Measuring connectedness among herds in French breeding programs for meat sheep

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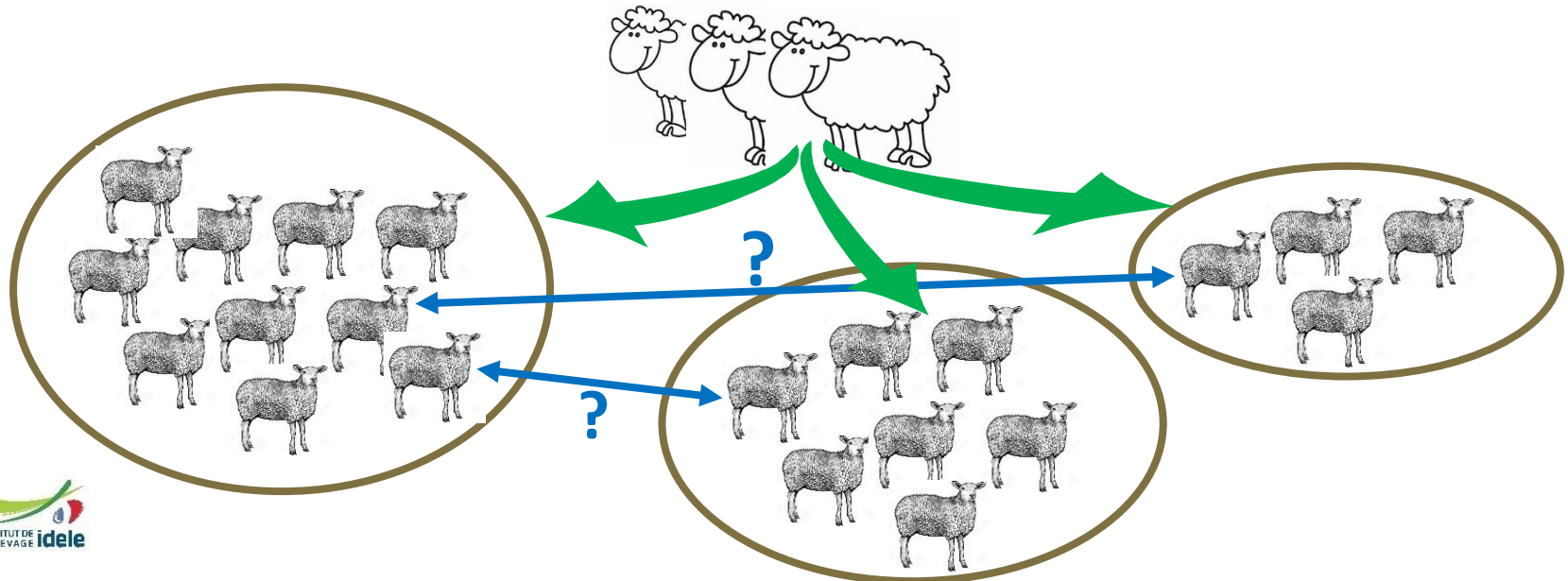
About connectedness…

- Genetic connectedness among herds through kinship and exchange of genes :
  - ✓ Use of artificial insemination (AI)
  - ✓ Sale of natural service rams
  - ✓ Sale of ewes (pregnant or not)
  - ⚠ **Pedigree registration**

- Impact on genetic evaluation:

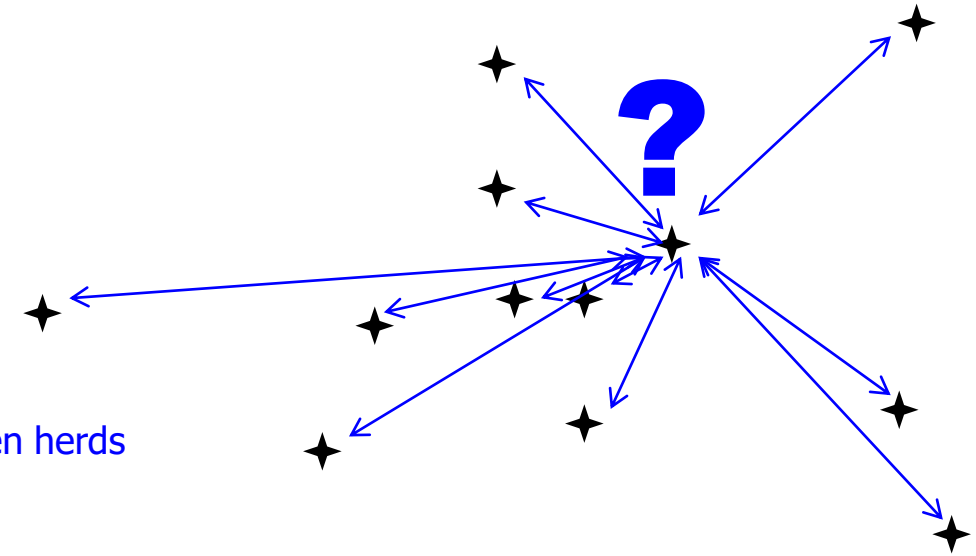
➢ Reliability of the comparison of EBVs of animals raised in different herds



How to estimate connectedness ?

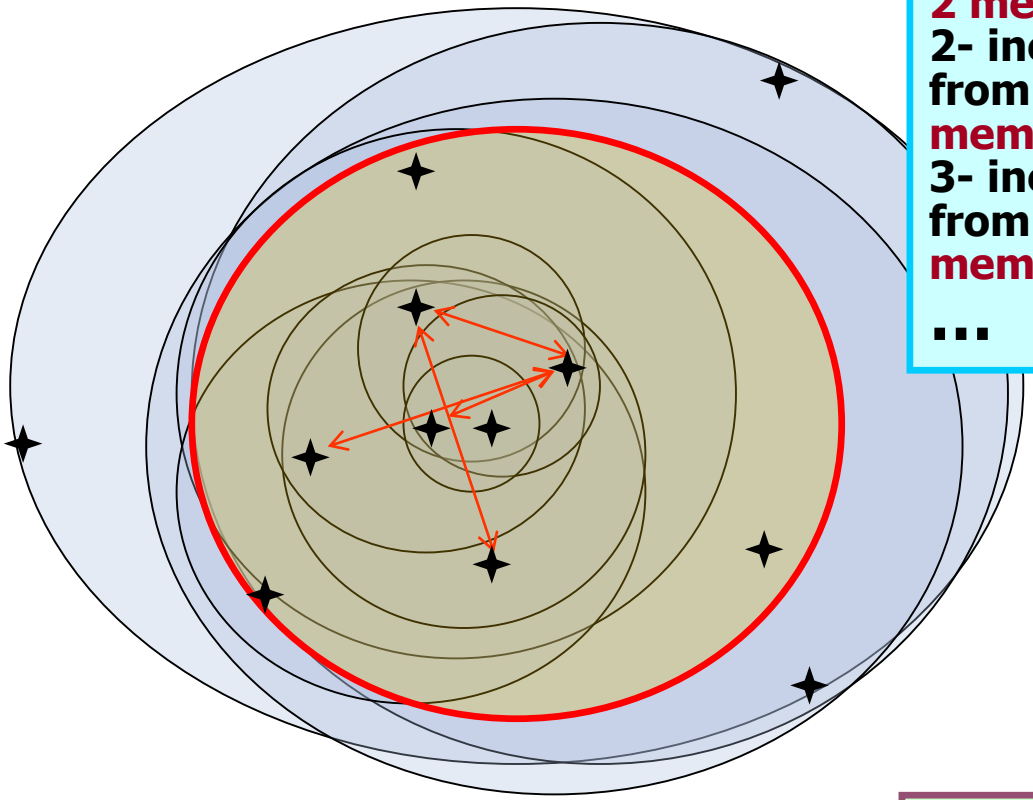
- **"Caco"** = French Criterion of Admission to the group of Connected Herds
  - for on-farm genetic evaluation of 13 beef cattle since 2002
  - for genetic evaluation of goats since 2007

  [Fouilloux & Laloë, 2001]
- 2 steps:
  1. **Estimating CDs of contrast between pairs of herds using a sampling-based method**
     -> by simulation: comparison of average "true" BVs vs. estimated BVs of animals from 2 herds
  2. **Clustering groups of connected herds (the CACO method)**



Within each breed:
one herd has (H-1) CDs of contrst with the others
→ Matrix: H(H-1) difference CD of contrast between herds

Guidelines of the CACO method



STEPS

1- Cluster of the 2 herds with the highest CD of contrast ➔ cluster of 2 members

2- including the less distant(1) herd from the cluster ➔ cluster of 3 members

3- including the less distant(1) herd from the cluster ➔cluster of 4 members

…

(1)The highest distance between that herd and each member of the cluster is the lowest =lowest CD of contrast is the highest

The lowest CD of the included herd
= CACO ∈[0 ; 1]
= Quantitative criteria

Application to on-farm genetic evaluation of French meat sheep

- Dataset = litter size at first lambing recorded during one of the last 5 campaigns [reference= 2018 campaign / 1200 herds]
  - →Identify current ewes in the herds (average annual renewal rate ≈ 20%)
- Missing sires replaced by one dummy sire in each herd per campaign
- Genetic model:
  - sire model (h^2=0,10) -> *pedigree link between herds*
  - with the following fixed effects:
    - ✓ Heard-year-season
    - ✓ Birth season of the ewe
    - ✓ Age at lambing
    - ✓ Reproduction method

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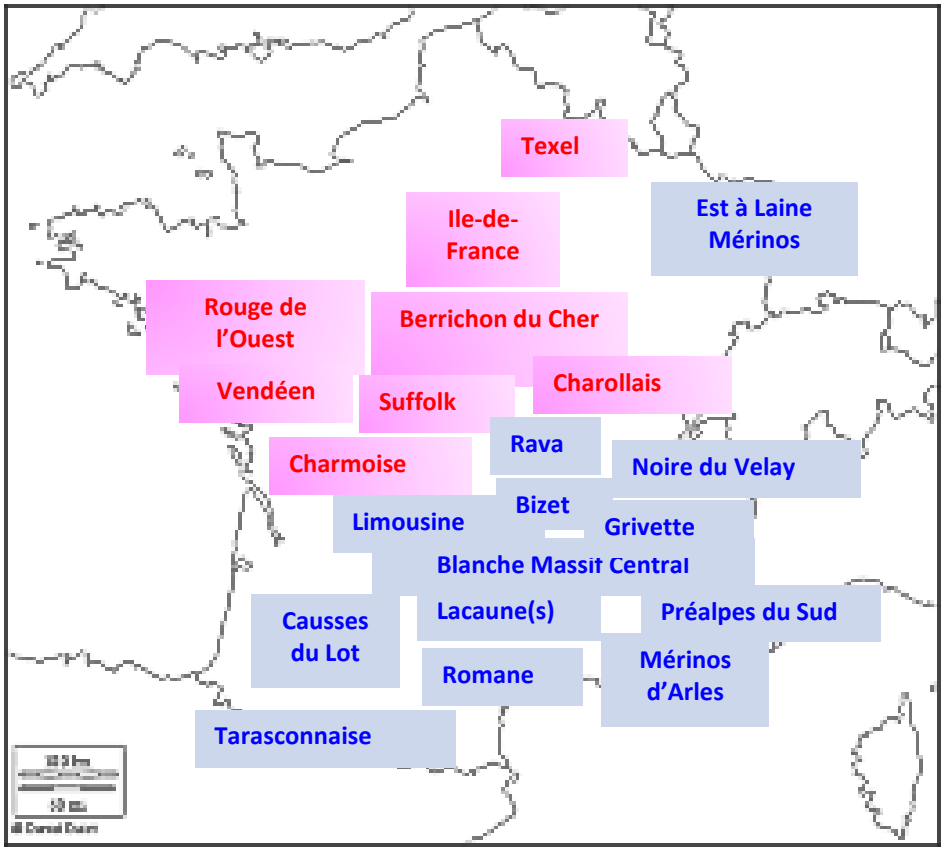
Application to on-farm genetic evaluation of French meat sheep



- in 22 meat sheep breeds
  - 8 Specialized meat breeds
    - **Average paternity rate: 92%** *[85%-99%]*
    - **Average AI rate: 26%** *[3%-50%]*
  - 14 Hardy breeds
    - **Average paternity rate: 54%** *[24%-91%]*
    - **Average AI rate: 24%** *[0%-86%]*

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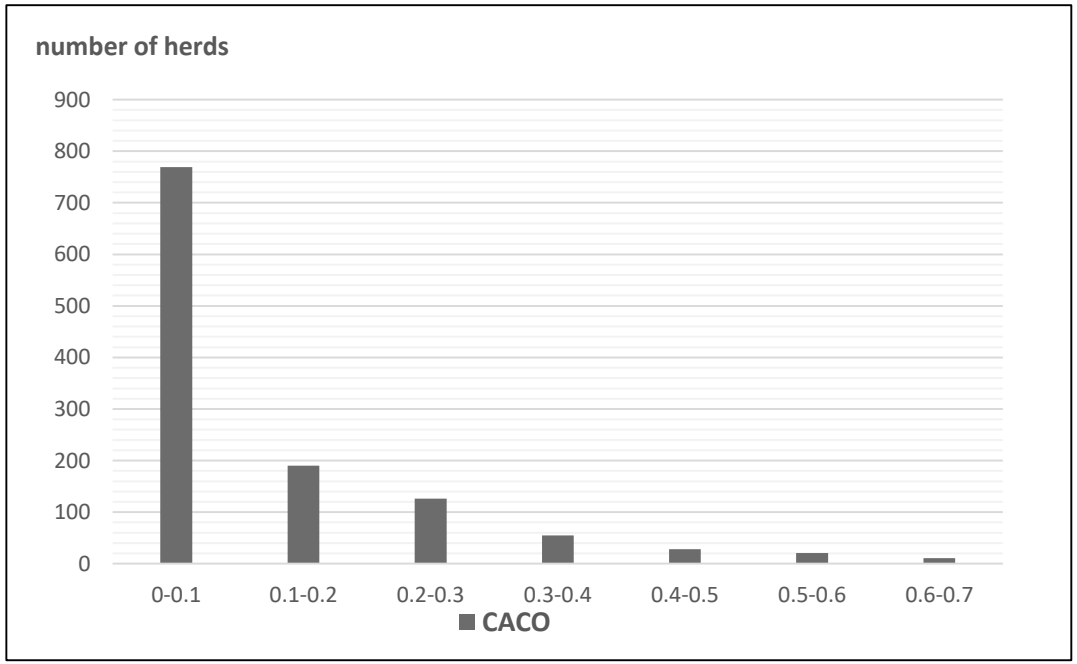
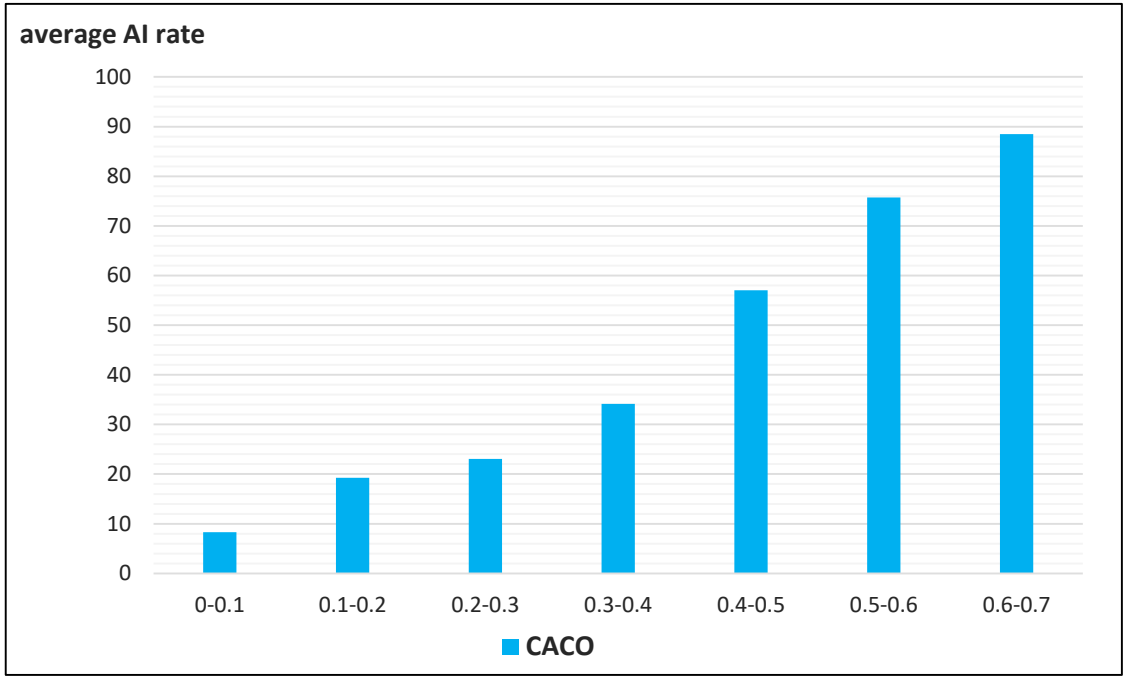
Application to on-farm genetic evaluation of French meat sheep



[over the 22 breeds]

Average CACO = 0.10 *± 0.14*

Application to on-farm genetic evaluation of French meat sheep

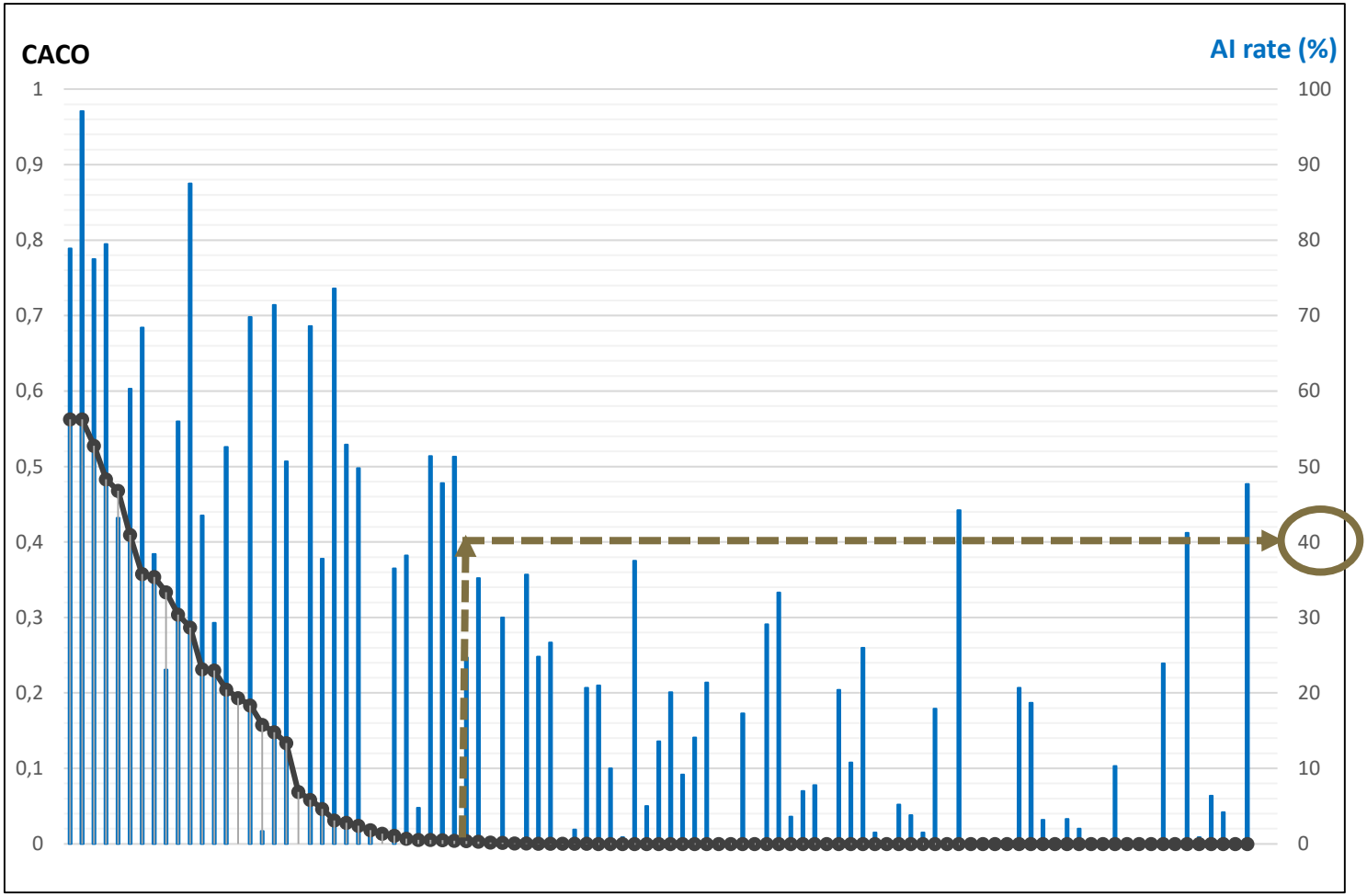


[over the 22 breeds]

AI rate: rate of ewes from AI sires calculated over for the last 5 reproduction campaigns

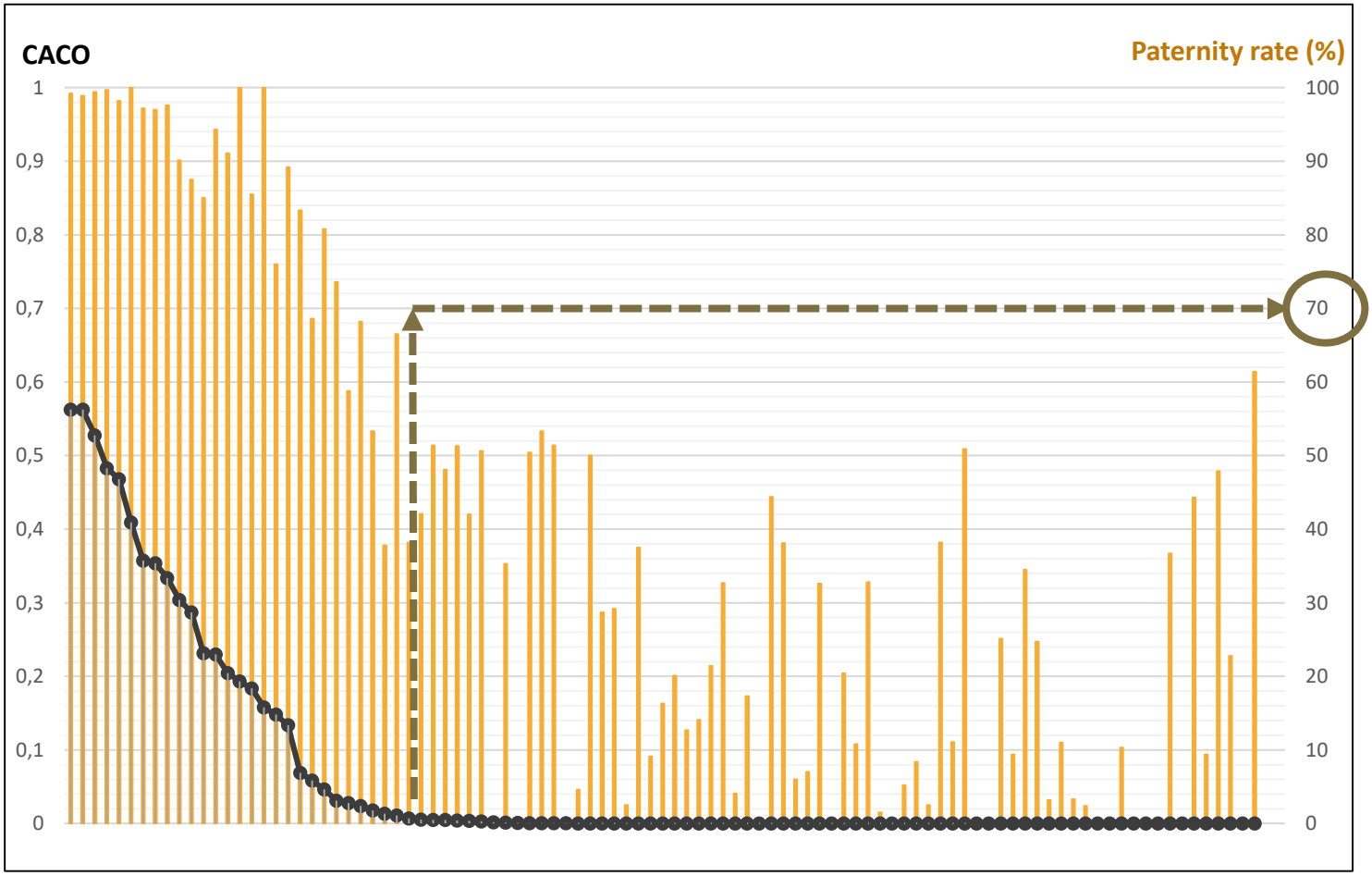
→ CACO was strongly related to the AI rate

Application to on-farm genetic evaluation of French meat sheep



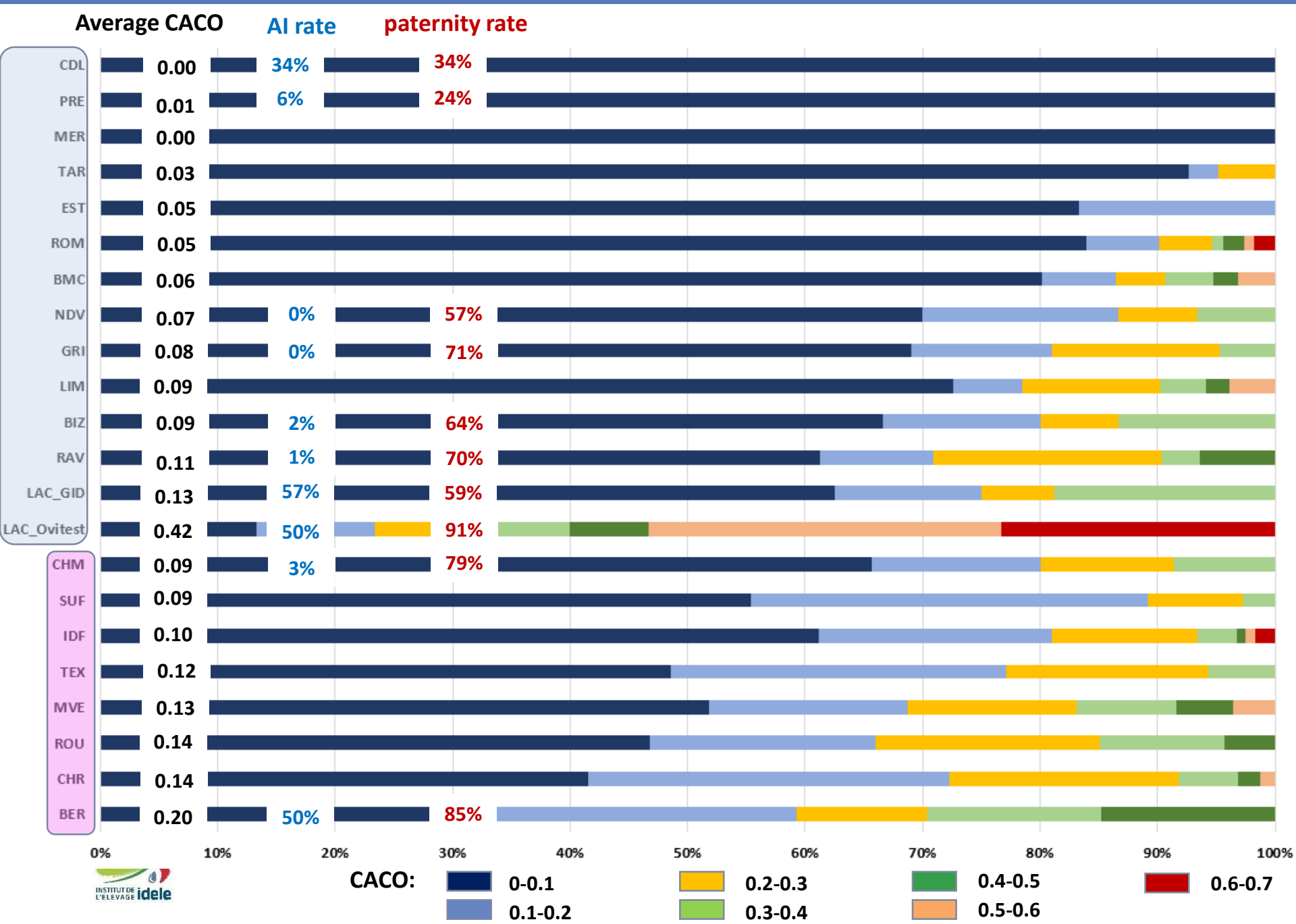
[e.g. Blanche du Massif Central breed]

Application to on-farm genetic evaluation of French meat sheep



[e.g. Blanche du Massif Central breed]

→ CACO was very sensitive to the percentage of missing sires


Average CACO
AI rate
paternity rate
CDL 0.00 34% 34%
PRE 0.01 6% 24%
MER 0.00
TAR 0.03
EST 0.05
ROM 0.05
BMC 0.06
NDV 0.07 0% 57%
GRI 0.08 0% 71%
LIM 0.09
BIZ 0.09 2% 64%
RAV 0.11 1% 70%
LAC_GID 0.13 57% 59%
LAC_Ovitest 0.42 50% 91%
CHM 0.09 3% 79%
SUF 0.09
IDF 0.10
TEX 0.12
MVE 0.13
ROU 0.14
CHR 0.14
BER 0.20 50% 85%
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
CACO:
0-0.1
0.1-0.2
0.2-0.3
0.3-0.4
0.4-0.5
0.5-0.6
0.6-0.7

Criteria of connectedness for French meat sheep herds

Consensus thresholds to define the connected status of a herd

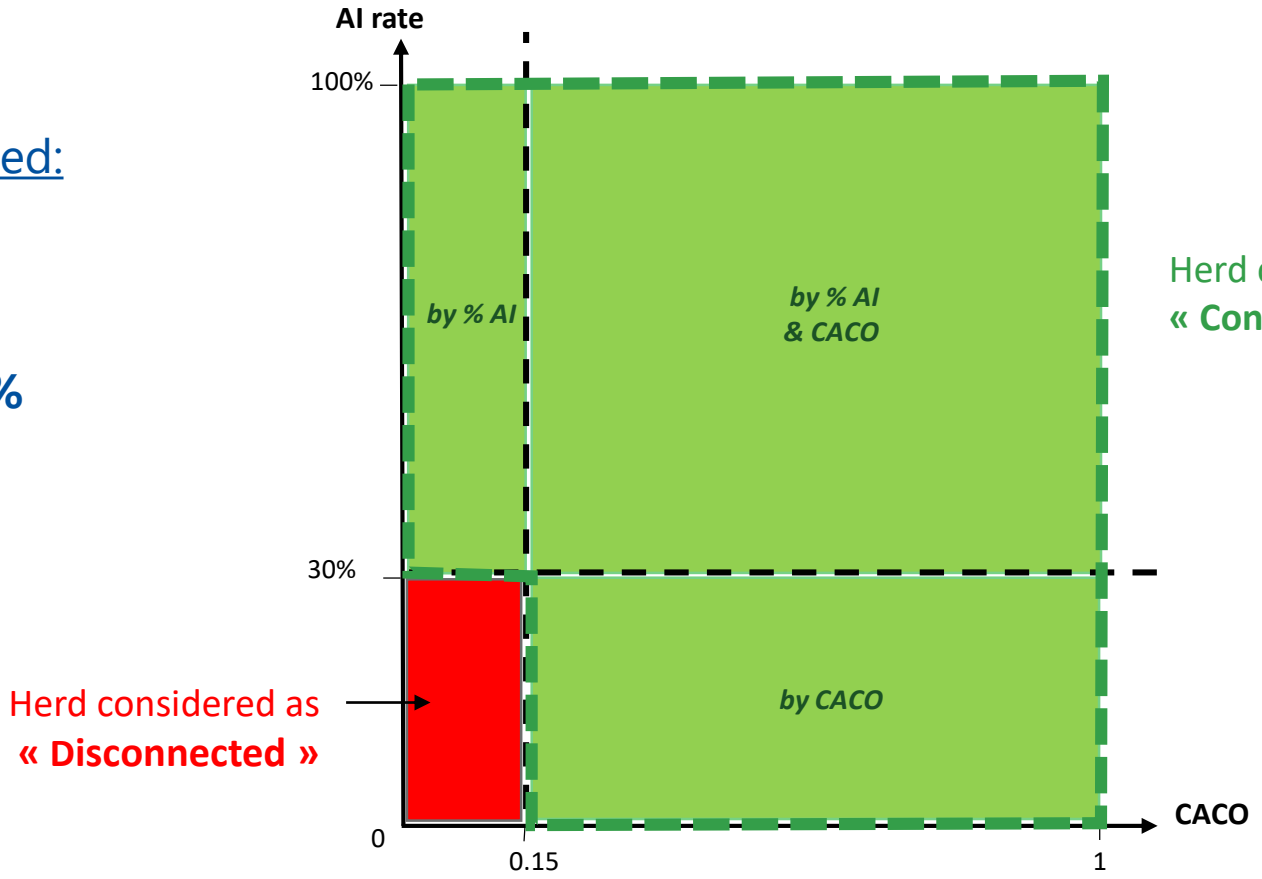
- In order to not discourage breeders
- To enhance the use of artificial insemination

Within each breed:

✓ **CACO ≥ 0.15**

AND/OR

✓ **AI rate ≥ 30%**



→ Officialy indicated on the certificate of pure-bred breeding animals from July 2018 on

Thanks for your attention !!