

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*

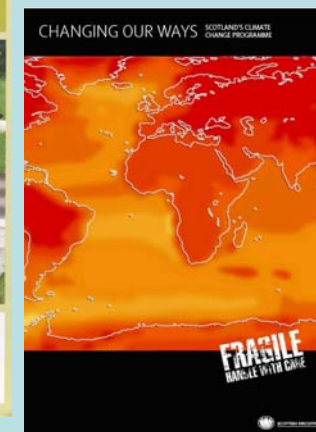


The European Agricultural Fund for Rural Development:
Europe investing in rural areas

UK National Action Plan on
Farm Animal Genetic Resources
November 2006



defra



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



**Strand 1:
Improving
product
quality**

The diagram features a large orange circle on the left containing the text 'Strand 1: Improving product quality'. A pink speech bubble originates from the right side of this circle, pointing towards the right. Inside the speech bubble, there are three lines of italicized pink text: 'Improved measurement techniques for carcass & meat eating quality in beef & sheep', 'Designing & testing breeding programmes for carcass & MEQ', and '[Livestock products & human health]'.

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

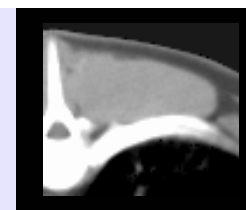
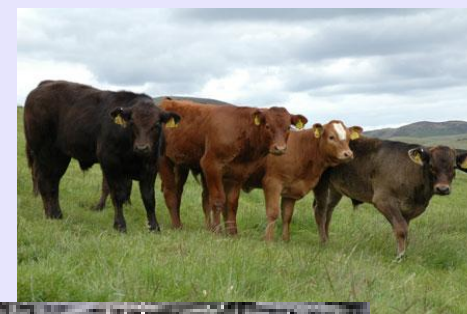
Designing & testing breeding programmes for carcass & MEQ

[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



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



Strand 1:

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

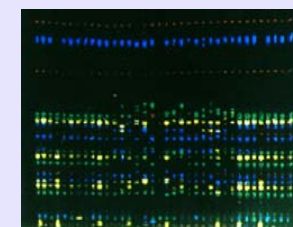
Developing & testing new breeding tools e.g. markers, reproductive technologies, [CT image analysis software]

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

Progress - Strand 2



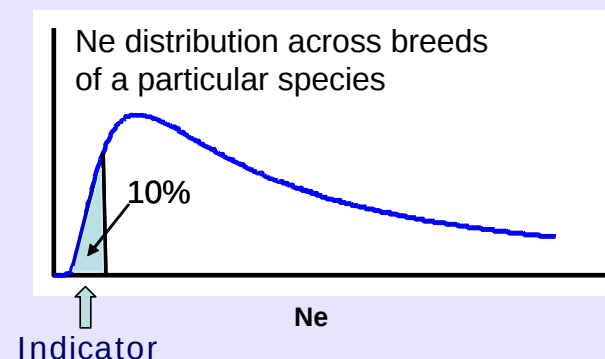
- Optimising breeding programme design
 - Use of genetic markers to increase gain while controlling inbreeding
 - Applying genome wide selection (GWS) in sheep (collaboration with AgResearch/Abacus Biotech NZ)
 - Prediction of rate of inbreeding under GWS obtained
 - lower rate of inbreeding than BLUP (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

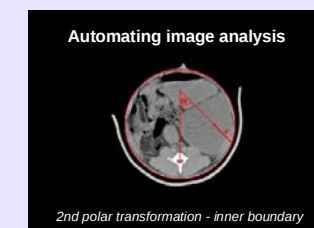
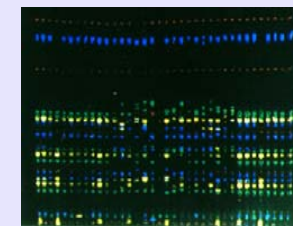
- Optimising breeding programme design
 - Simple genetic indicator of biodiversity for livestock developed
 - Villanueva, Roughsedge, Woolliams (RI)
 - Calculate 'effective population size' (N_e) for each breed
 - Plot distribution of N_e
 - Calculate average N_e for lower 10% tail
 - see Villanueva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



Progress - Strand 2



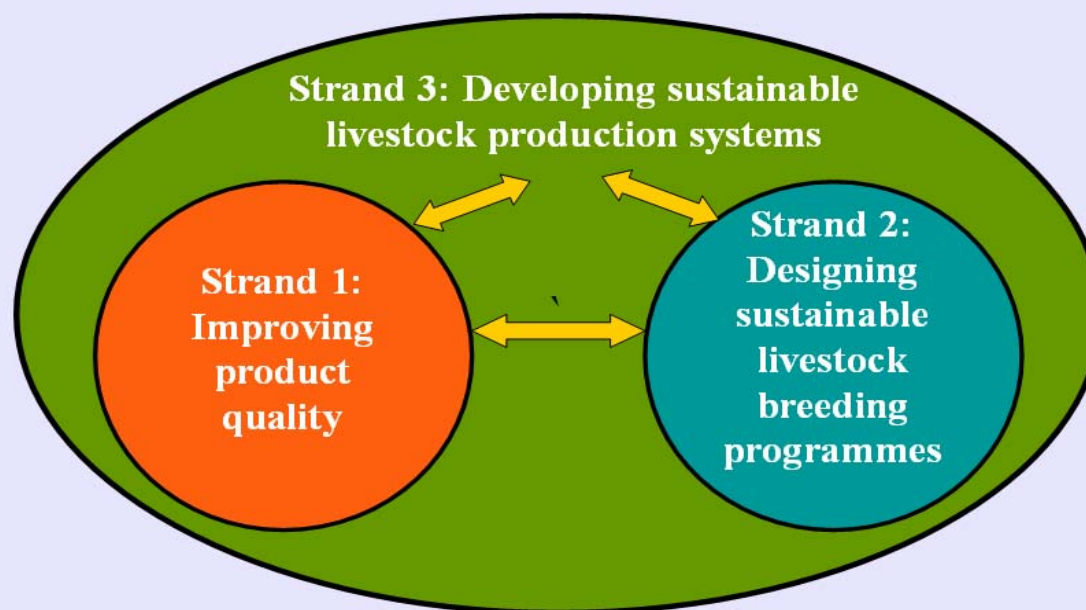
- Genetic markers
 - library of DNA/tissue samples organised
 - Initial sheep SNP chip order placed
 - See Bünger et al poster
- Biosecure reproductive technologies
 - Medium for maturation of bovine oocytes formulated – avoids animal products
 - Oocyte vitrification/evaluation procedures identified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



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



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



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

A diagram consisting of two overlapping circles. The larger circle on the left is green and contains the text 'Strand 3: Developing sustainable livestock production systems'. The smaller circle on the right is orange and contains the text 'Sustainable Livestock Production Systems'. A large, rounded pink rectangle is positioned in front of the orange circle, containing three lines of text in pink italics.

**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



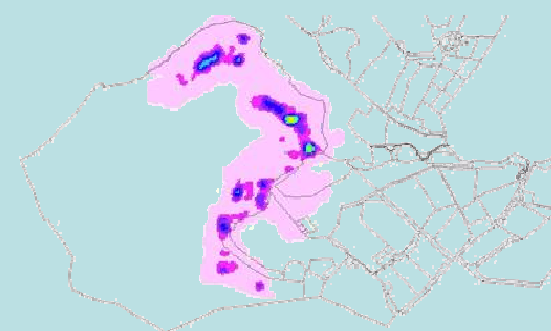
- Farming systems models (WP3.1)
 - Increased emphasis on Climate Change
 - ‘Retreat from the Hills’ policy paper identifying a particular Scottish issue
 - Progress in modelling economic, biodiversity and GHG impacts of different stakeholder-led farm scenarios
 - Poster from Morgan-Davies et al
 - Presentation/posters 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**

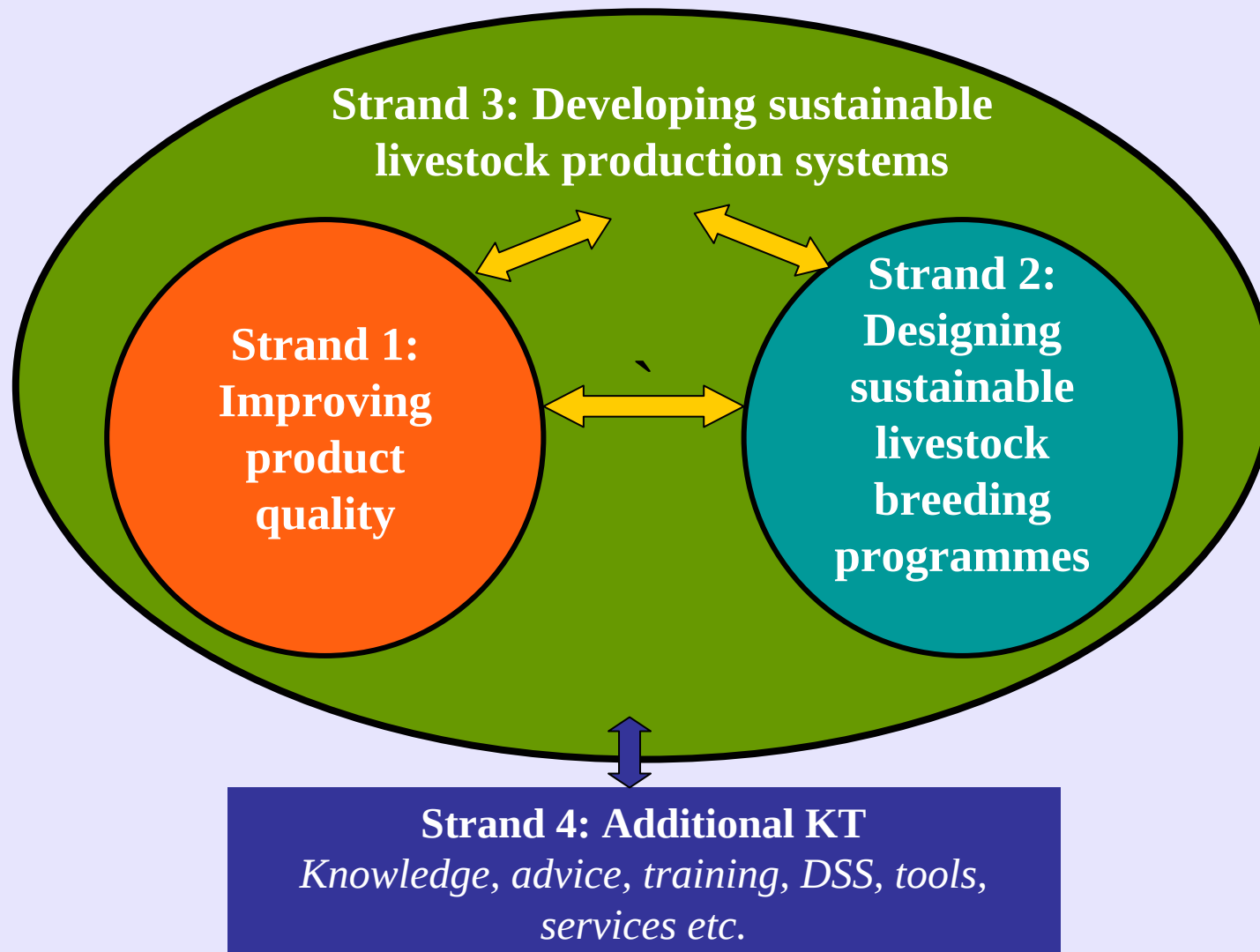
Progress - Strand 3



- 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



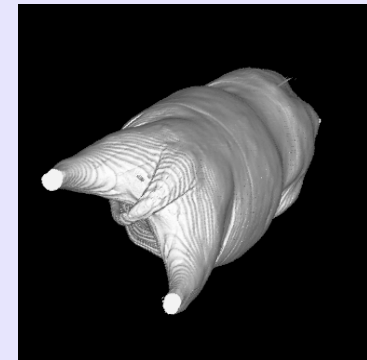
(KT campaigns agreed for 2008/09)

[illegible]

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



SAC