ICAR 2013 Health Data Conference

30th-31st May 2013

Dairy Futures CRC

Challenges of health data recording - Australia

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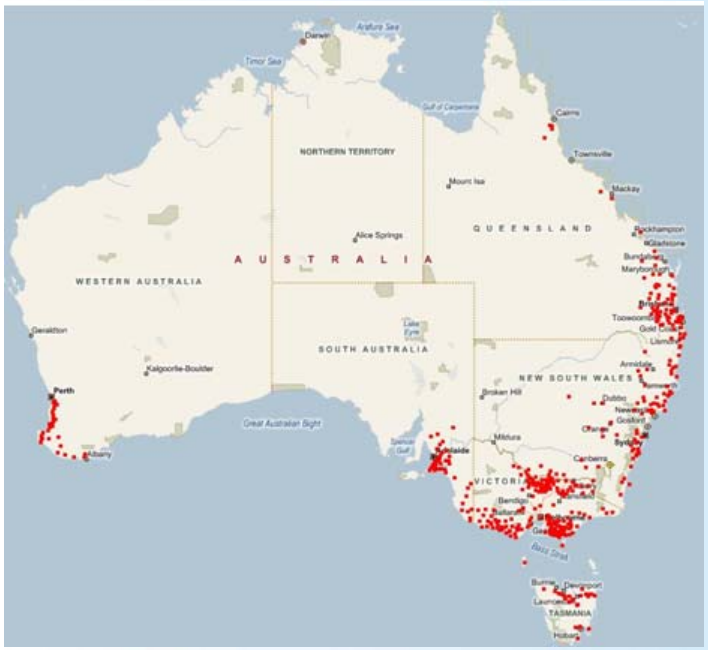
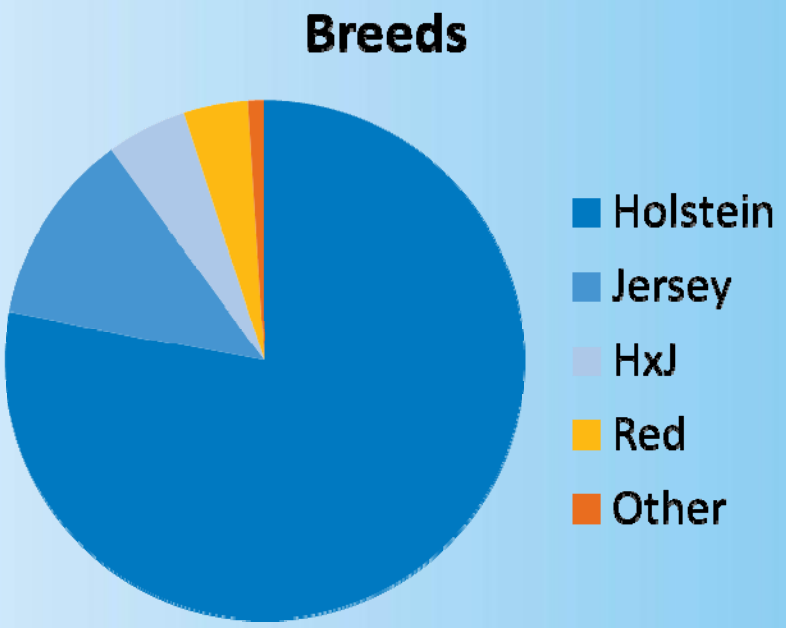
Outline

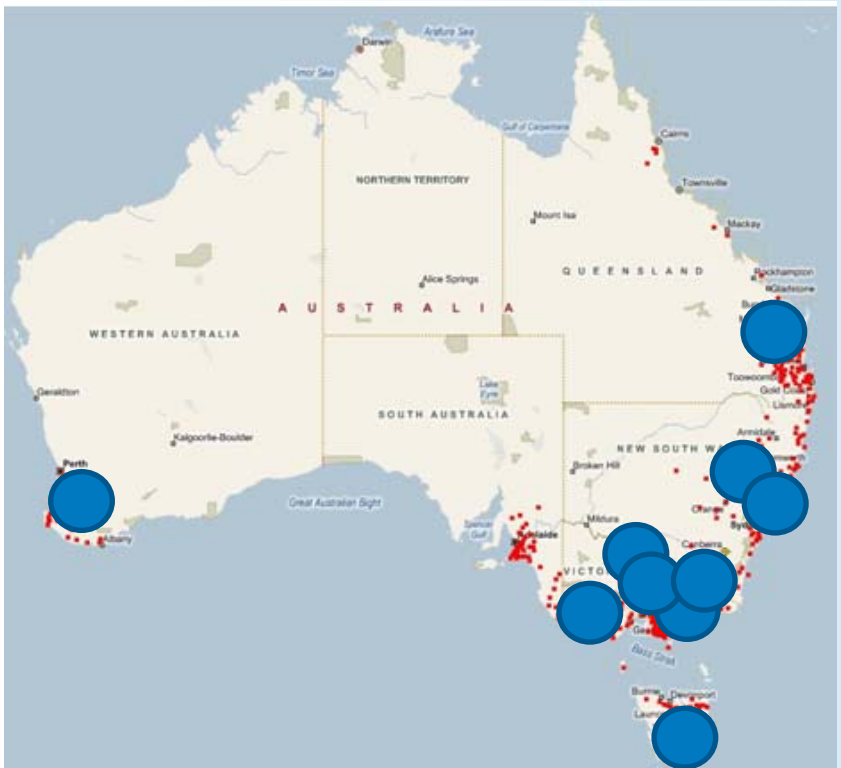
- Dairying in Australia
- Current data recording system
- Planned centralised data system
- Genomic reference population

Dairy production in Australia

- 1.6 million dairy cows
- 731,082 milk-record (46%)
- Average herd-size is 222
- Feed predominantly pasture
- 6930 litres/cow



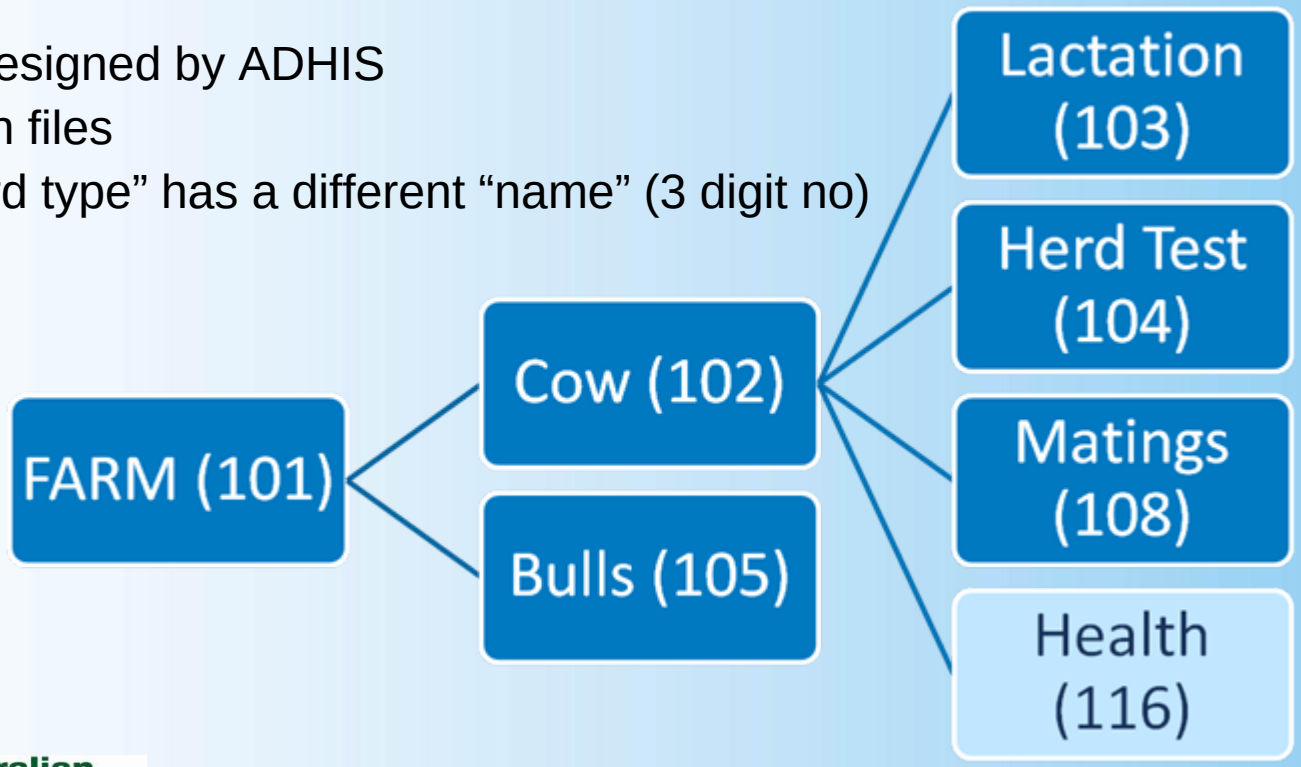




- Farms send data for health, fertility etc to milk-recording organisation (12) using farm software
- Data transferred electronically to ADHIS in flatfiles

Data interchange format (DIF) files

- Originally designed by ADHIS
- Fixed length files
- Each “record type” has a different “name” (3 digit no)



Australian Dairy Herd Improvement Scheme

DairyFutures

The following formats are described in this document

Format	Data Record	Version	Page	Latest Update
101	Herd Record	2	1	14th June 2002
102	Cow Pedigree Record	1	2	9th May 2001
103	Lactation Record	1	3	9th May 2001
104	Test Day Record	1	4	9th May 2001
105	Bull Pedigree Record (incorporates NASIS file)	3	5	22nd May 2012
106	Workability Record	1	6	9th May 2001
107	Herd Test Day Production Record	1	7	9th May 2001
108	Mating Record	2	8,9	22nd May 2012
110	Disclosure Record	2	10	9th May 2001
111	Liveweight Record	1	11	9th May 2001
112	Calving Ease Record	1	12	6th Sept 2007
114	Conformation Trait Record	3	13,14	6th Sept 2007
115	International Cow Pedigree Record	1	15	9th May 2001
116	Herd Health Record	1	16	14th June 2003
201	Bull ABVs for All Traits	4	17,18	22nd May 2012
202	Cow ABVs for All Traits	1	19,20	22nd May 2012
211	Cow ABVs for Production Traits	2	21	22nd May 2012
212	Herd Mean ABVs for Production Traits	2	22	22nd May 2012
251	Bull ABVs for All Traits (extended file)	4	23-30	22nd May 2012
401	Record for pre-printing of LTE forms	1	31	26th April 2001
481	Genotype Nominations file	2	32	22nd May 2012
501	Progeny Test Daughter Progress Report	2	33-34	6th Sept 2007
502	Calving Ease for Progeny Test Bulls	1	35	26th April 2001
Appendix A	Notes of Explanation			

Australian Dairy Herd Improvement Scheme

Snap-shot of 26 health events

1001	ACET	ACETONEMIA	DISEASE EVENT
1002	BLOAT	BLOAT	DISEASE EVENT
1003	GT	GRASS TETANY	DISEASE EVENT
1004	MF	MILK FEVER	DISEASE EVENT
1005	POIS	POISONING - Eg Rape, Nitrate	DISEASE EVENT
1006	BLEG	BLACKLEG AND OTHER CLOSTRIDIA	DISEASE EVENT
2001	PINK	PINKEYE	DISEASE EVENT
2002	ECANC	EYE CANCER	DISEASE EVENT
3001	WOODY	WOODY TONGUE	DISEASE EVENT
3002	DIPTH	CALF DIPTHERIA	DISEASE EVENT
3003	LJAW	LUMPY JAW	DISEASE EVENT
4001	DIARR	DIARRHEA	DISEASE EVENT
4002	JD	JOHNES DISEASE	DISEASE EVENT
4003	SALM	SALMONELLOSIS	DISEASE EVENT
4004	BVD	BOVINE VIRUS DIARRHEA	DISEASE EVENT
4005	SCOUR	CALF SCOURS - VIRAL DIARRHEA	DISEASE EVENT
4006	PERIT	PERITONITIS	DISEASE EVENT
4007	GRAIN	GRAIN POISONING	DISEASE EVENT
4008	LDA	LEFT DISPLACED ABOMASUM	DISEASE EVENT
4009	IND	INDIGESTION	DISEASE EVENT
4010	COCC	COCCIDIOSIS	DISEASE EVENT
4011	OBST	INTESTINE OBSTRUCTION/BLOCKAGE	DISEASE EVENT
5001	PERI	PERICARDITIS	DISEASE EVENT
5002	ENDO	ENDOCARDITIS	DISEASE EVENT
6001	PNEUM	PNEUMONIA	DISEASE EVENT
6002	LUNGW	LUNGWORM	DISEASE EVENT
8001	STAG	STAGGERS	DISEASE EVENT

Health data and farm software

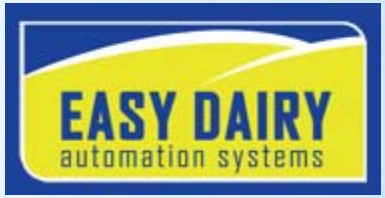
- Some farms meticulous in recording health events
  - Useful for basic herd management and culling
- They are the exception, rather than the rule
  - Even vet software poor reporting on health data
  - Need to work with vets to redesign DIF116 (Health recording)
  - Breeding values for some health traits would be useful
    - Need to accumulate more data first

Examples of Dairy Software

- Mistro
- Easy Dairy
- Dairy Data
- Allpro
- Identity
- Dairy 2000
- PCFarm
- Dairy Plan
- Dairy Man
- DairyExpress

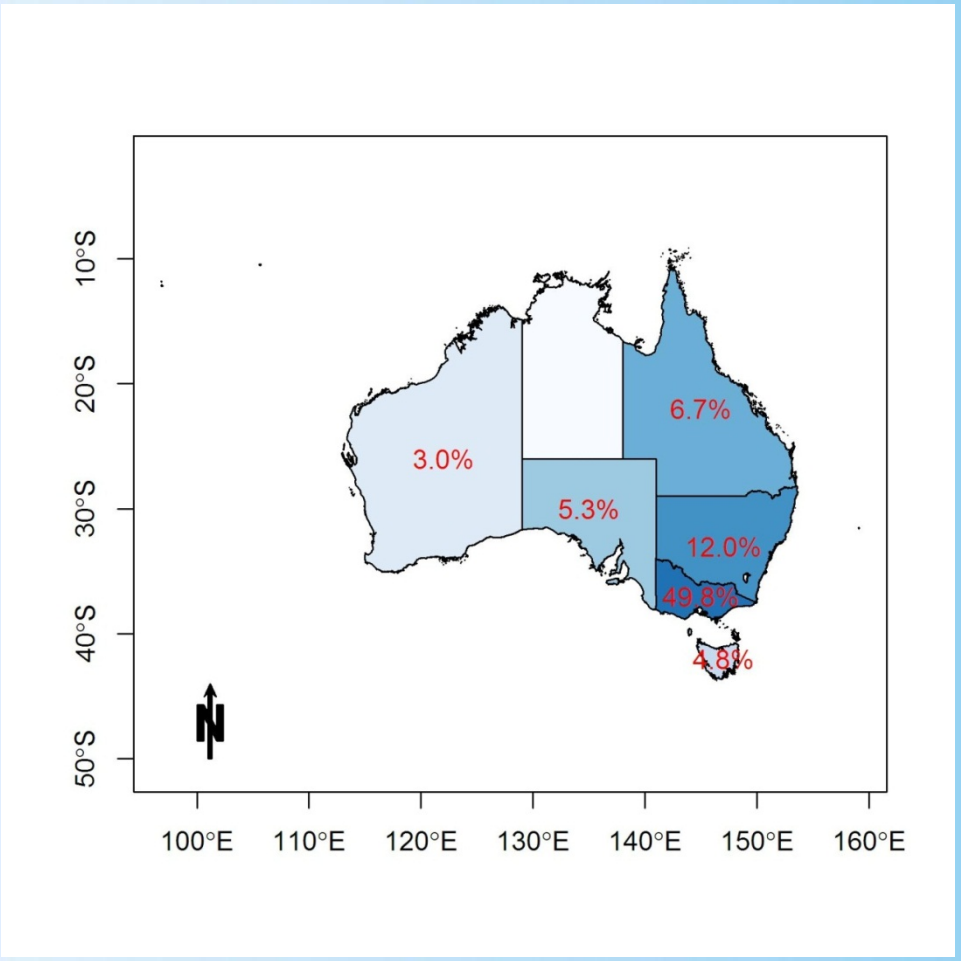
Dairy Software – programs in common use

- Mistro
- Easy Dairy
- Dairy Data (written by vets and used by vets and some farmers)



Accumulating extra fertility data

Percentage of herds that have mating data that qualifies for fertility ABV calculation by State



Action

- Project underway to increase the amount of fertility data that is captured
- Increase of 18% cows with fertility data that qualifies for ABV calculation in the same period for data extracted in August 2012 and March 2013
  - Increased awareness milk recording companies
  - Actively going out and getting the data

A National *Centralised Data System* (CDS)…

An Australian dairy industry working group (2010 Dairy Moving Forward) found:

> **"Australian does not have a *coherent approach to the collection use, transfer and access of dairy data* and this is limiting productivity gains"**

A CDS will help farmers in many areas:

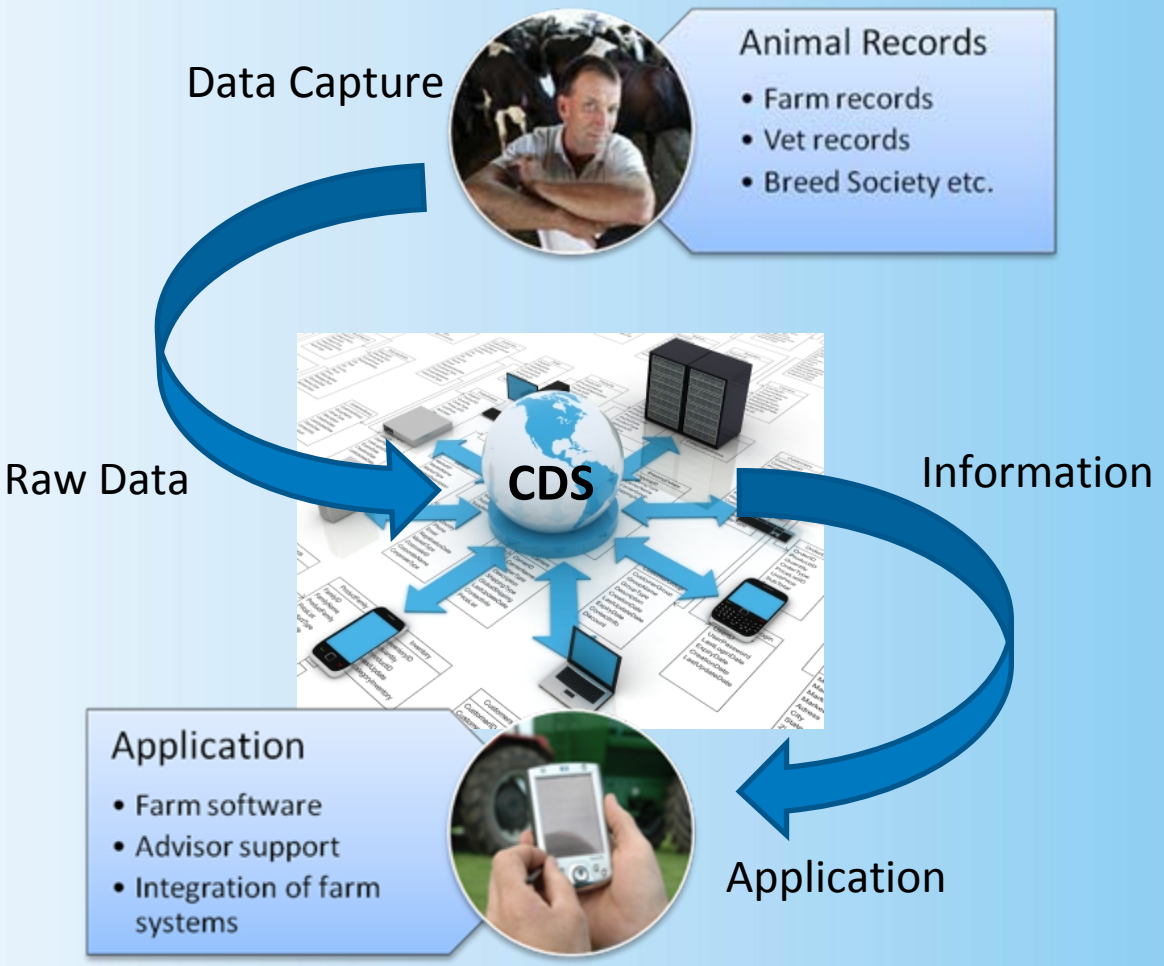
- On-farm decision making
- Fertility
- Animal health outcomes
- Integration of farm software and technologies

Centralised Data

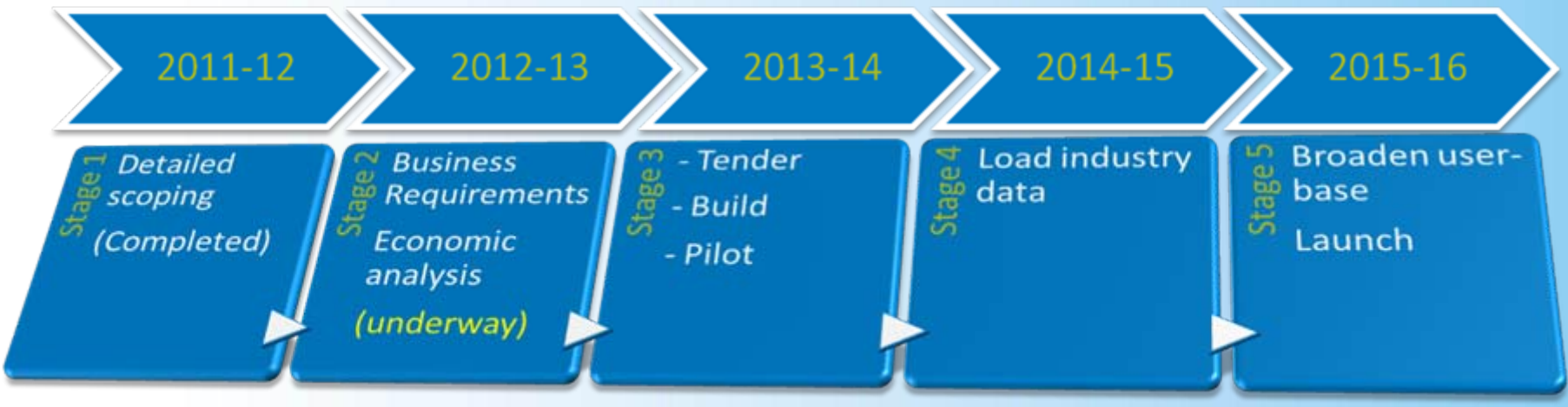
What is it?

It's:

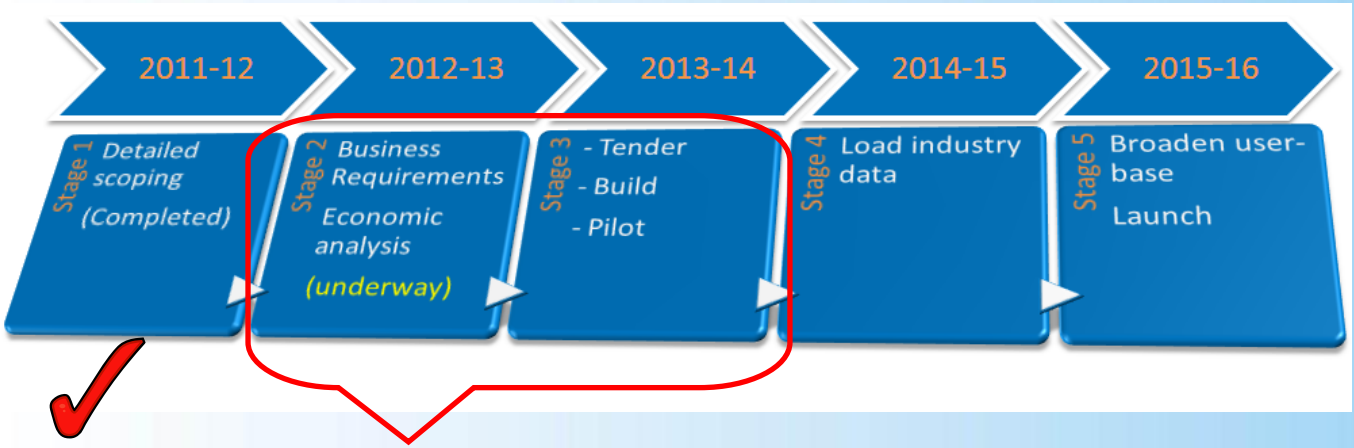
- Unified and consolidated animal data system
- Live
- National
- Pre-competitive
- Links on-farm technologies
- Incorporates other data over time



Timeline for CDS development



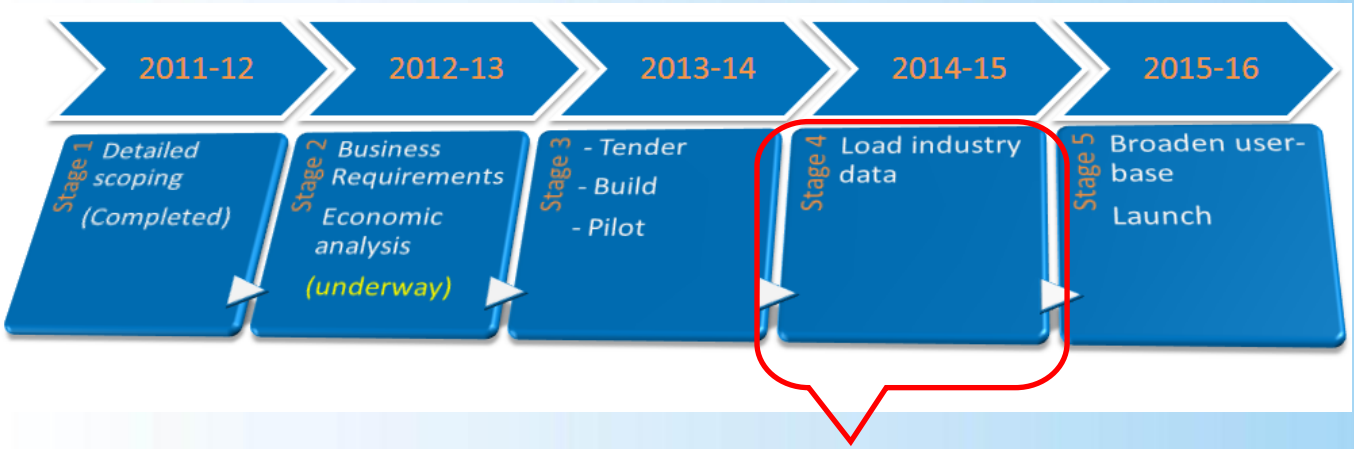
Timeline for CDS development



<u>Six pilot organisations</u>

1. ADHIS
2. Dairy Data
3. Dairy Express
4. Easy Dairy
5. Holstein Association
6. Mistro

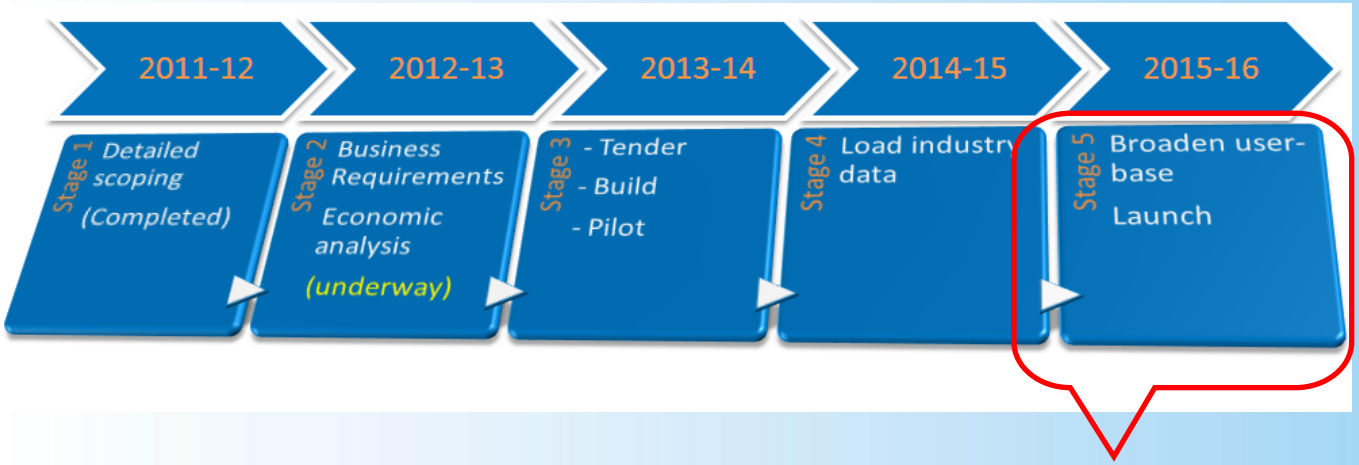
Timeline for CDS development



Approx 25 organisations

1. Breed Societies
2. DPC's
3. AB centres
4. High-tech system providers piloted

Timeline for CDS development



Remaining organisations (approx 20 identified)

Establish new entity and governance group

Launch

Outline

- Dairying in Australia
- Current system
- New central database
- Genomic reference population

Genomic information herds

– A new opportunity in data recording for genetic improvement purposes
  - Herds that do a really good job of data recording
  - All (most) cows in a herd genotyped
  - Used to generate prediction equations for genomic breeding values

10,000 Holstein cow project

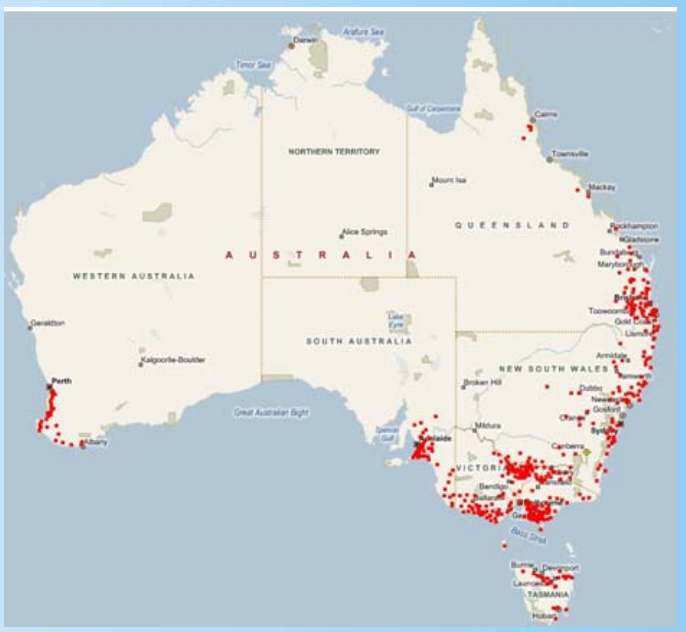
One-off genotyping of herds

Genotype 10,000 cows with excellent records

- ✓ fertility, survival, production

Collaboration with > 75 Herds Australia wide, and Holstein Australia

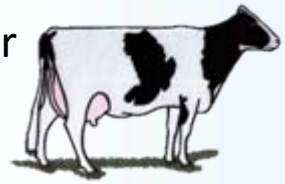
Work closely with Australian Dairy Herd Improvement Scheme (ADHIS) to implement, quality control



3449 bulls with
Australian daughters

Australian national DNA reference set

or



Equivalent to having **20** daughters

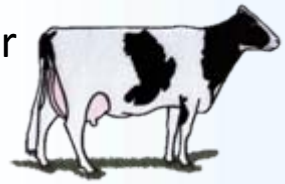
3449 bulls with
Australian daughters

ADD 4-8% IN RELIABILITY

8691 cows
deliberately selected

Australian national DNA reference set

or



Equivalent to having **30** daughters

946 bulls with
Australian daughters

Australian national DNA reference set

3996 cows
deliberately selected

or

Equivalent to having **25** daughters

New information source for calculating proofs

April 2013 Analysis

International Elite Holsteins

	With (g)	Without (g)	Difference	
APR	71	61	10%	
Production traits	77	68	9%	
Survival	59	49	10%	
Fertility	67	57	10%	
Mastitis Resistance	85	71	14%	
Conformation traits	69	63	6%	
Liveweight	73	65	8%	

Contribution of females to the reference

Strategies to reduce deterioration in reliability:

1. Exchange genotypes between countries
2. User denser SNP chips and better statistical tools
3. Genotype females to include in the reference population

The contribution of females to the reference population

- Need for a long-term genomic reference population
  - Well-recorded population that captures genetic diversity
- Genotyped females need to be incorporated cautiously
  - Preferential treatment a risk
  - Selecting herds on merit of data may be more beneficial

Genomic information nucleus

Herds being recruited this month!!

Opportunity:
Focussing on herds with a good track record of recording – an opportunity to broaden breeding values to difficult traits e.g. complex disease traits

Genomic information nucleus (n~100)

Herd-testing herds (n~3300)

Non herd-testing herds (n~4000)

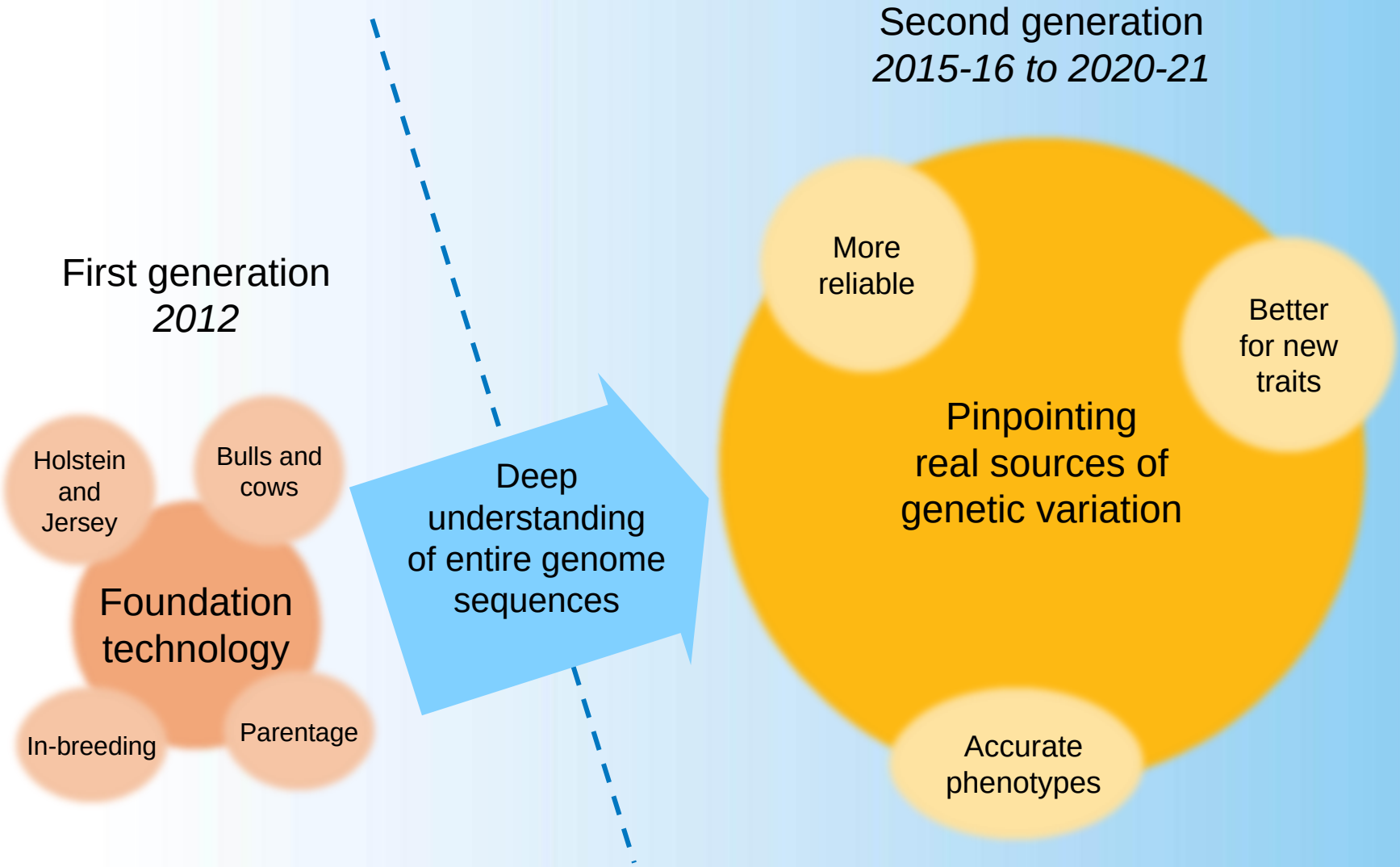
Summary

Health data not well captured and used in Australia

- Strategies to improve situation:
  - Improving connection between software and data storage (for example fertility data project)
  - New centralised data system: live and fully inclusive
- Strategies for broadening health breeding values
  - More data!
  - Genomic information population – can leverage off best data recorders
  - New wave of genomic breeding values

Selection criteria

- Based on 10,000 cow project
- Covers two breeds (Holsteins, Jerseys and their crosses)
- Identify cows that have useful phenotype data for all ADHIS traits or at least the most important traits (e.g. fertility)
- Ensure a good distribution of cows are chosen in terms of their genetic merit and sire families
- Extract information required to optimise the logistics of sample collection
- Develop a robust method of ranking the cows and herds
- Cows must have a registered sire


First generation
2012
Holstein and Jersey
Bulls and cows
Foundation technology
In-breeding
Parentage
Deep understanding of entire genome sequences
Second generation
2015-16 to 2020-21
More reliable
Better for new traits
Pinpointing real sources of genetic variation
Accurate phenotypes

Whole genome sequence information

1000 Bull Genomes Project

28.3 million variants

SNP selection

- Biological information
- Very large Aus + NZ data sets
- Pathway information

100,000 variants ??

Implementation

- Genomic Evaluations (ADHIS)

1000 bull genomes project

- 16 international partners
- **Run 3.0** 474 Bulls, 2 cow sequences
- **Run 2.0:** *28.3 million variants*!
- Early discovery: embryonic lethal recessive mutation
  - INRA collaborators
  - *Smc2* gene - controls chromosome separation during cell division
  - Mutation phenylalanine -> serine
  - Avoid carrier matings

Name	Fold coverage
Starlite	12.8
Shotime	11.9
Goldsmith	11.8
Gravita	15
Orana	9.5
Beau	12
OVGM	12.3
Goldwyn	22.7
Starbuck	30.3
Rameses	12.4
Donor	15.4
Donante	17.1
Mountain	18.9
Enhancer	16.8
Yukon	19
Gibbon	17
Jocko	15.1
Oman	14.7
Manhattan	17.9
Fatal	16.9
Cash	16.8
Boudewijn	18.5
Sabastian	26.2
Vickai	15.2