

# WP2.5: Livestock genetics & management for product quality & sustainability

Geoff Simm

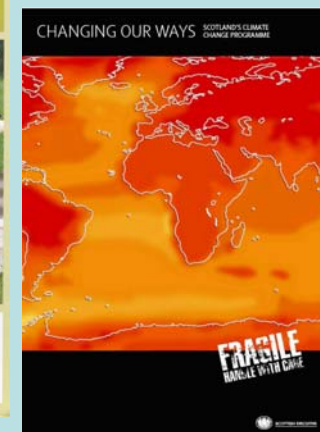
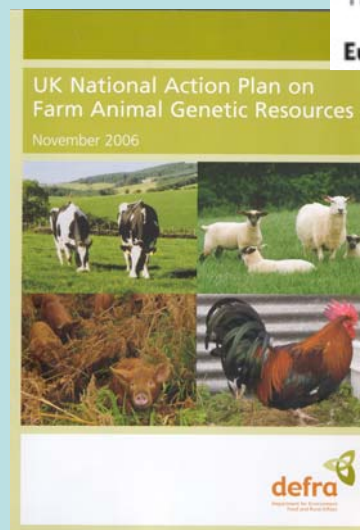
- 7 'Required Outputs' in support of [then] SEERAD Policy
  - *A Forward Strategy for Scottish Agriculture (& 'Next Steps')*
  - *Animal Health & Welfare Strategy for Great Britain*
  - *Scotland' Biodiversity - It's In Your Hands*
- Met by 4 strands of activity...



- New policy areas relevant to WP2.5
  - *UK National Action Plan on Farm Animal Genetic Resources*
  - *Changing our ways: Scotland's Climate Change Programme*
  - *Scottish Rural Development Plan (SRDP)*
  - *Choosing the Right Ingredients: The Future for Food in Scotland: Discussion Paper*



The European Agricultural Fund  
for Rural Development:  
Europe investing in rural areas



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**Strand 1:  
Improving  
product  
quality**

*Improved measurement techniques for carcass & meat eating quality in beef & sheep*

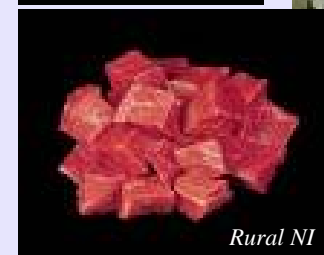
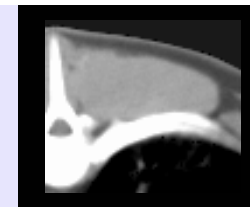
*Designing & testing breeding programmes for carcass & MEQ*

*[Livestock products & human health]*

# Progress - Strand 1



- Evaluation of live animal & carcass measures to predict beef carcass & eating quality
- 2 years experimental work complete – data collation & analysis underway
- Analysis of equivalent sheep data
- NIR, CT, VIA look promising in beef & sheep
- See posters from Roehe et al (x2)  
Ross et al; Rooke et al



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## Strand 1:

*Optimising breeding programme design, esp. for sustainable use of new technologies e.g. molecular genetic markers*

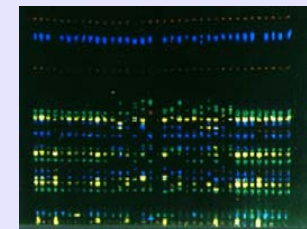
*Developing & testing new breeding tools e.g. markers, reproductive technologies, [CT image analysis software]*

**Strand 2:  
Designing  
sustainable  
livestock  
breeding  
programmes**

# Progress - Strand 2



- Optimising breeding programme design
  - Use of genetic markers to increase gain while controlling inbreeding
    - Applying genome wide selection (GWS) in sheep (collaboration with AgResearch/Abacus Biotech NZ)
    - Prediction of rate of inbreeding under GWS obtained
      - lower rate of inbreeding than BLUP (PhD EU)
    - Optimisation method developed to control inbreeding at specific genome regions
  - Review & web-based tool to assess value of DNA parentage testing in sheep (+ GFP Spark)

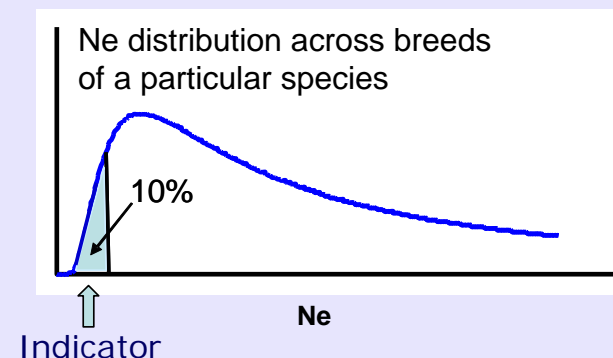


Net Benefit 1 (Includes Increased Value From Genetic Gain)			
Increased Survival (%)	5	10	15
DNA cost	£10.00	£10.00	£10.00
Flock Cost	£16,500.00	£17,000.00	£17,500.00
Net Benefit			
10% rams born sold	£-3,312.51	£-1,411.36	£501.63
20% rams born sold	£19.99	£3,227.28	£6,458.26
40% rams born sold	£6,684.97	£12,504.56	£18,371.52
60% rams born sold	£13,654.96	£21,781.84	£29,979.78



# Progress - Strand 2

- Optimising breeding programme design
  - Simple genetic indicator of biodiversity for livestock developed
    - Villanueva, Roughsedge, Woolliams (RI)
    - Calculate 'effective population size' ( $N_e$ ) for each breed
    - Plot distribution of  $N_e$
    - Calculate average  $N_e$  for lower 10% tail
  - see Villanueva & Roughsedge poster

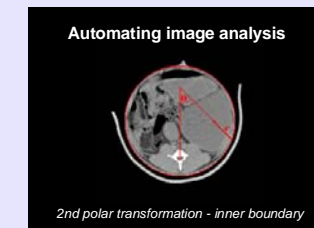
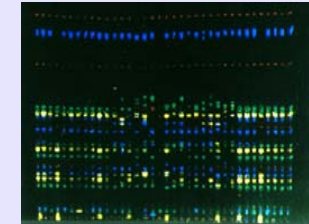




# Progress - Strand 2



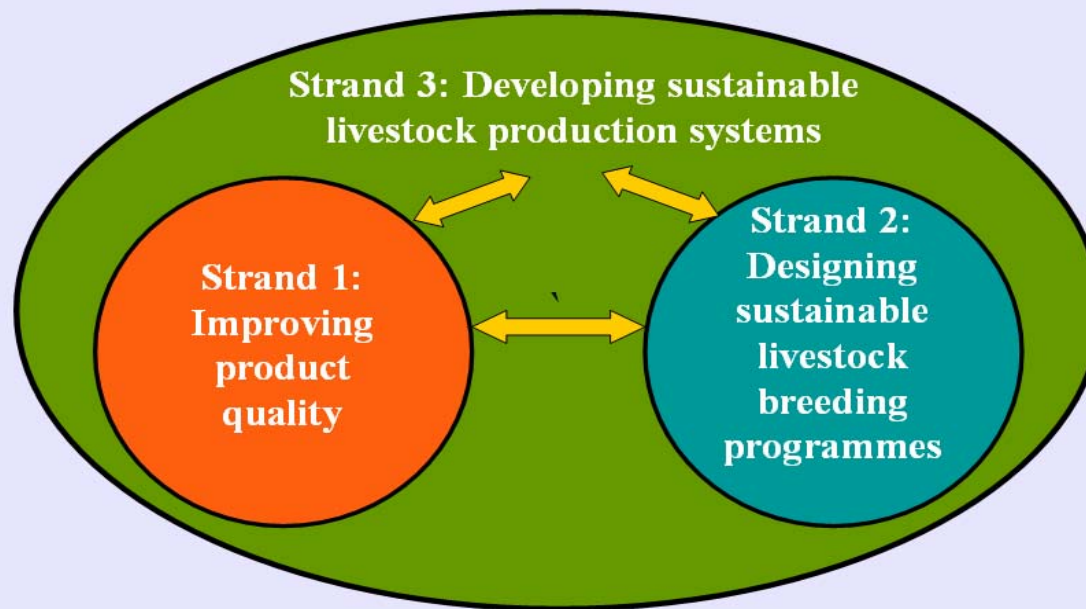
- Genetic markers
  - library of DNA/tissue samples organised
  - Initial sheep SNP chip order placed
  - See Bünger et al poster
- Biosecure reproductive technologies
  - Medium for maturation of bovine oocytes formulated – avoids animal products
  - Oocyte vitrification/evaluation procedures identified
  - See McEvoy et al poster
- Automating CT image analysis (BioSS)
  - See Glasbey poster



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## Strand 3: Developing sustainable livestock production systems

*Systems models to enhance sustainability (WP3.1)*

*Sheep & cattle epidemiological modelling*

*Experimental research to fill gaps in knowledge esp. biodiversity/environment*

# Progress - Strand 3



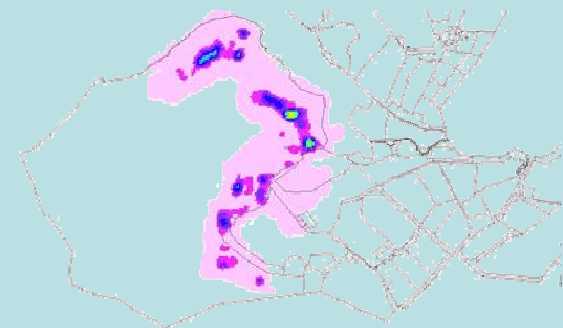
- Farming systems models (WP3.1)
  - Increased emphasis on Climate Change
  - ‘Retreat from the Hills’ policy paper identifying a particular Scottish issue
  - Progress in modelling economic, biodiversity and GHG impacts of different stakeholder-led farm scenarios
  - **Poster from Morgan-Davies et al**
  - **Presentation/posters from Chagunda, Wall, Bell & colleagues**
- Modelling sheep & cattle diseases
  - Models for lameness, EAE, ectoparasites in sheep; Johne’s and BVD in cattle
  - **Presentation/poster from Gunn, McCormick & colleagues**



# Progress - Strand 3



- Biodiversity/environment
  - First large-scale study of breeds - foraging and performance in hills
  - Field studies attempting for first time to identify biodiversity impact of cattle on hill grazing
  - Linked by surveys of farmer's experiences of breeds and their performance records benchmarked using 'BREEDS' software
  - Impacts of farming options on biodiversity and GHG
    - Environmental audits; frameworks for assessing biodiversity & GHG emissions; workshops
  - See 3 posters: Umstätter, Pollock, Holland & colleagues



**Location density map  
for Charolais**



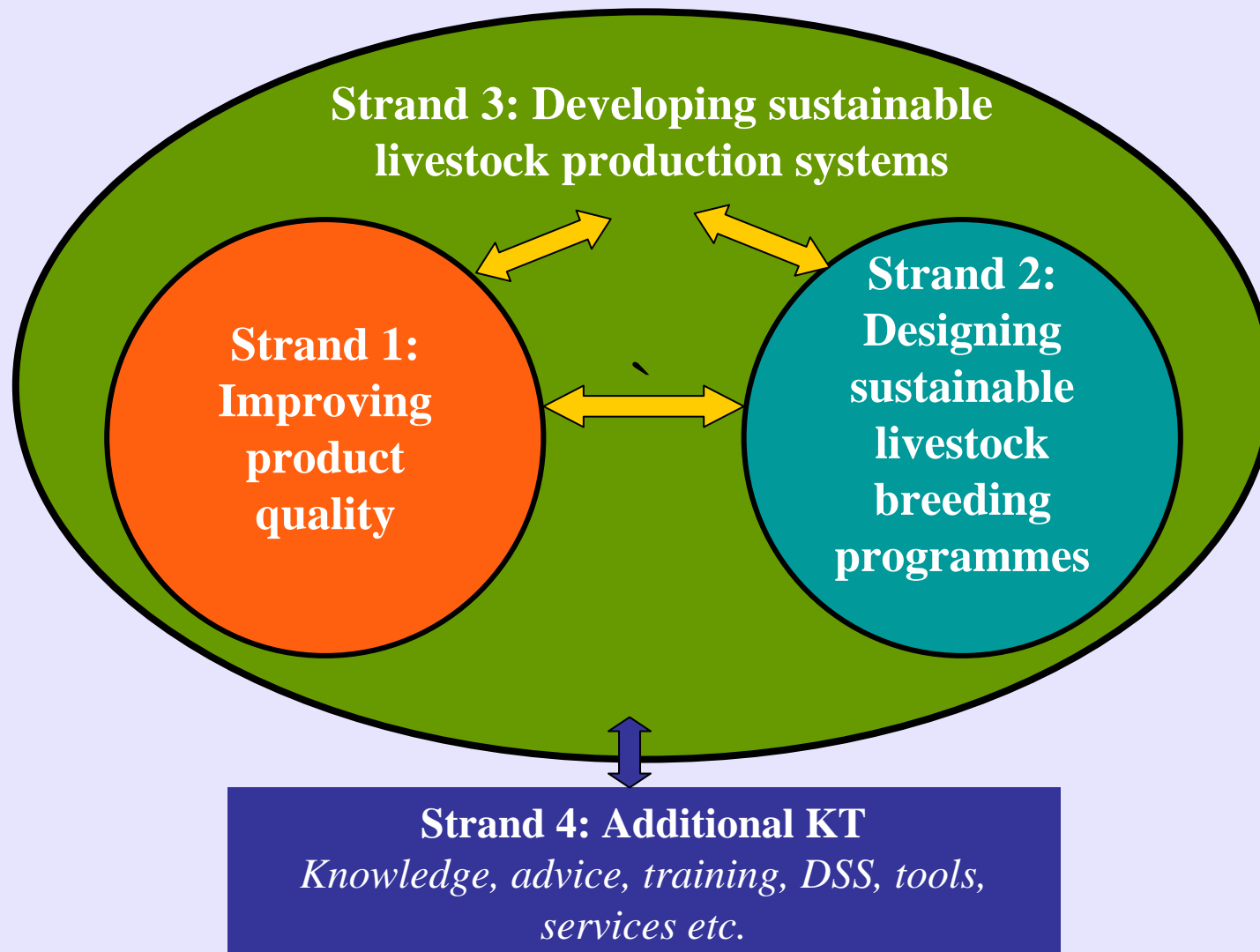
# Progress - Strand 3



- Financially viable mixed habitats on dairy farms (field margins/seed mixes)
  - 22 sites being monitored on 7 Ayrshire dairy farms
  - Invertebrates; vegetation composition, density, height complete
  - Fenced better - leatherjackets, sawfly larvae, harvestmen
  - Grazed better - ground beetles
  - Grazing or cutting necessary to allow bird foraging
  - See poster of Cole et al
- Dairy genotype x systems experiment ongoing
  - High & av. genetic merit for milk solids
  - Divergent systems (High input/High forage)
  - Impact on health, welfare, environment, economics
  - GHG emissions and N losses compared
  - See posters: Roberts, Chagunda & colleagues



# WP 2.5: Livestock genetics & management for product quality & sustainability





# Progress - Strand 4



## Success through Knowledge

Land based industry: Scotgrass;  
 Beef Open Day; Royal Highland Show; Northsheep;  
 LEAF Innovation Centre;  
 Future Dairy Systems videoconference;  
 Herdsman's day;  
 Livestock breeding decision support software;  
 Dairy crossbreeding & sheep breeding workshops

Public: Farm Sunday

+ KT embedded in projects

(KT campaigns agreed for 2008/09)



**meb breeding+** Evaluations

RAISING HERD PROFITABILITY THROUGH BETTER BREEDING

Home: Friesian | Ayrshire | Jersey | Jersey Island | Guernsey | Shorthorn

Breeding: > Holstein Reports > Available UK proven Holstein Bulls

Available UK proven Holstein Bulls

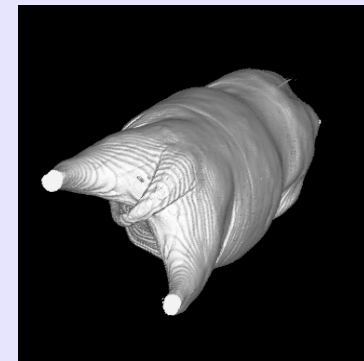
Export to Excel

Rank	Bull Name	Breed	60%	65%	70%	75%	80%	85%	90%	95%	100%	105%	110%	115%	120%	125%	130%	135%	140%	145%	150%	155%	160%	165%	170%	175%	180%	185%	190%	195%	200%	205%	210%	215%	220%	225%	230%	235%	240%	245%	250%	255%	260%	265%	270%	275%	280%	285%	290%	295%	300%	305%	310%	315%	320%	325%	330%	335%	340%	345%	350%	355%	360%	365%	370%	375%	380%	385%	390%	395%	400%
1	PRICOTON SHUTTLE *ML*TV	61	97	896	27.2	17.0	0.08	-0.02	97	81	27	5.0	-1.6	3.2	GEN																																																								
2	MONT SUGARLOFT *PO*	61	99	728	16.6	28.0	-0.11	0.03	89	79	137	8.2	16.8	3.8	GEN																																																								
3	MCCLEOD HORN TRUMP *M*TV	68	99	961	26.0	23.1	0.08	0.00	74	79	-1	6.1	-1.3	0.9	HO																																																								
4	ROCKCREST BOONE *TV*	68	94	854	28.0	19.9	0.07	0.06	88	88	79	14	8.2	-0.4	GA																																																								
5	MPHENIXIDE SYRWARD *ML*TV	61	99	896	26.0	24.0	0.04	0.00	76	79	1	6.2	-0.7	1.0	CGD																																																								
6	BOODS BEAR *ML*TV	71	99	729	19.8	24.4	-0.04	0.01	84	84	12	3.1	-2.7	3.8	GEN																																																								
7	KLASSIC HERWILL VINC *TV*	69	97	241	21.4	13.2	0.04	0.07	92	84	-4	6.2	1.8	0.5	HO																																																								
8	BOGAN VIEW FRENCH *ML*TV	69	99	391	17.8	13.0	0.04	0.01	82	80	139	8.4	1.2	2.8	SH																																																								
9	VISION GEN DIZIE *ML*TV	65	96	812	28.0	21.4	-0.02	-0.06	81	82	-8	6.0	-2.0	1.0	GEN																																																								
10	DAMERS DELAYE *ML*	59	99	128	29.2	16.8	0.06	0.00	91	85	136	10.2	-2.0	0.2	SH																																																								
11	KAFID BAY LIGHT YEAR *ML*TV	64	99	818	28.2	19.2	0.06	-0.01	82	81	-10	-0.1	-0.8	2.1	GA																																																								
12	GRANDS PRINCIPAL *ML*TV	61	99	919	26.7	26.7	0.01	0.08	82	89	12	6.0	-2.0	1.8	CGD																																																								
13	WINDHOLM HUBBARD *ML*TV	62	98	109	18.0	8.2	0.44	0.29	81	89	-1	6.1	-0.1	0.3	HO																																																								
14	MORTONHILL HATULLERY	61	92	478	18.7	17.4	0.02	0.00	83	88	7	8.2	-0.9	1.0	CGD																																																								

# Studies on value of genetic improvement



- Retrospective (Amer et al , 2007):
  - 10 years sheep improvement - £29m
    - £111m possible
  - 10 years beef improvement - £23m
  - Internal rate of return on investment - 32%
- Prospective (Moran et al, 2007):
  - Value animal and plant genetics R&D - likely future policy priorities inc. climate change
  - Public good rates of return 11-18% for animal case studies
  - c.f. 3.5% recommended Treasury rate



# Adding value to WP2.5



- Complementary R&D projects
  - Sheep muscling QTL/VIA (LINK)
  - Live cattle VIA (LINK)
  - Sheep & cattle genomics
    - AgResearch; Abacus (NZ); Iowa State University; EU
  - Several under review
- 6 PhD studentships ...
  - sheep VIA (MLC, QMS, HCC, Eblex)
  - bird ecology (SAC, SNH, GCT)
  - genetics of piglet survival (links to WP2.4) (EU)
  - use of molecular information in selection (EU, with Roslin Institute)
  - dairy breeding to mitigate climate change (Scottish Govmnt, links to WP3.1)
  - genome wide selection in sheep & beef (GFP CASE, with Roslin Institute)
- New SEERAD ‘development fund’ activity
  - Genetic epidemiological modelling
    - » link to other Programme 2 WPs
  - Livestock breeding to mitigate climate change

Supporting the  
land-based industries  
for over a century

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