



A cow for Australia

Jennie Pryce





Outline

- Index evolution
 - Listening to farmers and consumers
 - Showing the value
- Breeding for heat tolerance
- Breeding for feed efficiency



Selection index

- Includes traits that contribute to breeding objective e.g. profit
- Shapes the future cow
- Tool to select parents of the next generation
- You get what you breed for!





Question # 31

Which of these 2 (hypothetical) herds do you prefer?

8 less lameness cases per 100 cows per year

this one

or

1.5 kg more protein per cow per year

this one

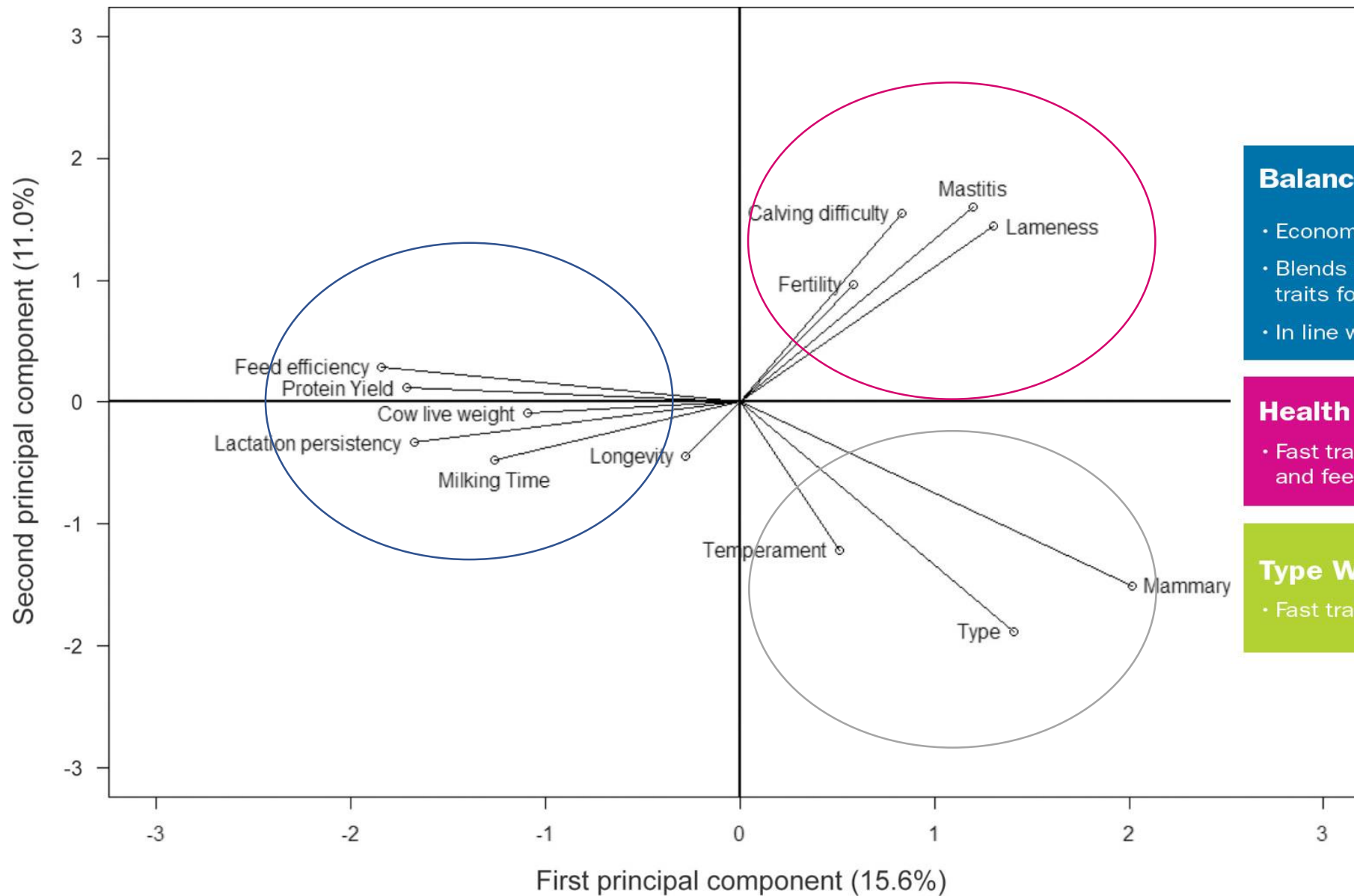
« undo last decision

they are equal

skip this question for now »

95% complete

☐ Larger font for questions (easier to read)



Balanced Performance Index (BPI)

- Economic index
- Blends production, type and health traits for maximum profit
- In line with farmer preferences



Health Weighted Index (HWI)

- Fast track fertility, mastitis resistance and feed saved



Type Weighted Index (TWI)

- Fast track type



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Your Herd's Genetic Snapshot

Last update: 27/03/17
National herd ID: 2345456X

Cows currently in herd : 706
Report breed code : Holstein and Holstein X

[x close](#)

Genetic Progress for Balanced Performance Index

The Balanced Performance Index (BPI) replaces the Australian Profit Ranking and achieves farm profit through a balance of longevity, health, type and efficient production.

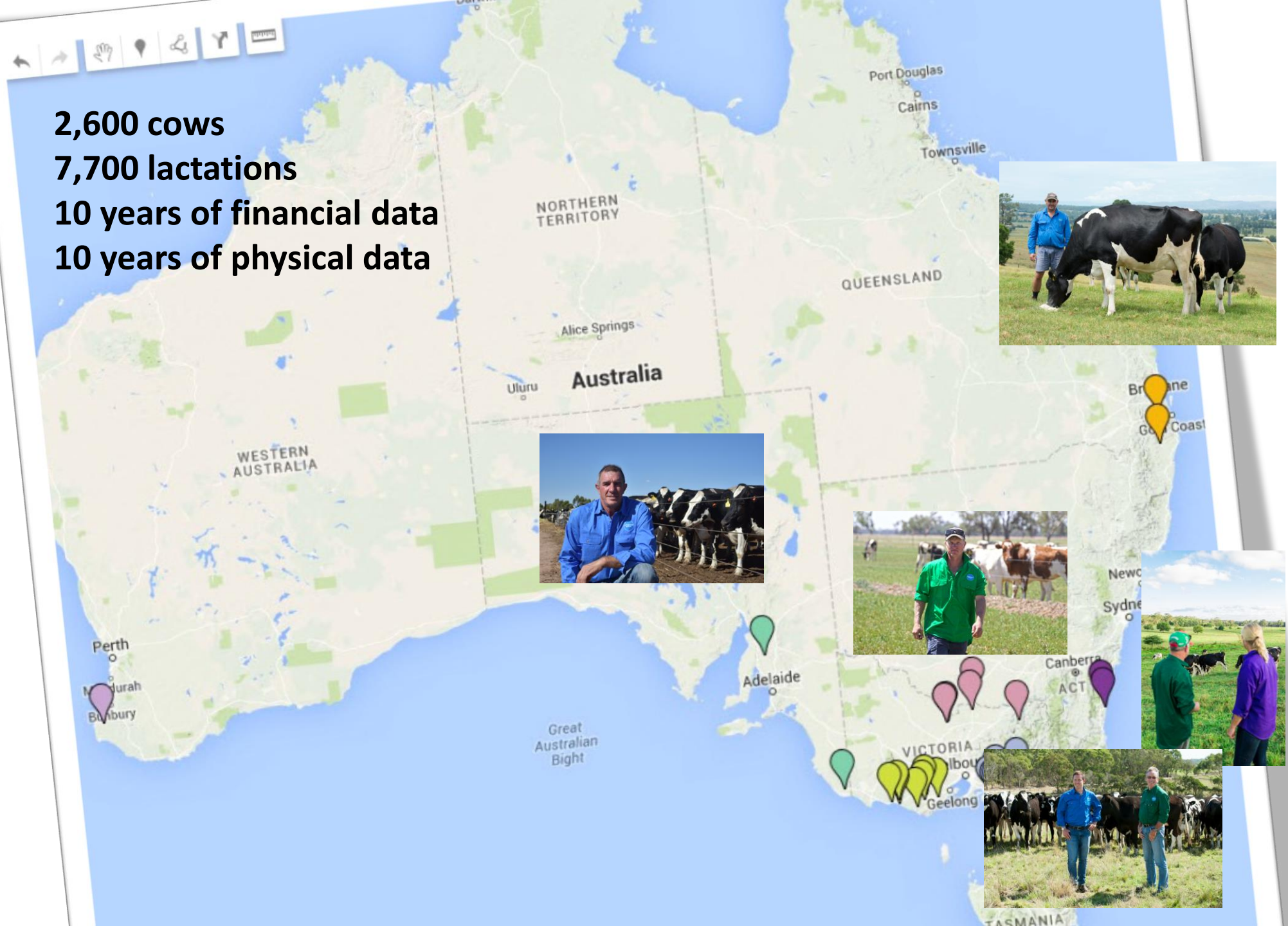


IMPROVING HERDS



Difference between top and bottom 25% of cows

2,600 cows
7,700 lactations
10 years of financial data
10 years of physical data

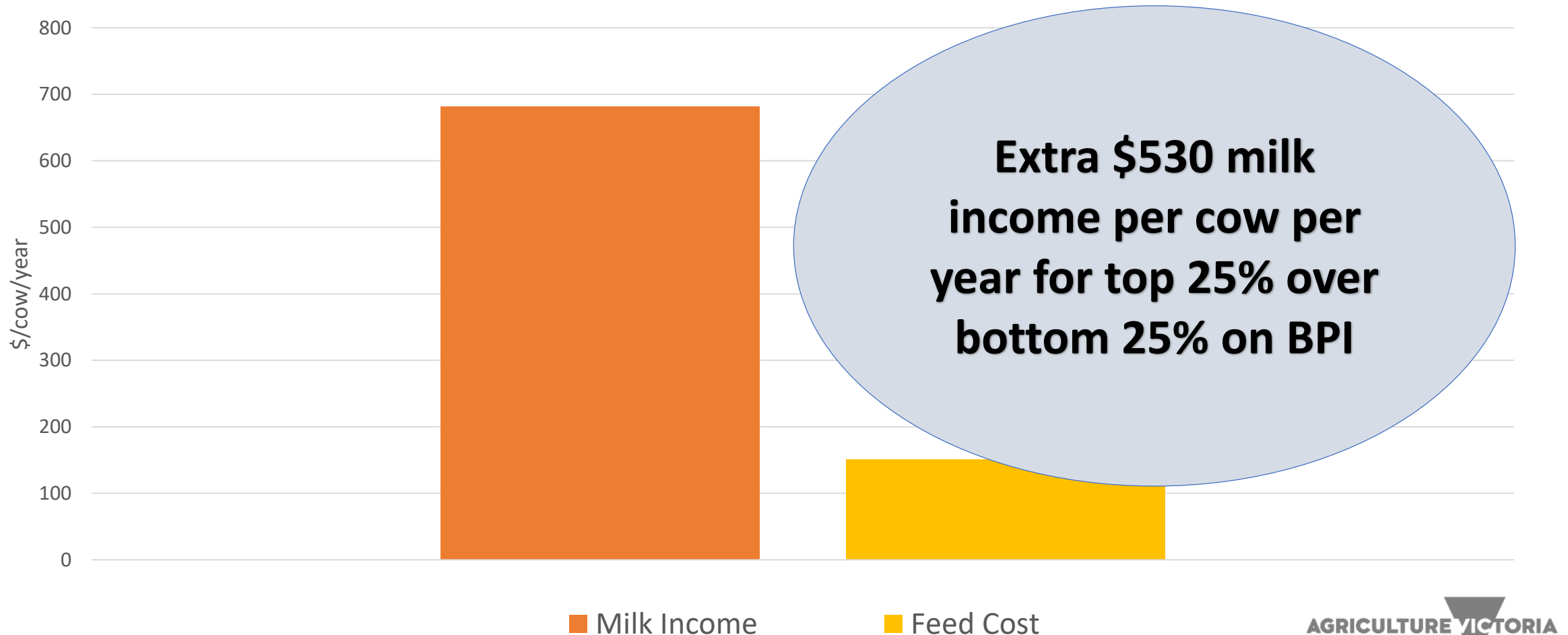


Graeme and Michele Hamilton

IMPROVING
HERDS



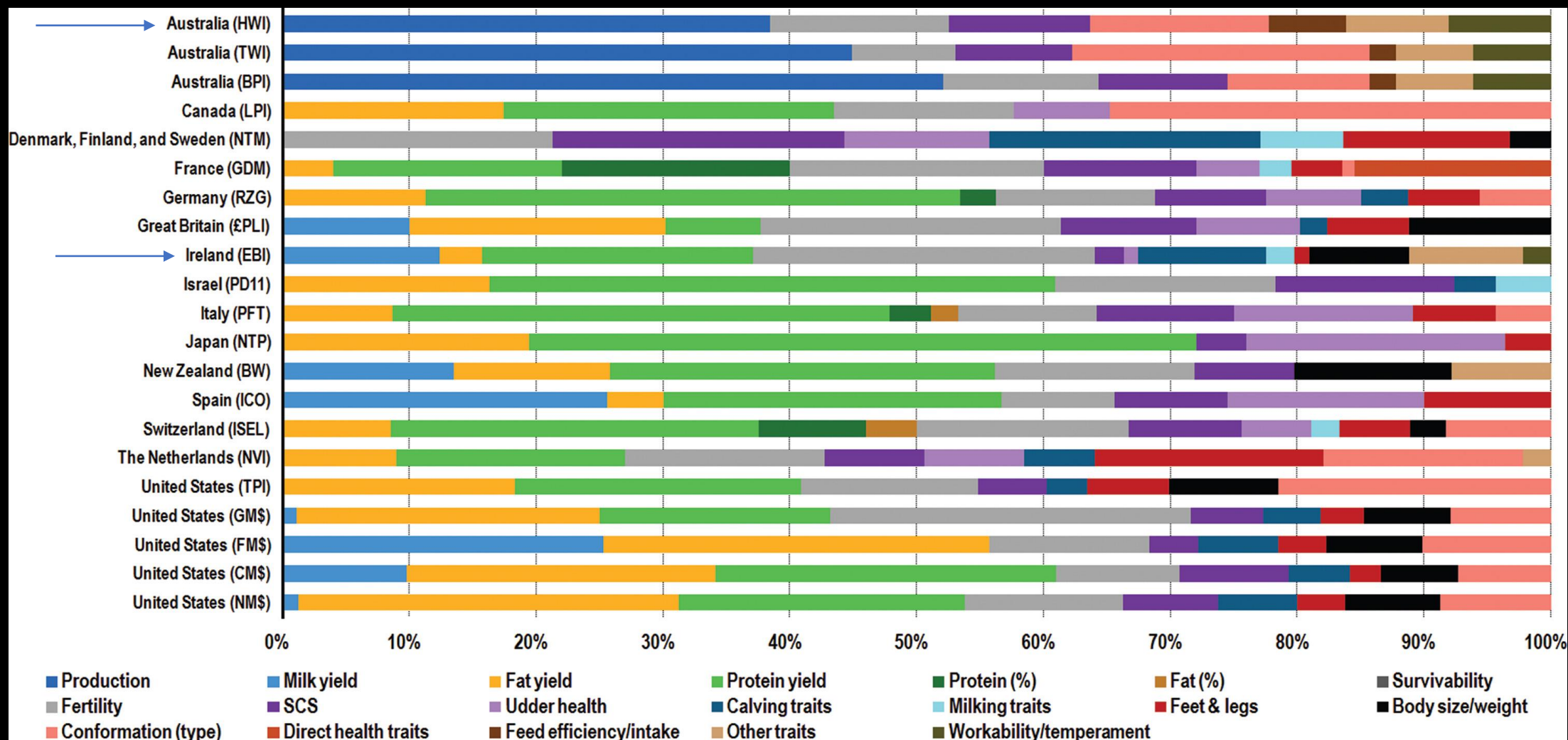
Milk income over feed costs



What about health, fertility, components?

Only Australia (BPI) and Ireland (EBI)
have validated selection index using
independent economic data

Traits included in 21 total merit indices of the United States and 16 other countries

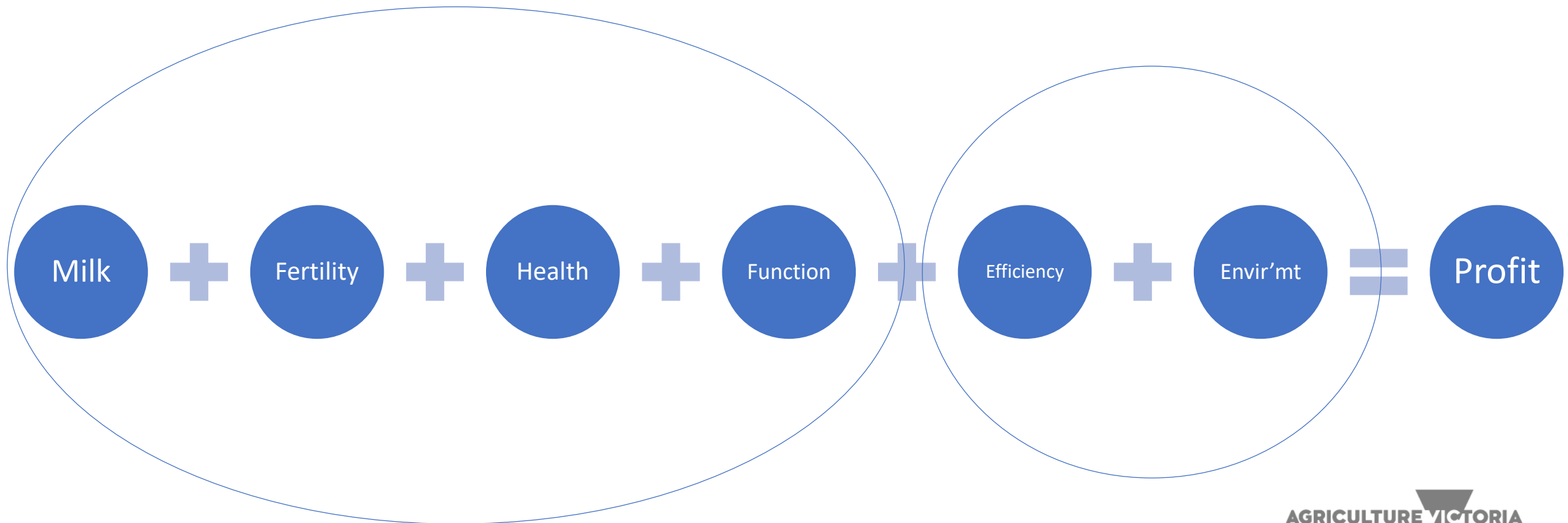


John Cole and Paul VanRaden “Possibilities in an age of genomics: The future of selection indices”

Journal of Dairy Science 2018 101, 3686-3701 DOI: (10.3168/jds.2017-13335)

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Selection indices in a nutshell

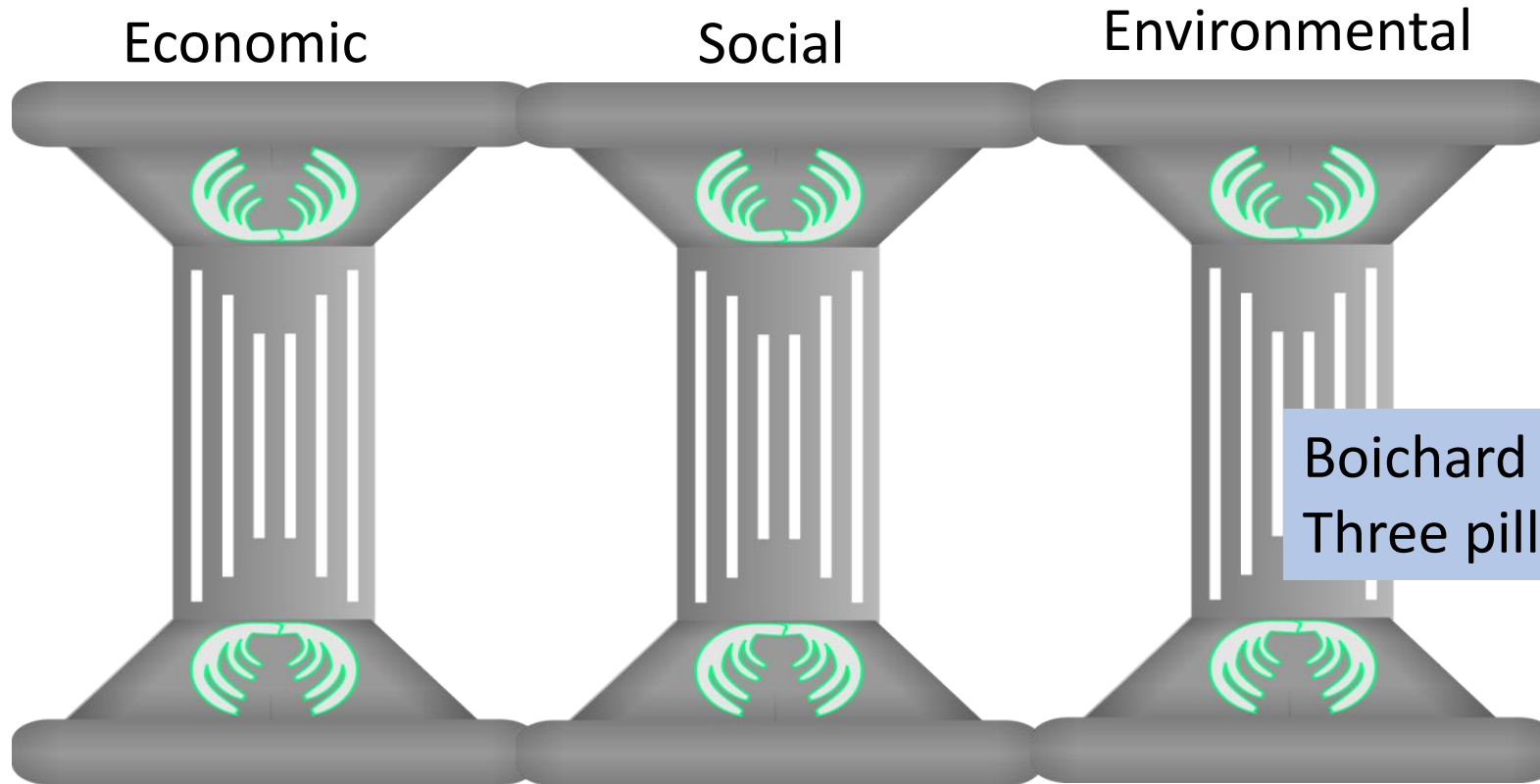


Future?

- Future indices need to consider consumer perspectives:
 - animal welfare
 - environment
- Inevitable that breeding objectives will have a greater environmental and social dimension?

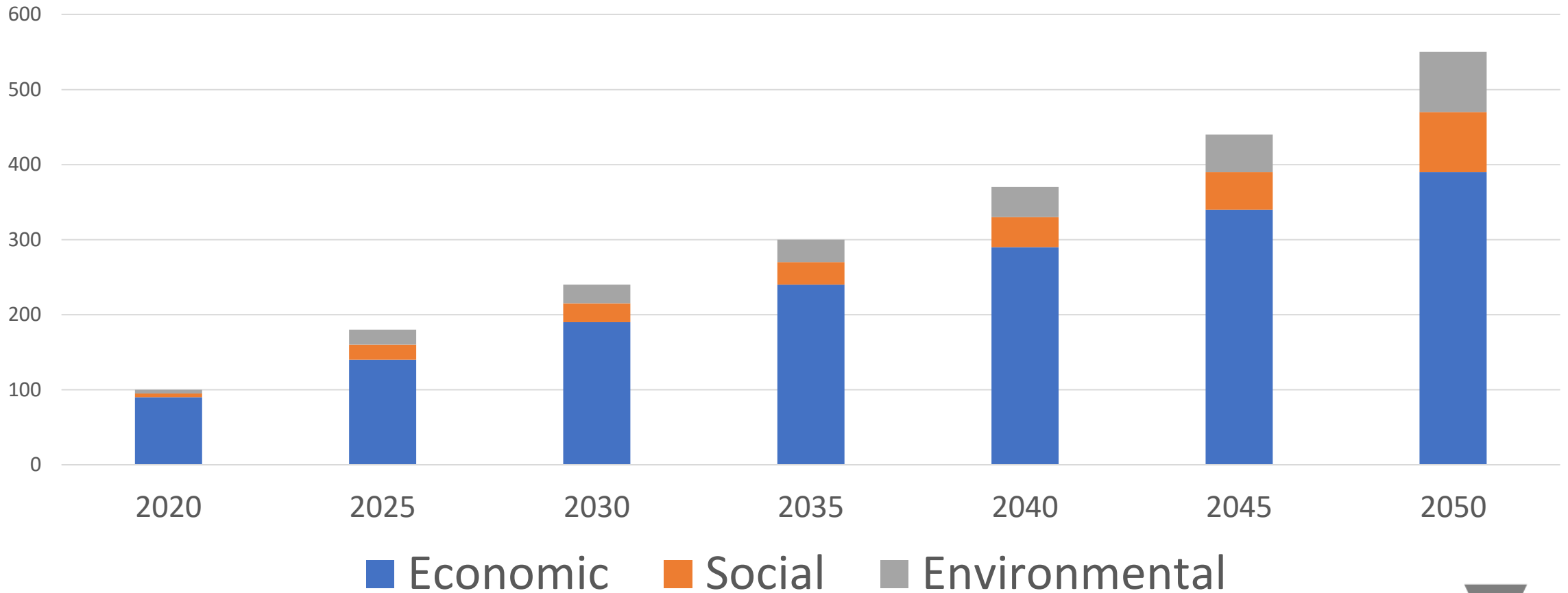


Future selection objectives



Boichard and Brochard (2012)
Three pillars of sustainability

Future of dairy indices?





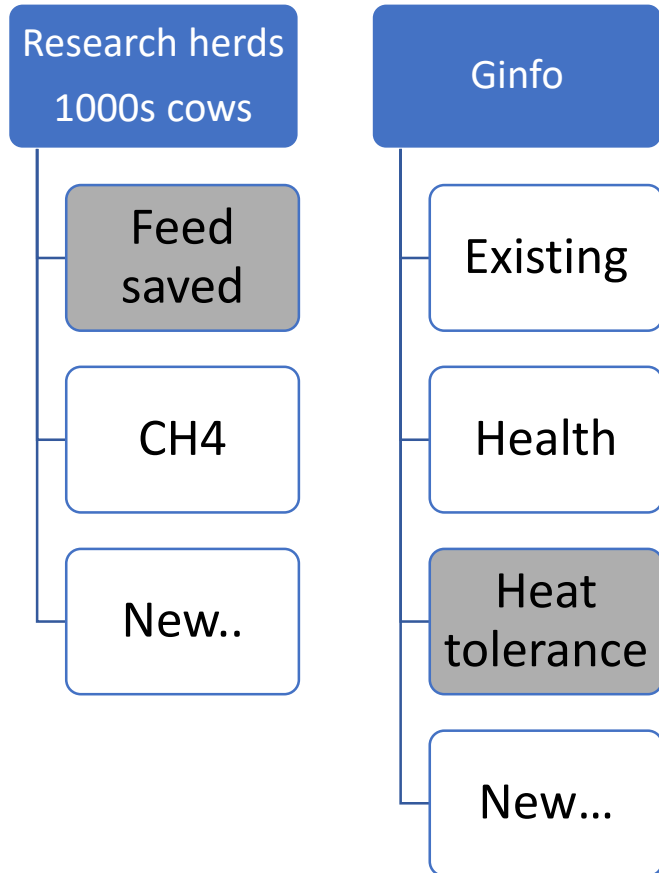
Using technology

New traits and reference populations

- Genomic “only” breeding values
 - Feed saved
 - Heat tolerance
 - Methane emissions
 - Some health traits
 - Other high cost phenotypes
- Lower reliabilities than other breeding values
 - Feed saved and heat tolerance average reliability ~ 35%



Female reference populations in Australia



Ginfo – Australia's genomic information nucleus

Search for herds that have great phenotypes

Scoring
system

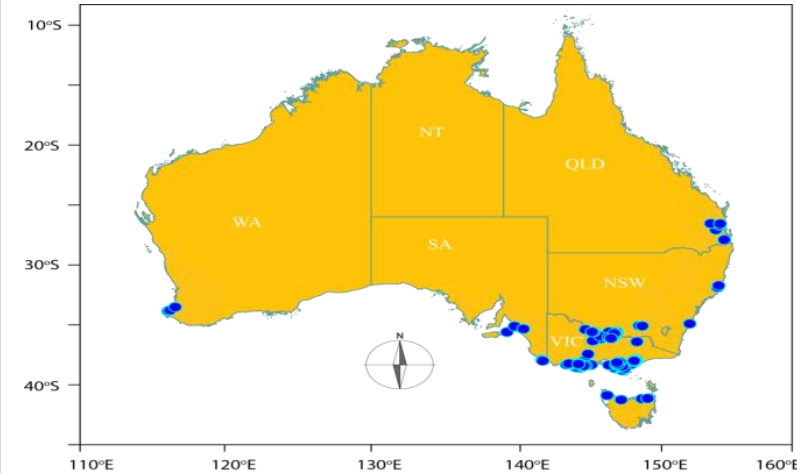
Best 100 herds selected and
genotyped

All States
included

All cows
genotyped

Ginfo+ 200 herds

Genomic evaluations enhanced
GEBVs to farmers



Heat tolerance

Research herds
1000s cows

Feed
saved

CH₄

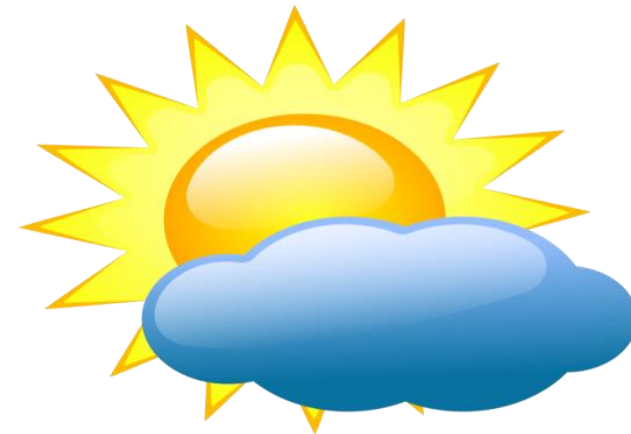
New..

Ginfo

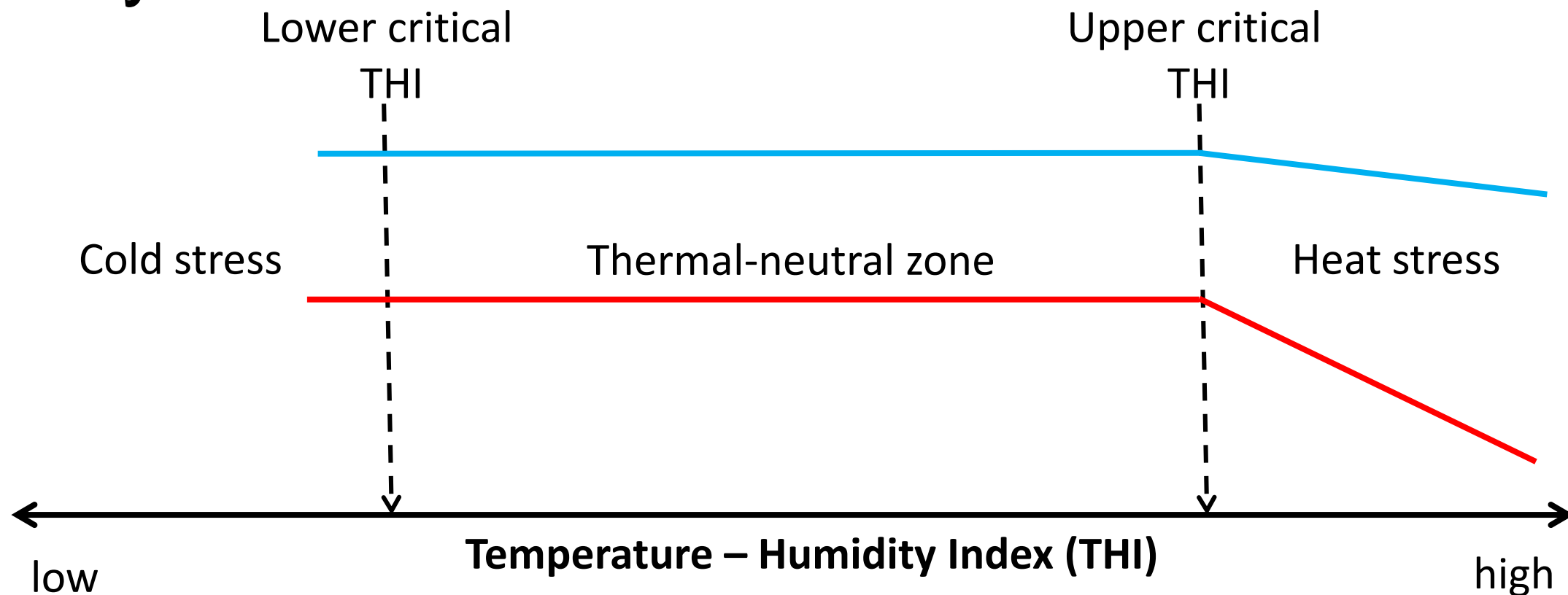
Health

Heat
tolerance

New...



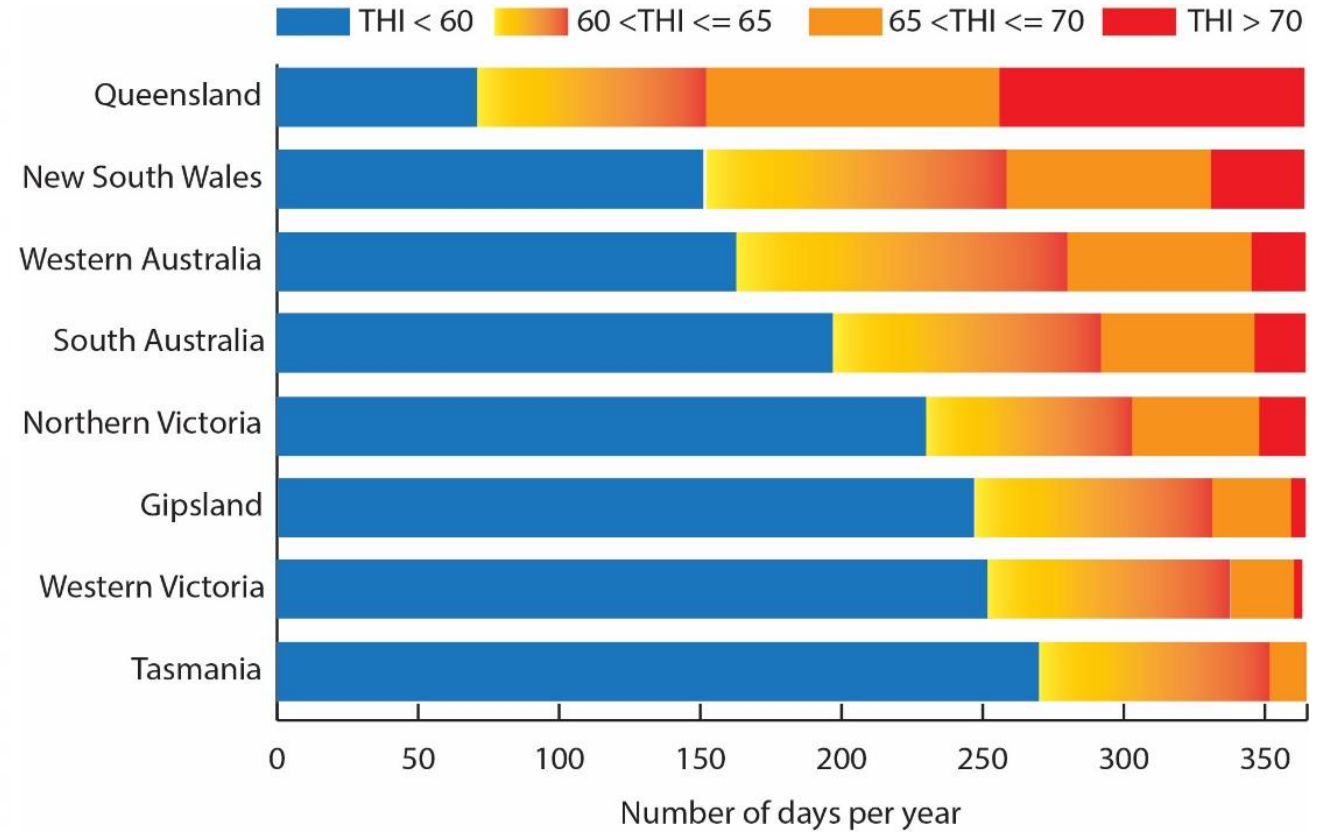
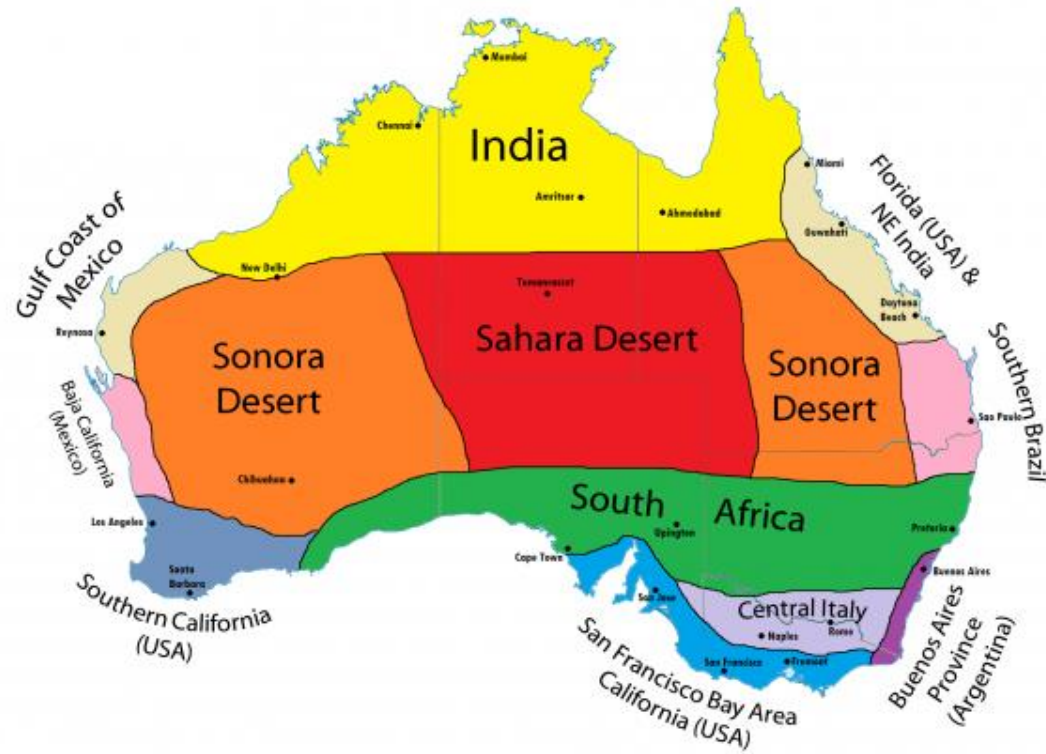
Dairy cattle and ambient heat load



THI threshold (60) is equivalent to 20°C (68°F) at 45% relative humidity

Adapted from NRC (1981)

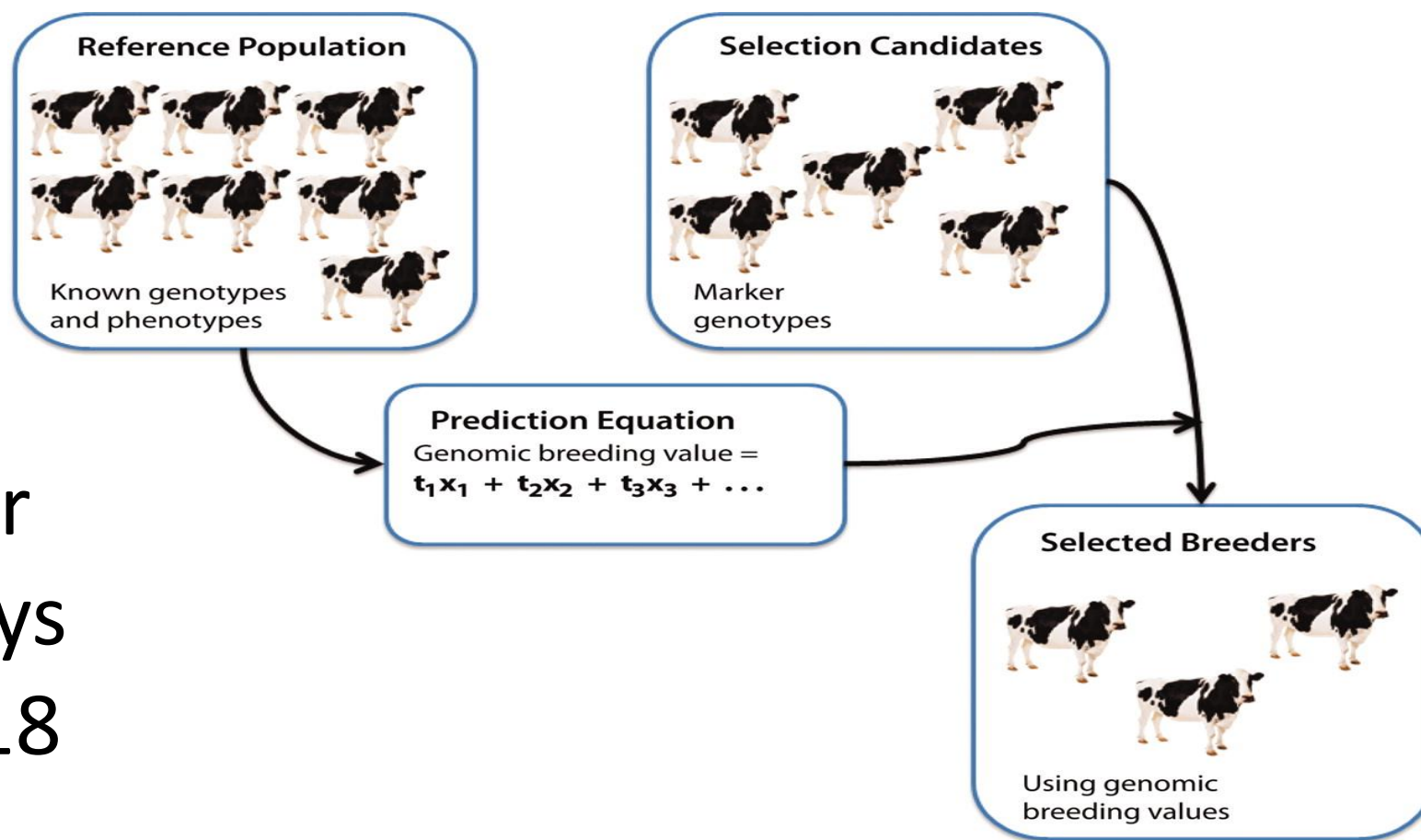
By region



Genomic prediction equation was developed from a reference population of 2,236 sires (with heat tolerance phenotypes on daughters)



Heat tolerance
breeding values for
Holsteins and Jerseys
released in Dec 2018



Genomic Selection

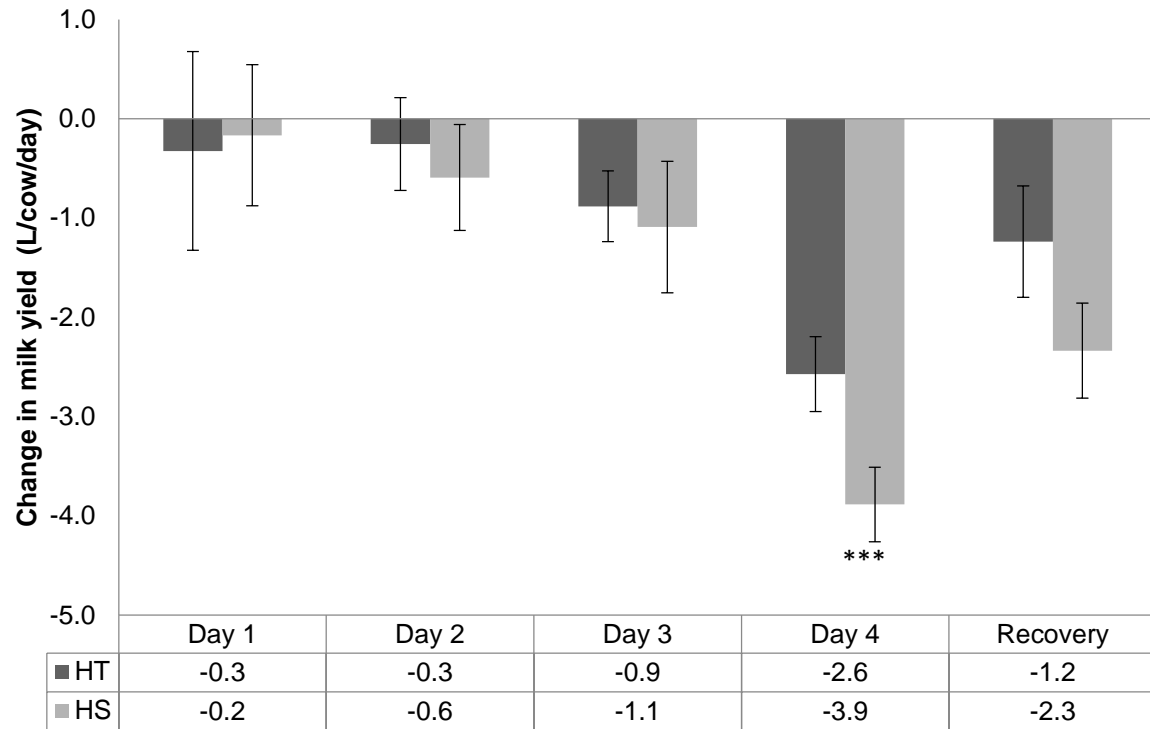
Empirical validation

- Genomic breeding values calculated for 400 heifers
- 24 predicted most heat tolerant, 24 predicted most susceptible selected on genomic BV
- Run through a simulated heat wave
- 4 day event, measure milk production, core temperature, intra-vaginal temperature



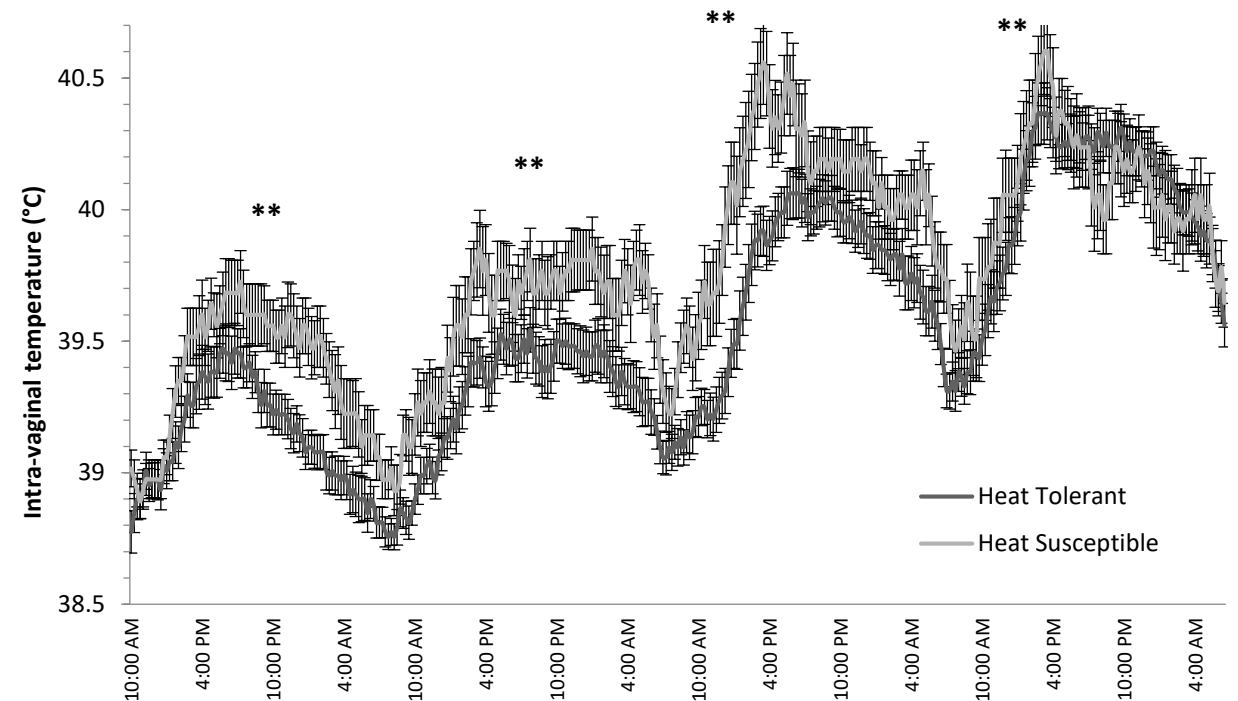
Garner et al (2016) Scientific Reports

Empirical validation Decline in milk production



Garner et al (2016) Scientific Reports

Difference in intra-vaginal temperature

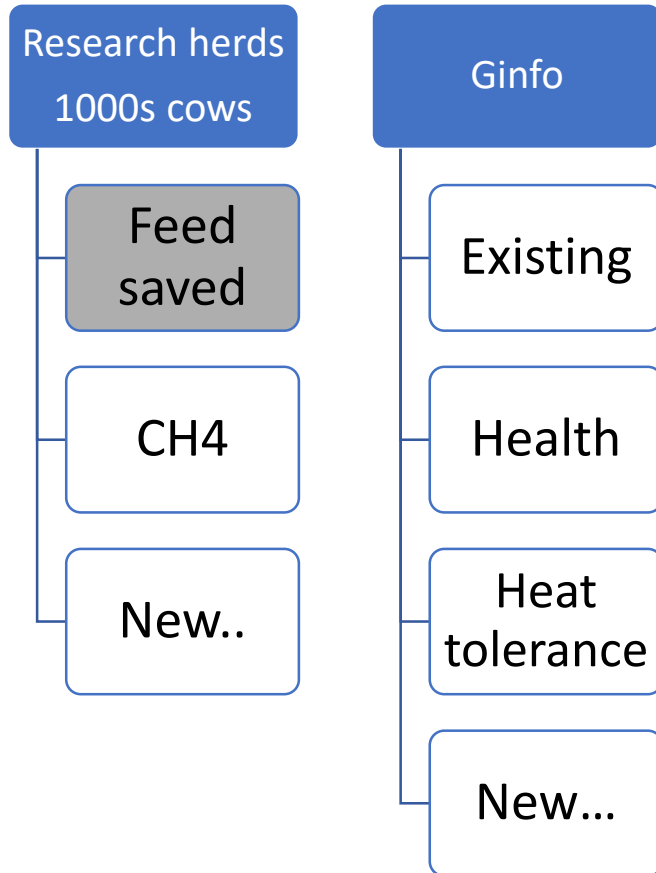


Research gaps

- Heat tolerance breeding values for dairy cows in countries other than Australia
- Ranking of dairy breeds for heat tolerance in Australia
- Can we feed cows to improve heat tolerance? (Cool Cows – Dairy FeedBase)



Female reference populations in Australia



What is “Feed Saved”?



Feed
saved
ABV



Residual
feed intake
Genomic BV



Maintenance from
Bodyweight Breeding
Value

Global Dry Matter Initiative: **g**DMI

- 9 countries, 15 parties
- ~9,000 phenotyped animals
- ~6,000 genotyped animals
- ~12,000 parities
- At >\$1000/cow/yr and \$50/genotype this dataset is worth >\$10,000,000



J. Dairy Sci. 97:3894–3905
<http://dx.doi.org/10.3168/jds.2013-7548>
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International genetic evaluations for feed intake in dairy cattle through the collation of data from multiple sources

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J. Dairy Sci. 97:1799–1811
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Imputation of genotypes from low density (50,000 markers) to high density (700,000 markers) of cows from research herds in Europe, North America, and Australasia using 2 reference populations

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J. Dairy
<http://dx.doi.org/10.3168/jds.2011-5280>
© American Dairy Science Association®, 2012.

Improved accuracy of genomic prediction for dry matter intake of dairy cattle from combined European and Australian data sets

Y. de Haas,^{*1} M. P. L. Calus,^{*} R. F. Veerkamp,^{*} E. Wall,[†] M. P. Coffey,[†] H. D. Daetwyler,[‡] B. J. Hayes,^{‡§} and J. E. Pryce^{‡§}

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Reference population

International collaboration essential!

Year	Status	Australian cows	Australian heifers	Overseas cows	Informative SNP
2015	Implemented	234	843	954	No
2017	Implementation late 2017	440	843	954	Yes (from 4772 beef)
2019	In development	~620	843	?	Yes

Feed saved ABV is in all 3 DataGene indices

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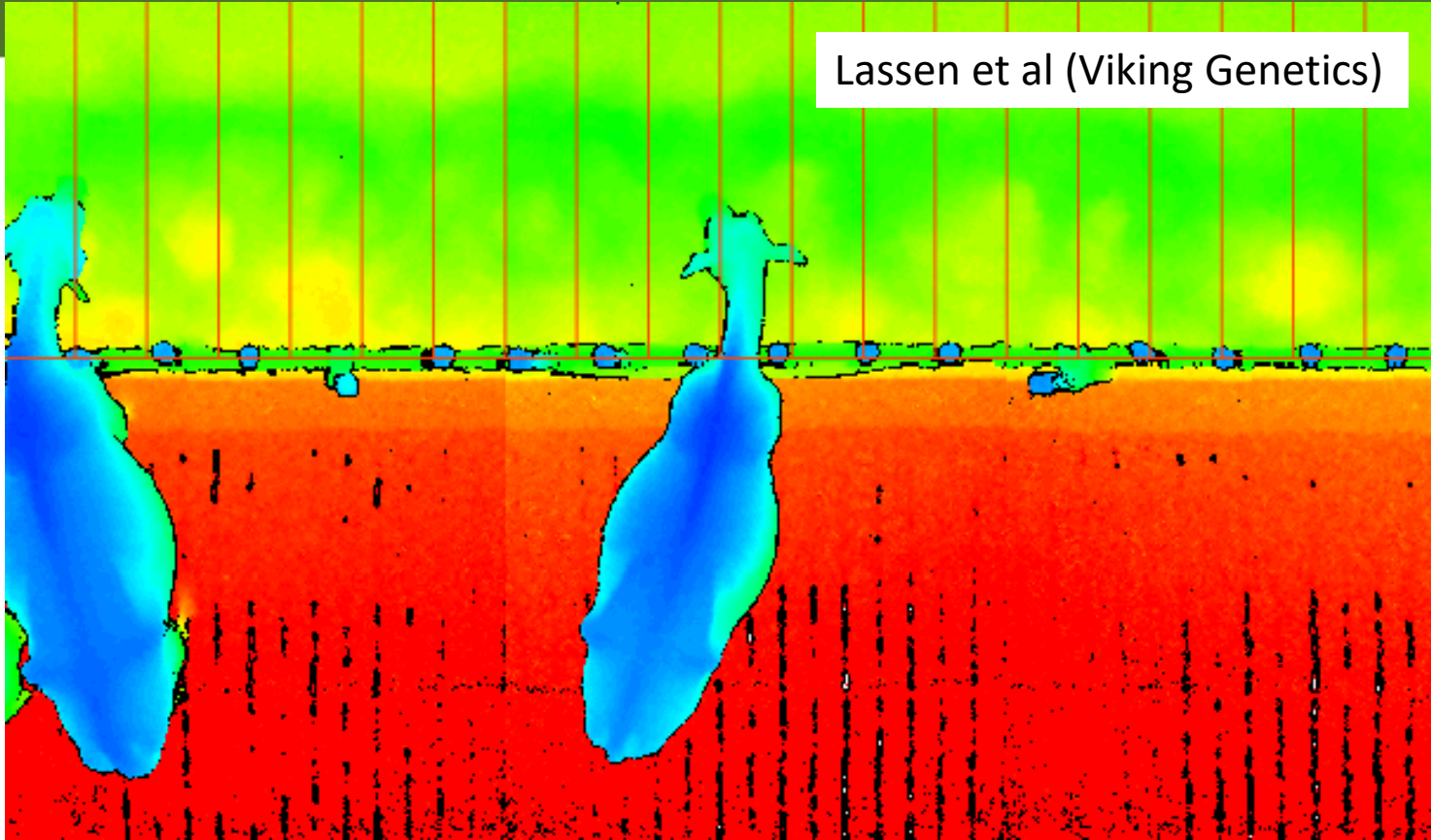
10 unit increase in BPI
(i.e. ~ annual gain) would
result in ~0.55kg
improvement in feed
saved (2% of \$ response)

Example Feed Saved ABVs



Holstein		
	BPI	FEED SAVED
BULL ID	BALANCED PERFORMANCE INDEX	FEED SAVED ABV
A	336	- 43
B	320	- 147
C	302	- 4
D	301	110
E	285	2
F	282	- 6
G	277	72

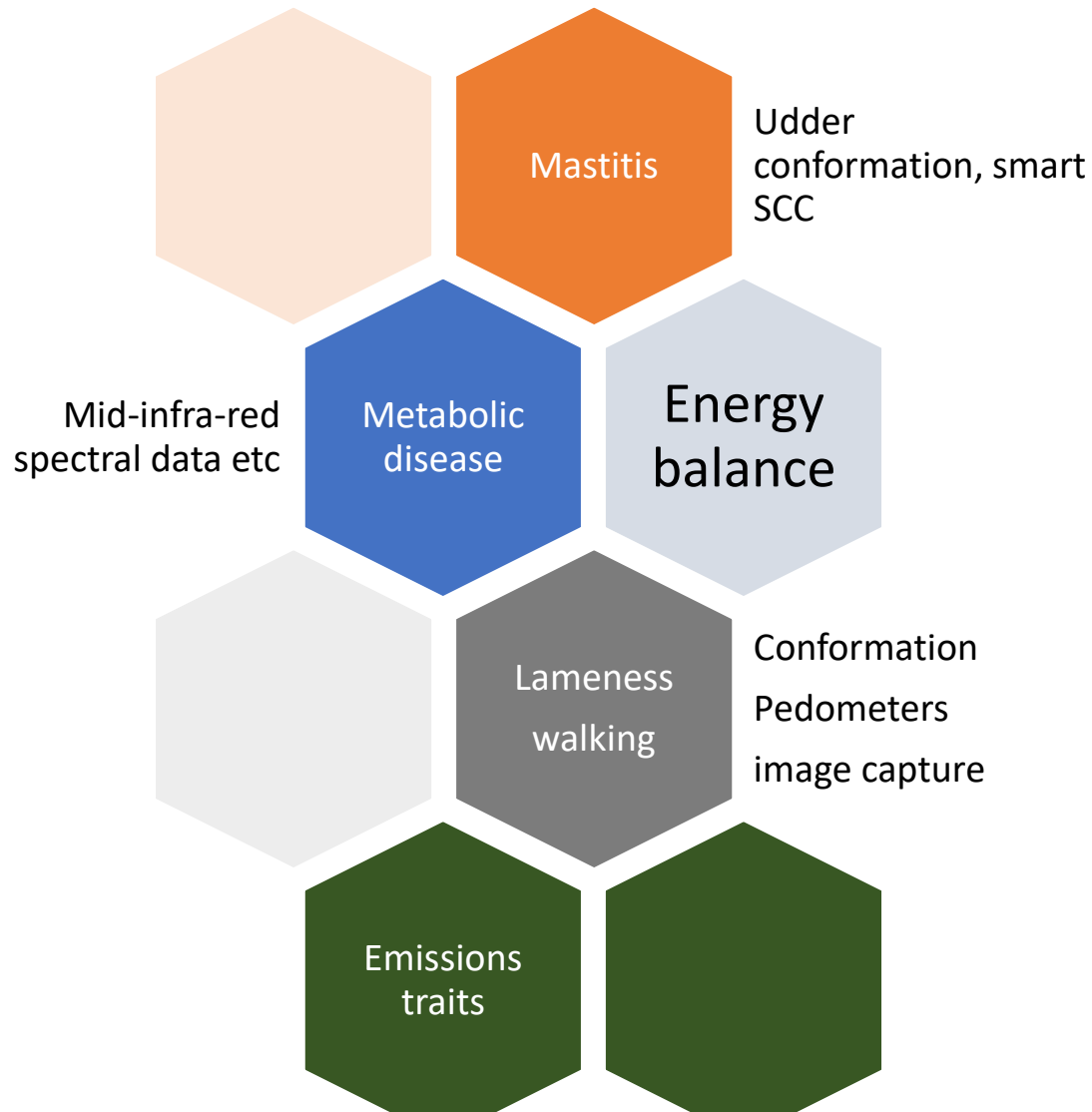
Lassen et al (Viking Genetics)



What about Feed Saved
for other breeds?

- We need a cheap way of measuring feed intake
- In confined systems:
Lassen et al (Viking) 3D cameras to measure feed intake on commercial farms
- Bite monitors:
 - Bite rate
 - Bite amount
 - Pasture quality

What's next....



- Health traits
- Predictor traits
- Mid-infra-red spectral data promising
- Not all traits will be included in the indices
- Improved data capture?

Conclusions

- Australian indices use science **and** farmer preference data
- Genomic selection has revolutionized breeding values in Australia e.g.
 - Feed Saved (from 2015)
 - Heat tolerance (from 2017)
- Female genomic reference populations give opportunities for new traits
 - Main challenge is lower reliabilities
 - Tackling hard to measure traits
- Across industry collaboration on research priorities
- Help farmers make better decisions
 - Indices that align to philosophies
 - Tools make better breeding decisions

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Thank you!

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