Developments in multi-source genetic evaluations for beef cattle: a BREEDPLAN perspective

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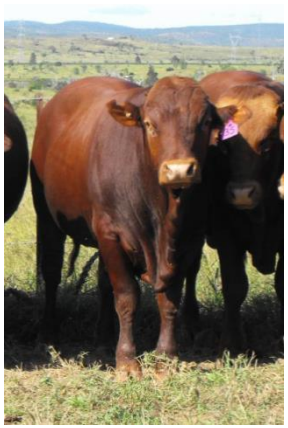
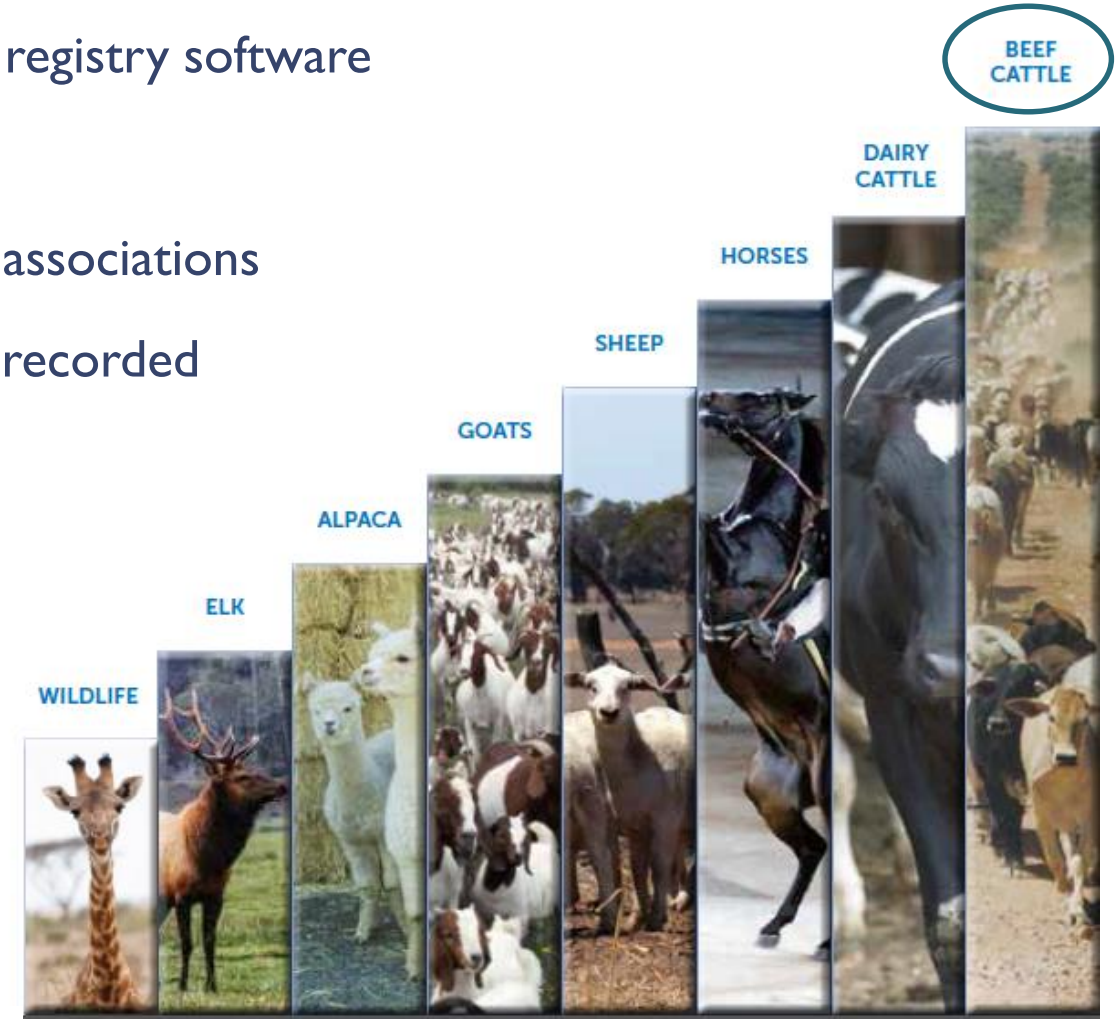


Agricultural Business Research Institute

- ABRI is a commercial company:
  - founded in 1970
  - based UNE, Armidale (AUS)
- primary business → to provide a diverse range of agribusiness information services to livestock industries, worldwide:
  - integrated pedigree & performance database (ILR2)
  - genetic analyses (BREEDPLAN)
  - breed registry services
  - extension services
  - multi-species

International Livestock Registry 2

- world-leading breed registry software
- multi-species system
- used by >190 breed associations
- > 40 million animals recorded
- “global language”



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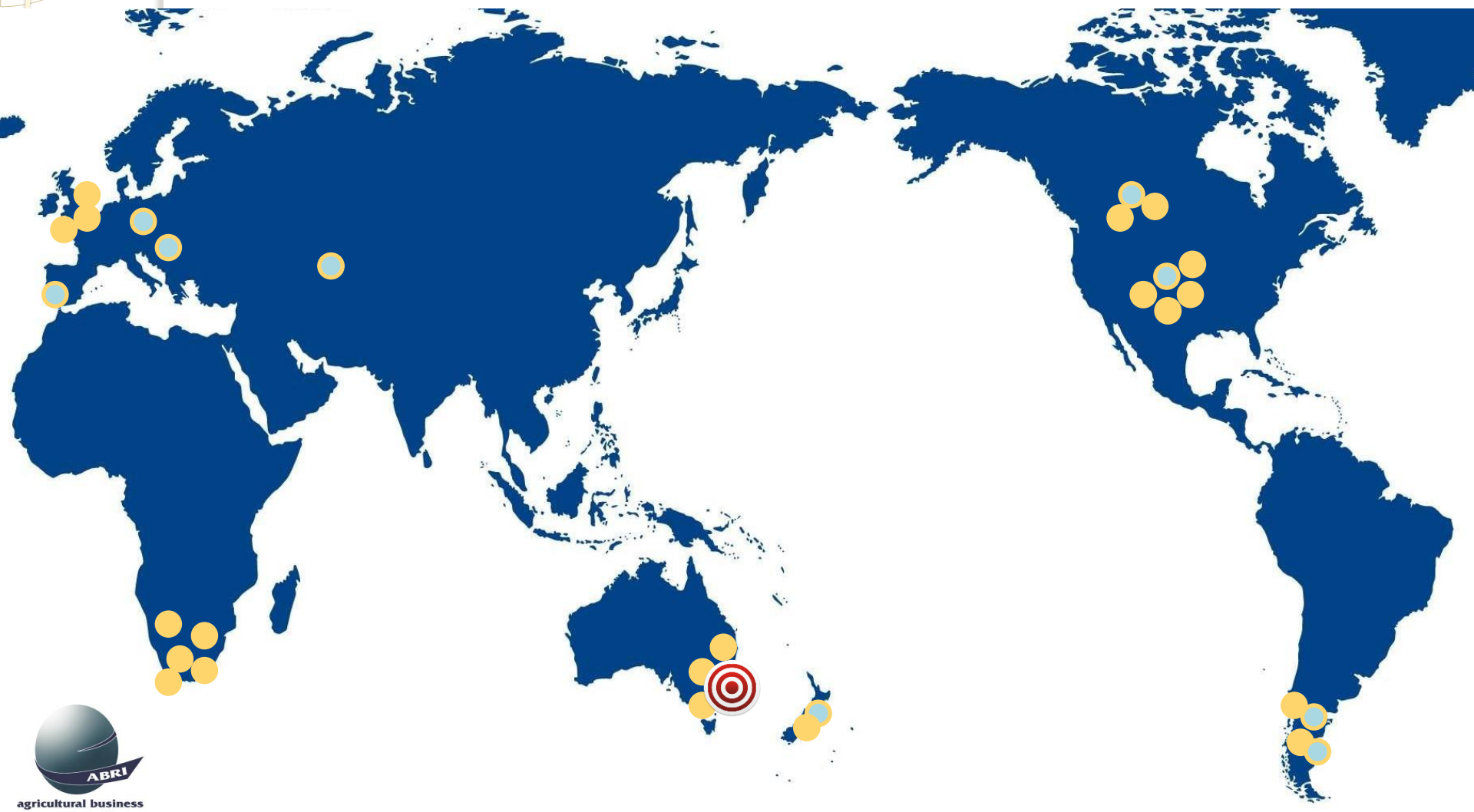
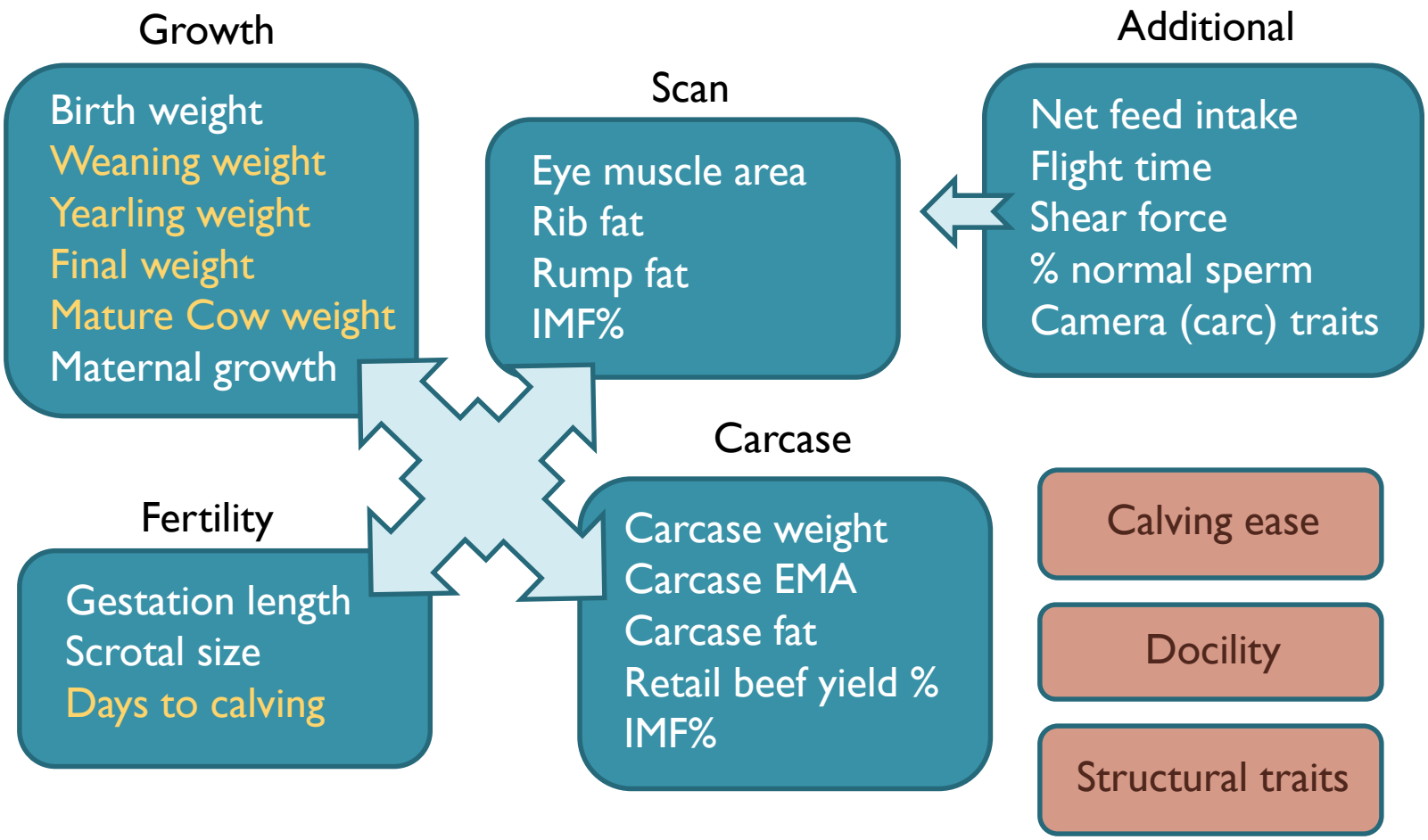
INTERNATIONAL BEEF RECORDING SCHEME BREEDPLAN

ILR2 – global language for beef cattle



- standardised PED, PERF, GENO extracts → for genetic analysis
- storage of cross-reference information → building global XREF files
- automated → no need for involvement of office staff

BREEDPLAN®



BREEDPLAN® software is developed by the Animal Genetics & Breeding Unit, a joint venture of the University of New England and NSW Department of Primary Industries, with support from Meat & Livestock Australia.

Multi-source BREEDPLAN developments

Breed	Countries
Hereford	AUS, NZ, CAN, UK, NAM, UY, AR
Brahman	AUS, RSA, NAM, USA

Country	Breeds
Australia	Brahman Santa Gertrudis Droughtmaster Belmont Red

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INTERNATIONAL BEEF RECORDING SCHEME
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Multi-country BREEDPLAN: approach

- **Each country:**
  - standarised extracts (ILR2)
  - estimate trait-specific parameters:
    - adjustment factors: AOC, AOD, sex-specific
    - variance components: V_A, V_M, V_C, V_{SXH}, V_E

- **Multi-country model:**
  - estimate across-country correlations, per trait
  - multi-country COVAR matrix:
    - pooled variances (weighted by effective phenotypes)
    - correlations (derived from most comprehensive data set)
  - model includes:
    - sire x herd interactions
    - allowance for heterogeneity of variance
    - comprehensive genetic groupings: country, year, "other breed"
  - single "multi-country" expression per trait

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Multi-country BREEDPLAN

Trait	Hereford-7	Brahman-4
Birth weight	1,749,276	795,466
Weaning weight	2,229,446	540,945
Yearling weight	1,374,949	260,690
Final weight	769,455	234,152
Mature cow weight	128,461	60,079
Scrotal circumference	243,519	52,922
Scan EMA	469,172	45,814
Scan RIB	471,333	43,474
Scan IMF	270,090	-
Total records	7,705,701	2,033,542

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INTERNATIONAL BEEF RECORDING SCHEME
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Multi-country BREEDPLAN: approach

Single country:

Current national COVAR

Country VAR, multi-country CORR

Multi-country COVAR

Validate assumptions

Multi-country:

Multi-country COVAR

Results

Animal is a Published Sire, Birth Wt. (kg) <= 2.2, 200 Day Wt. (kg) >= 20, 400 Day Wt. (kg) >= 28, 600 Day Wt. (kg) >= 38,

Primary Country	Birth Wt. (kg)	200 Day Wt. (kg)	400 Day Wt. (kg)	600 Day Wt. (kg)	Mat. Cow Wt. (kg)	Milk (kg)	Scrotal Size (cm)	Eye Muscle Area (sq.cm)	Rib Fat (mm)
Namibia	+2.1	+22	+35	+55	+60	+4	+1.8	+2.6	-0.4
USA	+1.6	+22	+34	+38	+44	+4	+0.5	+0.4	-0.1
Australia	+1.8	+22	+34	+44	+52	+1	+2.3	+1.5	+0.5
Australia	+1.4	+22	+29	+43	+40	+6	+3.5	+3.2	+0.3
Australia	+1.4	+22	+34	+44	+43	+4	+0.5	-0.7	+1.9
South Africa	+2.0	+21	+30	+44	+39	+6	+1.5	+2.4	-0.3
Namibia	+2.0	+21	+28	+42	+39	+6	+0.1	+3.7	0.0
USA	+2.1	+21	+32	+39	+49	+4	+0.7	+5.3	-1.2
Namibia	+2.2	+21	+28	+41	+61	+6	+0.1	+1.8	+0.4
USA	+1.9	+21	+35	+42	+51	+2	0.0	+5.8	-1.2
Australia	+1.1	+20	+28	+45	+42	+2	+2.7	+4.5	+0.3
USA	+1.4	+20	+33	+42	+41	+2	0.0	+4.6	-0.5
Breed Avg. EBVs	+2.1	+16	+21	+29	+34	+3	+0.4	+2.0	-0.2

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INTERNATIONAL BEEF RECORDING SCHEME BREEDPLAN

Multi-breed BREEDPLAN developments

BREEDPLAN EBVs

Santa Gertrudis
BREEDPLAN EBVs

Northern Multi-breed Database

Droughtmaster
BREEDPLAN EBVs

Belmont Red
BREEDPLAN EBVs

Northern Tropical BREEDPLAN analysis

Northern
Repronor
tabase

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INTERNATIONAL BEEF RECORDING SCHEME
BREEDPLAN

Current considerations:

- **Multi-country:**
  - cross-validation studies
  - inclusion of additional traits
  - transition to genomics (ssGBLUP)

- **Multi-breed:**
  - breed association structures
  - structured multi-breed herds
  - technical considerations
    - >1 (co)variance matrix?
    - implications for ssGBLUP





Thank you

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