gEPDs for commercial beef cattle

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& Donagh Berry

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Improving feed efficiency, product quality, profitability, environmental impact and food security

gEPDs for commercial beef cattle

GOAL: accelerate genetic improvement using genomics to generate gEPDs and multi-trait indices that perform well in crossbreds

Deliverables:

1) 34 million variants screened for functional impact on feed efficiency and carcass quality traits;

2) gEPDs for 10 traits with > 35% accuracy in crossbred cattle;

3) two multi-trait value indices for commercial producers; and

4) Deploy genomic tools with immediate impact and value (sire assignment, genomic breed composition and retained heterozygosity).

Project Team Members

From top left:
John Basarab, Donagh Berry, John Crowley, Paul Stothard

From middle left:
Colin Coros, Michelle Miller, Graham Plastow, Changxi Li,

From bottom left:
Dawn Trautman, Mohammed Abo-Ismail, Kirill Krivushin, Tara Carthy

Project Management Committee

Cory Van Groningen (VG Meats)
Kajal Devani (Canadian Angus Association)
Jennifer Stewart-Smith (Beefbooster Inc.)
Troy Drake (Cow-Calf Health Management Services)
John Basarab (Principal investigator, AAF & Gentec/UofA)
Donagh Berry (Co-PI, Teagasc)
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Paul Stothard (Activity lead, Gentec/UofA)
Colin Coros / Michelle Miller (Activity lead, Delta Genomics)
Dawn Trautman (Project manager, Gentec/UofA)
Ryan Mercer (Genome Alberta ex-officio)

End-User Committee

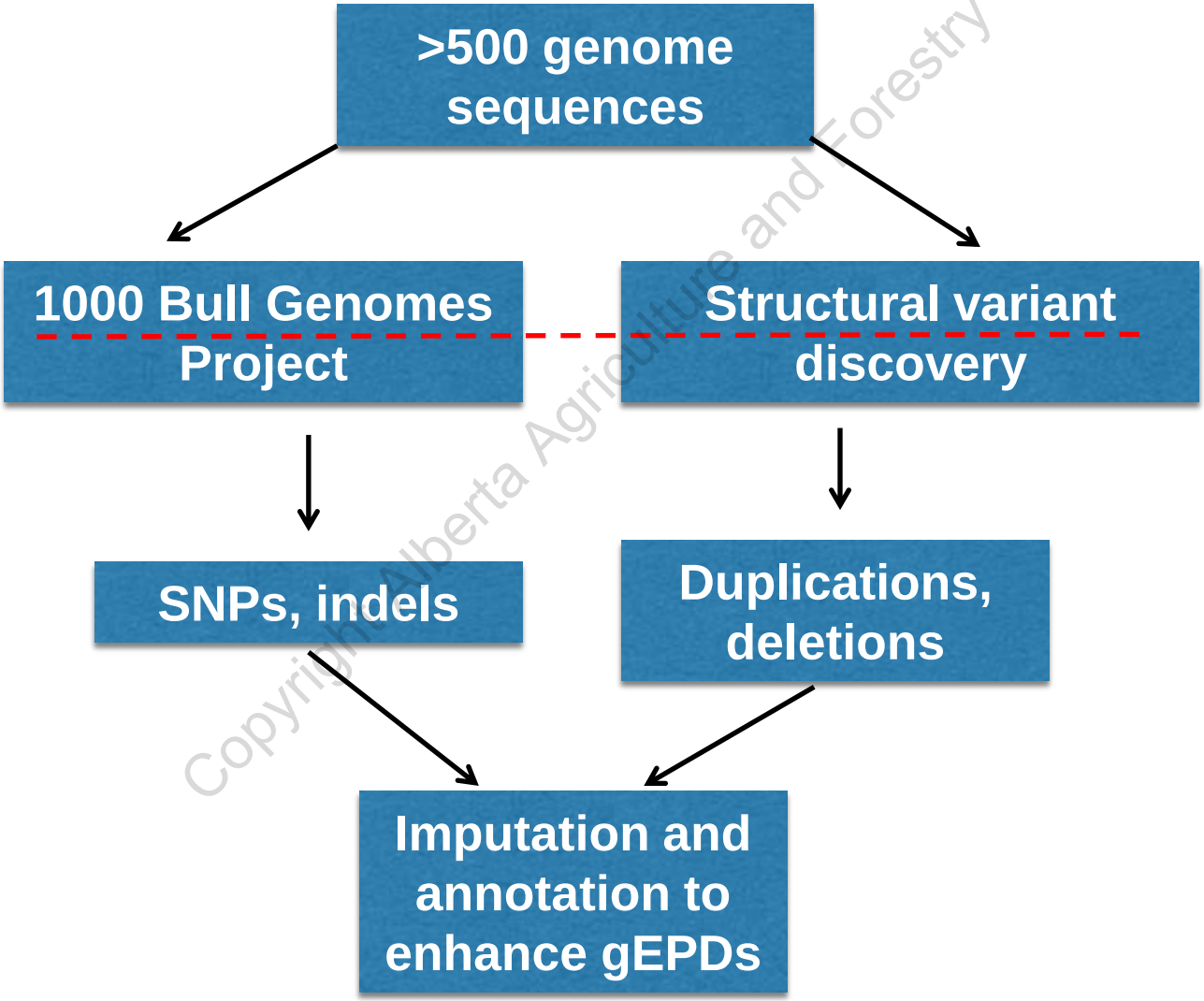
Brian Groten (Cargill Canada)
David Bolduc (Producer, Cudlobe Angus)
Jared Sherman (Soderglen Ranches Ltd.)
Jay Cross (Producer, Barpipe Farms & Professor, UofC)
Milton Scott (Thorlakson Feedyards Inc.)
John Basarab (Principal investigator, AAF & Gentec/UofA)
John Crowley (Co-PI, CBBC & Gentec/UofA)
Dawn Trautman (Project manager, Gentec/UofA)

Whole Genome Sequencing

Breed	CCGP	new
Simmental	61	27
Limousin	34	30
Charolais	41	42
Angus	47	15
Hereford	33	15
Gelbvieh	31	
Holstein	48	
Other	43	9
Composite / crossbred	41	
Total	379	138

Stothard et al., 2015 GigaScience 4:49

Sequence-level genotypes for gEPDs



Progress

Genotyped 2311 feeder progeny with GGP-LD (31k SNPs) and 133 sires with Illumina BovineSNP50

Completed sire assignment for 1428 progeny (success rate = 64%)

Completed genomic breed composition and retained heterozygosity on 2280 progeny, 2274 dams and 133 sires

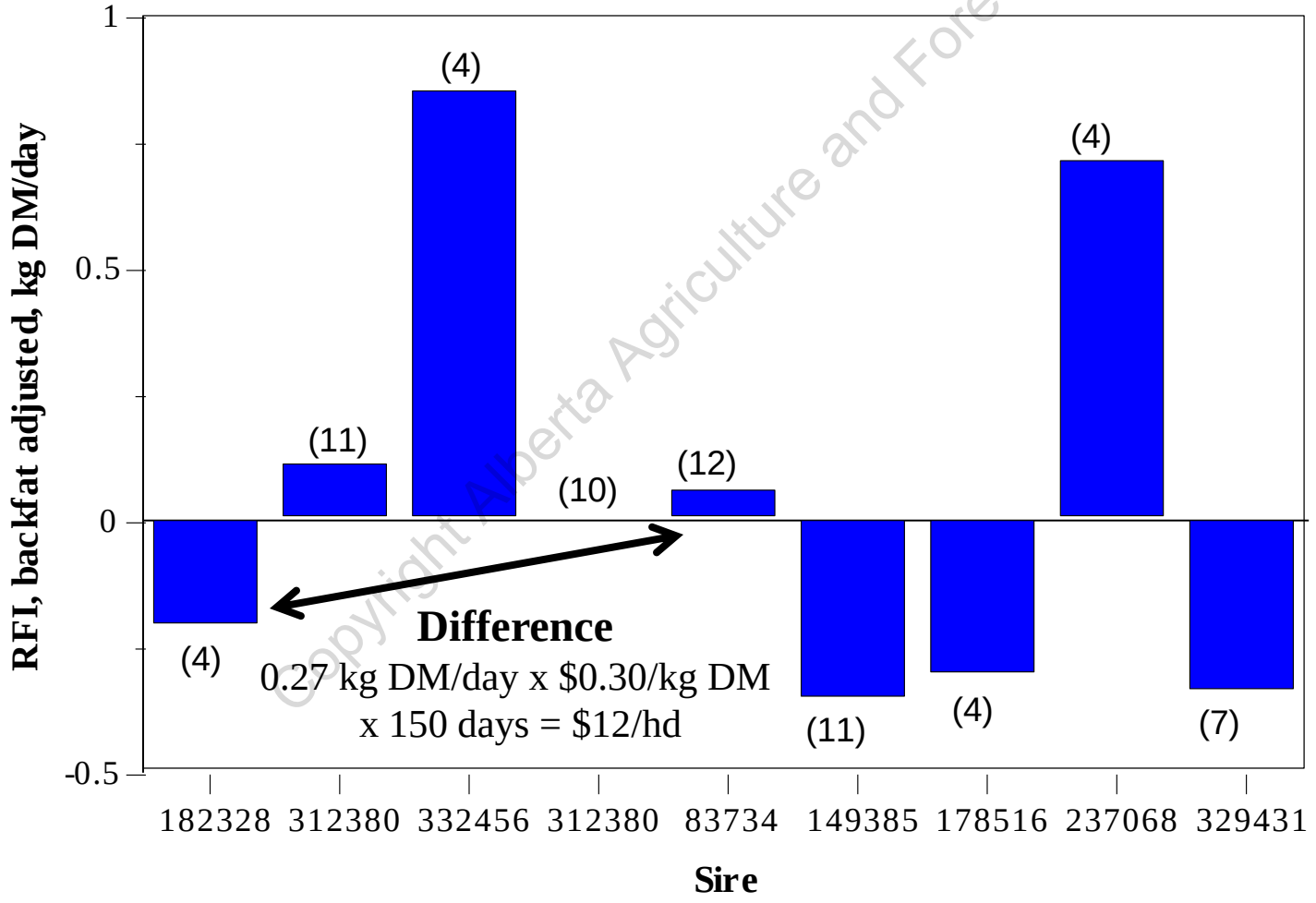
Completed short duration RFI on 650 crossbred steers and heifers.

Received carcass data on over 2400 project cattle

Sire assignment

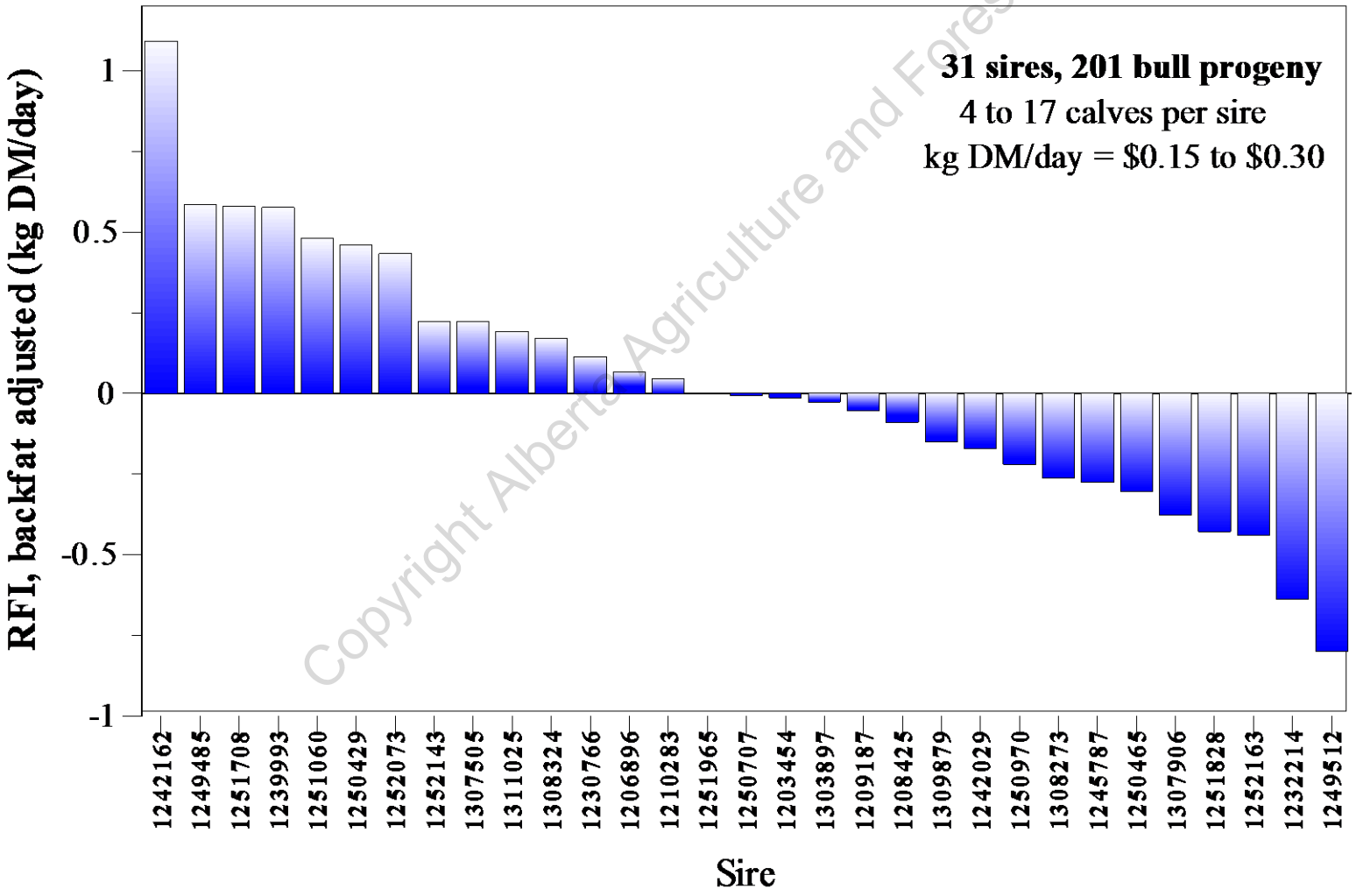
Steer progeny feed efficiency by sire

(number of progeny/sire are in parenthesis)



Sire assignment

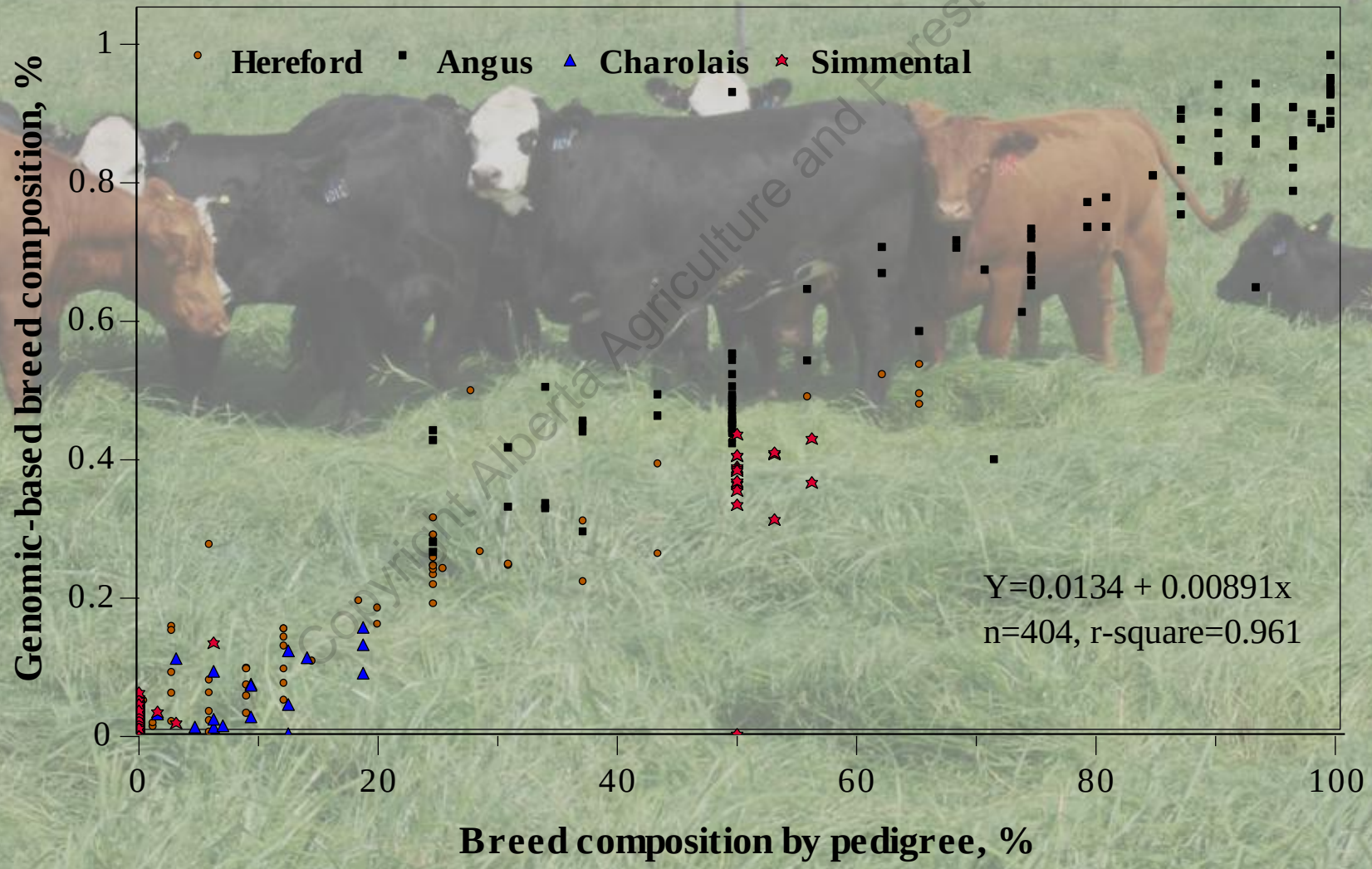
Bull progeny feed efficiency by sire



Genomic breed composition

Relationship between breed composition by pedigree and genomic-based breed composition in crossbred beef heifers

(Lacombe Research and Development Centre; 2015 born, n=102)

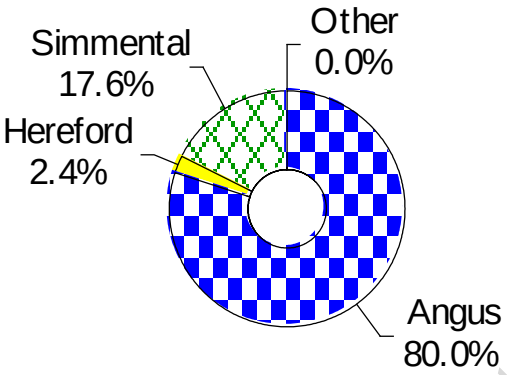


Genomic breed composition

MyHerdandMe ... genotyping for beef cattle

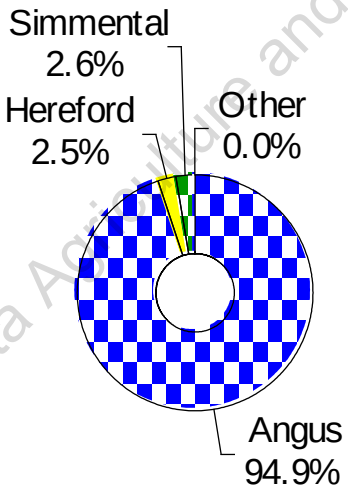
Genomic-based breed composition & retained heterozygosity

Steer progeny



Total: 100

Red Angus bull



Total: 100

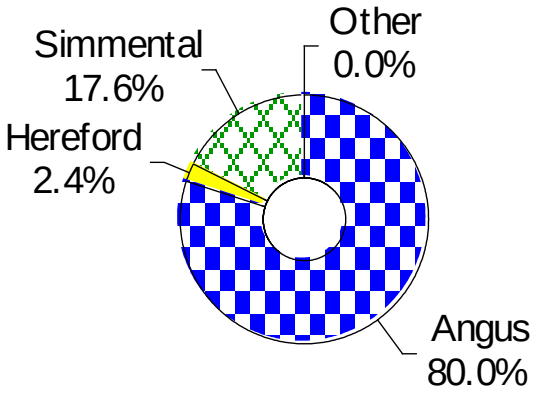
Retained Heterozgosity:	32.8%	19.8%

Angus **Hereford** **Simmental** **Other**

MyHerdandMe ... genotyping for beef cattle

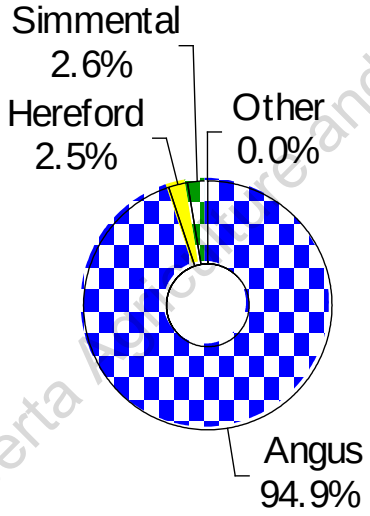
Genomic-based breed composition & retained heterozygosity

Steer progeny



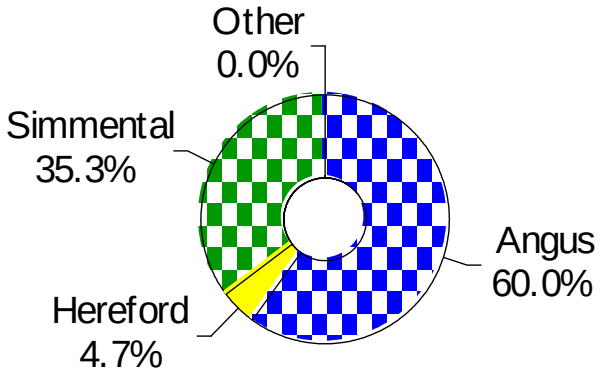
Total: 100

Red Angus bull



Total: 100

Crossbred cow

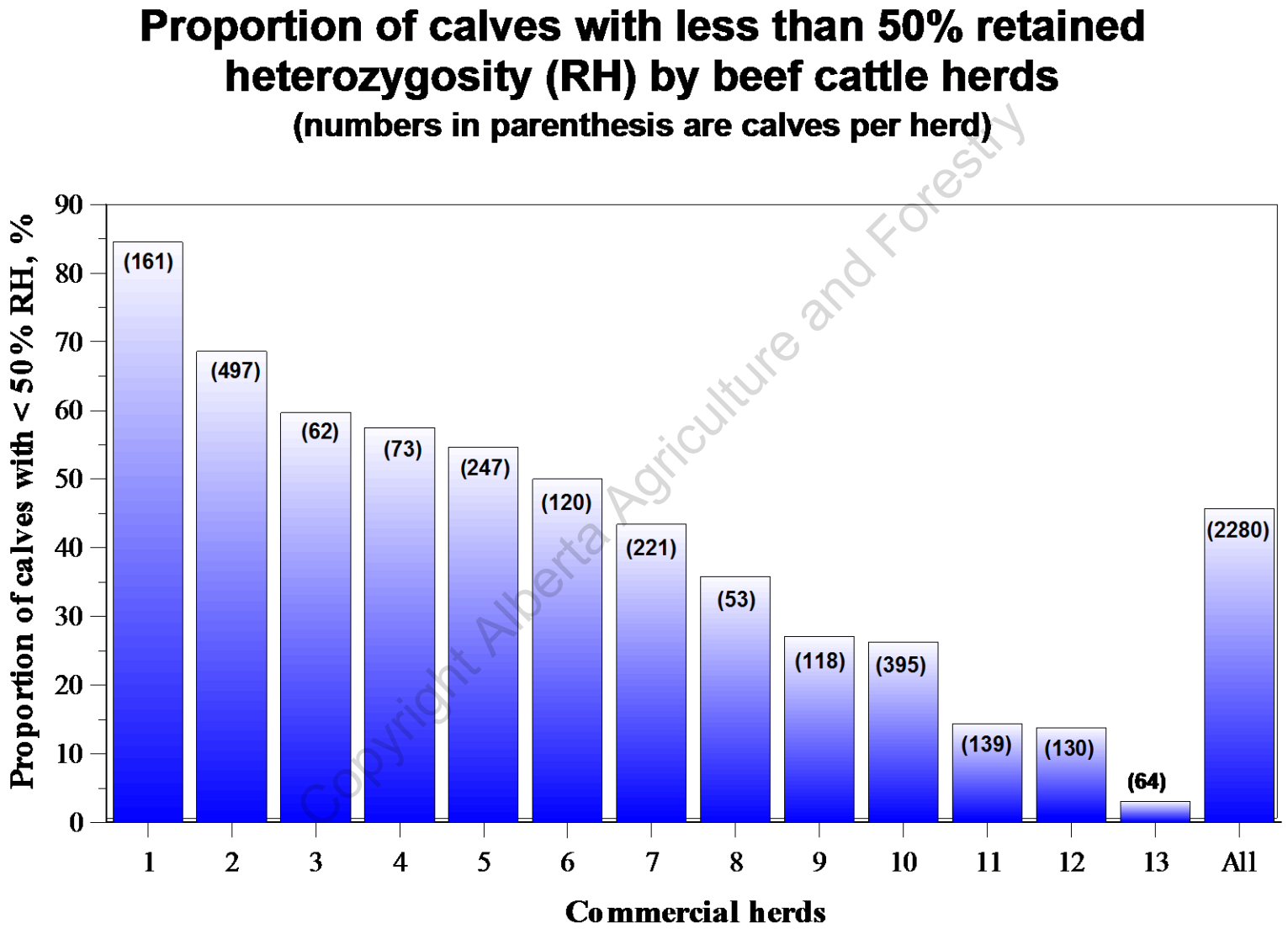


Total: 100

Retained Heterozgosity:	32.8%	19.8%	51.4

Angus **Hereford** **Simmental** **Other**

Is low %RH and reduced hybrid vigor an opportunity?



Yes, 10 of 13 herds could improve hybrid vigor in crossbred cattle

Retained heterozygosity (RH) and RFI_{fat} in crossbred beef cattle.

Groups	Type	n	%RH		Linear effect, kg DM/day per 1% increase in %RH
			mean	SD	
DW	steer	109	49.5	9.4	-0.016±0.007
JM	steer	99	54.2	17.0	-0.007±0.005
LRC	heifer	95	41.5	18.8	-0.006±0.002
All		303	48.4	16.2	-0.008±0.002

Each 10% increase in RH improves feed efficiency by 0.08 kg DM/d. Thus increasing RH from 30% to 60% would save $18/head in feed costs over 250 days of feeding.

Next Steps

1) Continue to detect genomic variants and rank for functional impact on feed efficiency and carcass quality;

2) Generate gEPDs for 10 traits (< 30% accuracy);

3) develop two multi-trait value indices for commercial producers; and

4) Continue to deploy genomic tools to producers

Questions?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Extra slides below

Is low %RH and reduced hybrid vigor an opportunity?

Retained heterozygosity (RH) in calves born to 13 commercial beef cattle herds				
Herd	calves	RH, %	SD	% < 50% RH
1	161	30.4	14.2	84.5
2	64	67.7	9.1	3.1
3	221	49.8	6.3	43.4
4	395	55.6	16.7	26.3
5	118	53.0	10.7	27.1
6	62	43.5	19.8	59.7
7	139	60.6	10.0	14.4
8	53	49.5	11.2	35.8
9	120	47.2	13.4	50.0
10	73	48.0	16.9	57.5
11	130	59.9	9.7	13.8
12	497	40.7	14.7	68.6
13	247	48.8	10.0	54.7
Total	2280			

Yes, 10 of 13 herds could improve hybrid vigor in crossbred cattle