,  
conformation

# Difficulties with international exchange of breeding animals based on foreign breeding values

Different breeding goals

Different registrations

Different  
calculations/methods

**Different genetic levels**

**Different environments**



**Different scales for  
EBVs**

## **International EBVs for comparing animals across countries**

- Uses all known pedigree within and across populations
- Handles differences in national evaluations
- **Possibility for greater genetic progress**

# International EBVs beef breeds – 3 advantages

## **1. Import animals/AI**

- small populations have a higher need for foreign genetic material suitable for our breeding goals

## **2. Export animals/AI**

- Increased possibilities to sell/spread high quality genetics

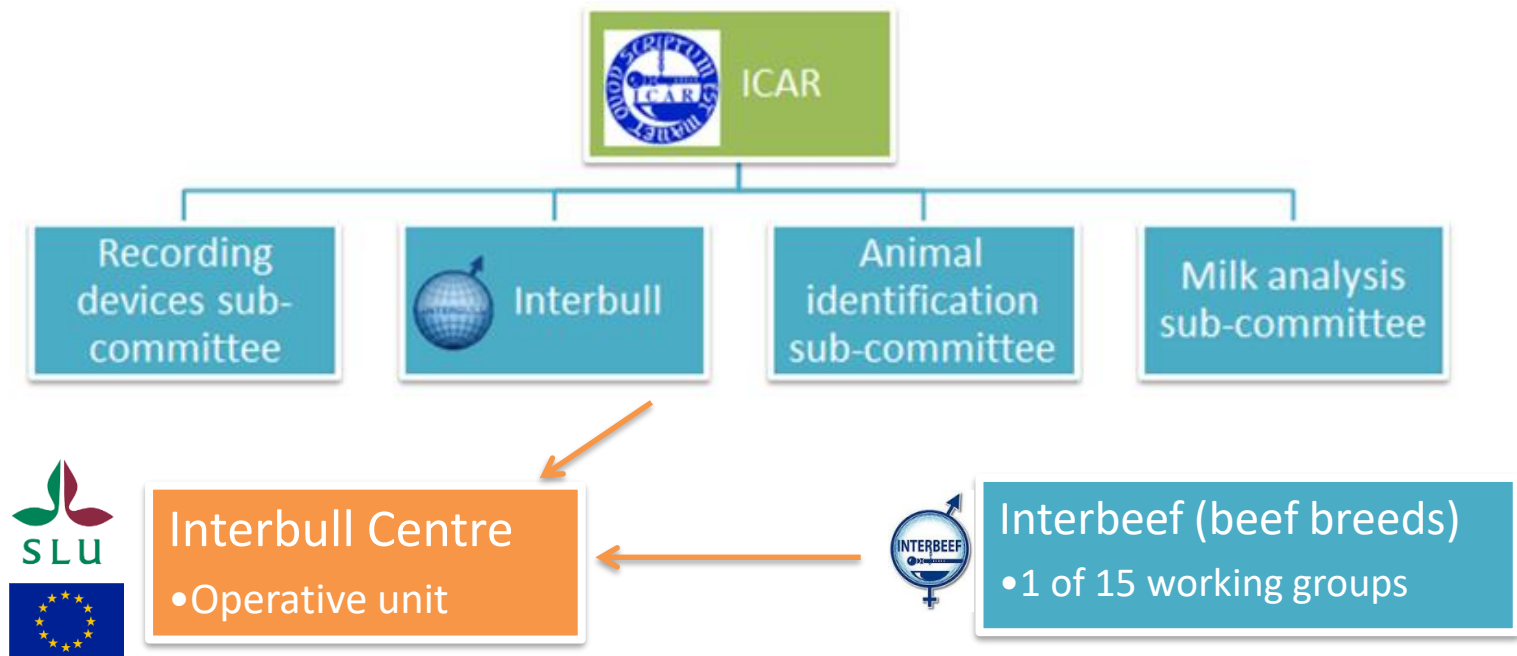
## **3. More reliable breeding values**

- For foreign animals or domestic animals with foreign pedigree



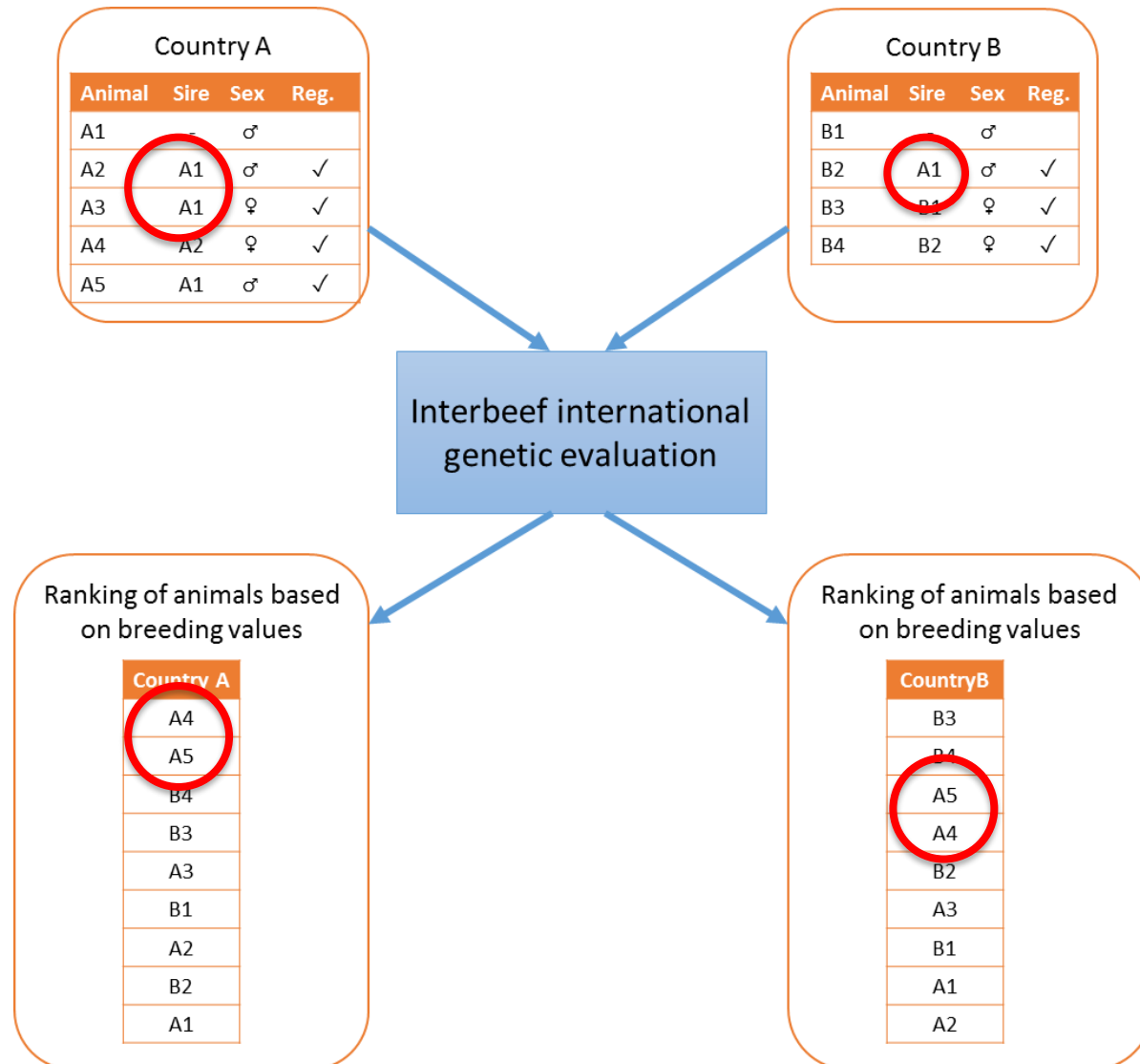
# Interbeef - organization structure

- ICAR = International Committee for Animal Recording
- Interbull = International Bull Evaluation Service (1983)
  - Perform international dairy evaluations



# Principle for Interbeef

- **Country registrations and pedigree**
  - Genetic links needed
- **Genetic model accounts for differences**
  - Registrations from different countries = different traits
- **One EBV per country for each animal**
  - Re-ranking occurs



# INTERBEEF – current routine

- 1st official Interbeef EBVs 2015 (Jan)
- Currently 3 traits – direct and maternal EBVs
  - Adj. weaning weight
  - Birth weight
  - Calving ease
- ...and 3 breeds
  - Charolais, Limousin, beef Simmental
- 2 official runs/year (March and Nov)
- Participating populations/countries
  - CHE, CZE, DEU, **DFS** (Denmark, Finland, Sweden), FRA, IRL, GBR (LIM) + AUS





# Publication of results

- Official Interbeef results on DFS scale for single traits from NAVs web page: [www.nordicebv.info](http://www.nordicebv.info)
- Current top list of internationally official charolais bulls based on weaning weight direct

Ranking	International ID	International name	Birth year	Birth date	AWW direct - Breeding value	AWW direct - Reliability (%)
1	CHAFRAM007121963595	IMPOSANT	2013	20130322	148	49
2	CHAFRAM005109037940	EPERNAY	2009	20090913	147	69
3	CHASWEM020923167708	DAYBREAKER AV SONARP	2008	20080324	147	80
4	CHASWEM064631190809	ENOK AV NYBO	2009	20090309	147	85
5	CHAFRAM005706034572	ILESTLA	2013	20130314	146	47

...and top 6 on calving ease direct...

CHAFRAM003615085279	ADONIS-LP	2005	148	43
CHAFRAM007121074461	VIZIR P	2004	137	81
CHAFINM000009501891	Kauniais Durango	2008	137	79
CHAFRAM005811112678	HERACLES	2012	135	54
CHAFRAM005703810336	GLASGOW	2011	134	65
CHASWEM056278223908	DANNY BOY AV JATSBERG	2008	134	80

# Development ongoing in Interbeef

- New traits in different research projects
  - Female fertility (age 1<sup>st</sup> calving, calving interval, number of calvings)
  - Slaughter traits
- More breeds
  - Crosses (after purebred beef sire)
  - ANG, HER
- Co-operation with ABRI/Breedplan and new countries...
- Facilitate genomic evaluation



Large differences between countries – many have too small populations and little resources to predict national genomic EBVs for beef

# Take home message...



- National beef breeding in Sweden is well-organized but genetic progress is limited by small populations and lack of resources
  - International cooperation is needed to facilitate exchange of genetics and to increase progress by including new traits and genomics
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Thanks for your attention and  
enjoy your stay in Sweden!



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