Native Breeds at Risk
confusion or standardisation?

Lawrence Alderson

lawrence@clltd.demon.co.uk

Confusion!

Pejorative word –

- is it justified?

Does the current situation –

- establish reasonable and effective thresholds?

- allow sensible and consistent decision-making?

- enable stakeholders to develop optimum policy and programmes?

Confusion!

- **Pigs**:   EU 15,000 sows; FAO 1,000 sows
- **Poultry**: EU 22,500 hens; FAO 1,000 hens

Rationale for EU thresholds –

- numerical (N_e) determines inbreeding and possibility of extinction in 50 years
- no allowance for other relevant factors – trends, reproductive rate, geographical, etc

Seminar in London (February 2010) to resolve the problems

Standardisation

Conservation of FAnGR: four steps:

- **Basic definitions** – what is a (native) breed?

- **Indicators of Endangerment** – which breeds are at risk?

- **Factors of Prioritisation** – which to support?

- **Management of Breeds at Risk** – policies and programmes of management are subject to national decisions
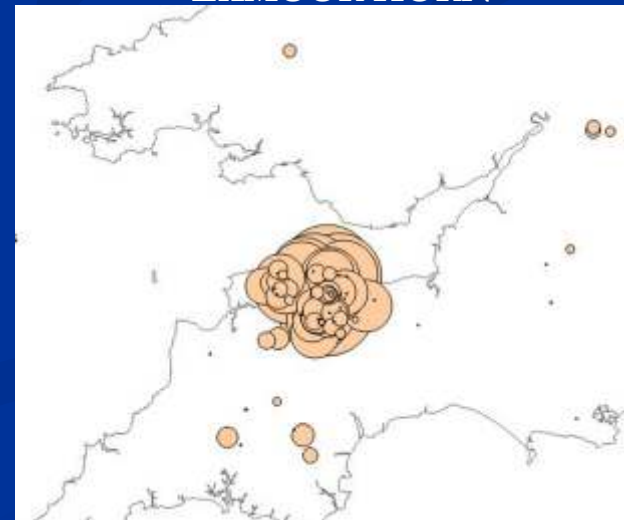
Indicators of Endangerment

Two essential primary indicators –

NDS

- **Numerical**

- size of population

EXMOOR HORN

- **Geographical**

- range or distribution

Indicators of Endangerment

Two **modifying primary** indicators –

- **Genetic** (genetic erosion; loss of alleles) modifying
- **Introgression** (threatens breed integrity) precursor (i.e. when is a breed not a breed?)

Other dangers are causal (they influence primary indicators) -

- Demographic – number/age of owners, etc
- Changing marketplace, disease threats

Numerical

Questions:

- Population only in **country of origin**
- **Registered animals** or all animals

Options:

- **Effective population size** – N_e 50 = 1% p gen
- No. of **breeding females** – commonly used
- No. of **female replacements** – best measure of health of breed (ideally with 3-year rolling average)

Numerical

Pragmatic Option:

■ No. of breeding females – commonly used

Starting point: FAO criteria (100 / 1000), plus

■ modify with extra warning threshold

■ vary according to species to allow for differences in:

■ ~ generation interval

■ ~ mating ratio / number of breeding units

■ ~ reproductive rate

Numerical

■ **Thresholds for standardisation** – developed from FAO criteria

number of females of breeding age

Category	Cattle	Sheep	Goats	Equines	Pigs	Poultry
1	150	300	300	200	100	100
2	1500	3000	3000	2000	1000	1000
3	3000	6000	6000	4000	2000	2000

Geographical

Value of native adaptation

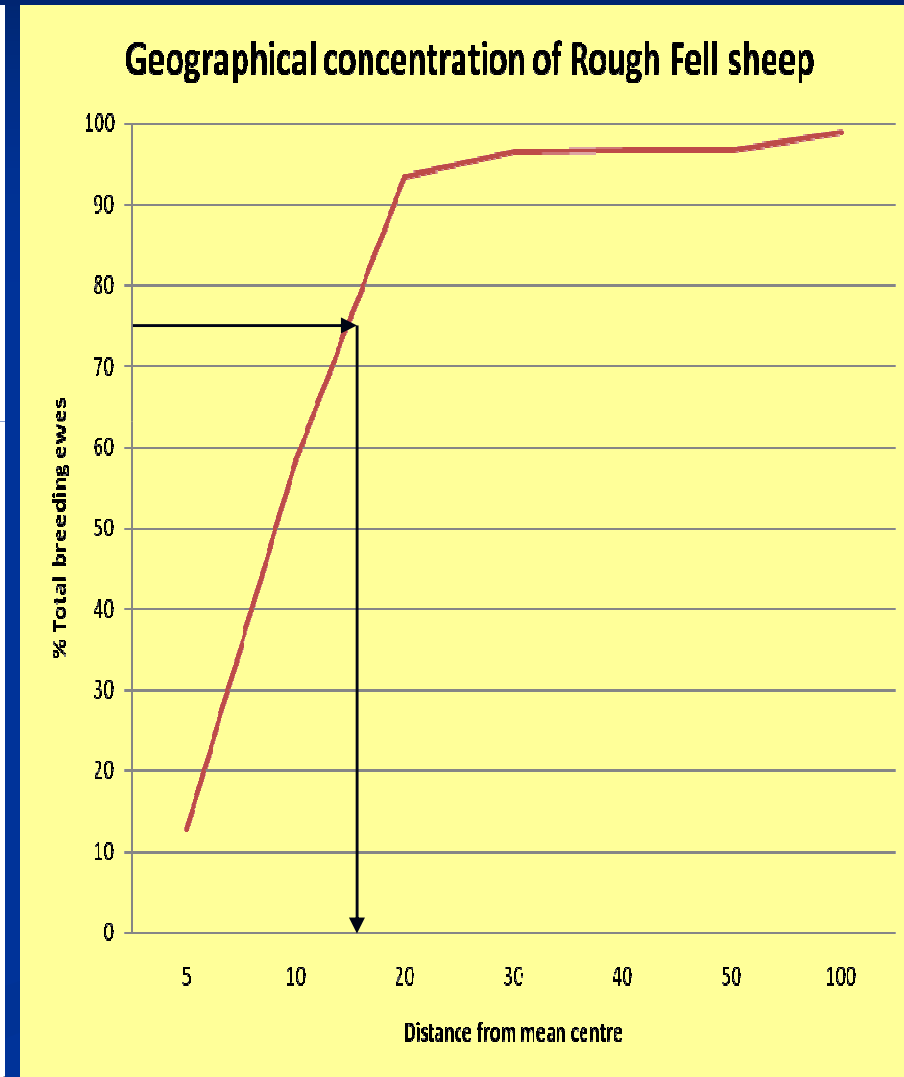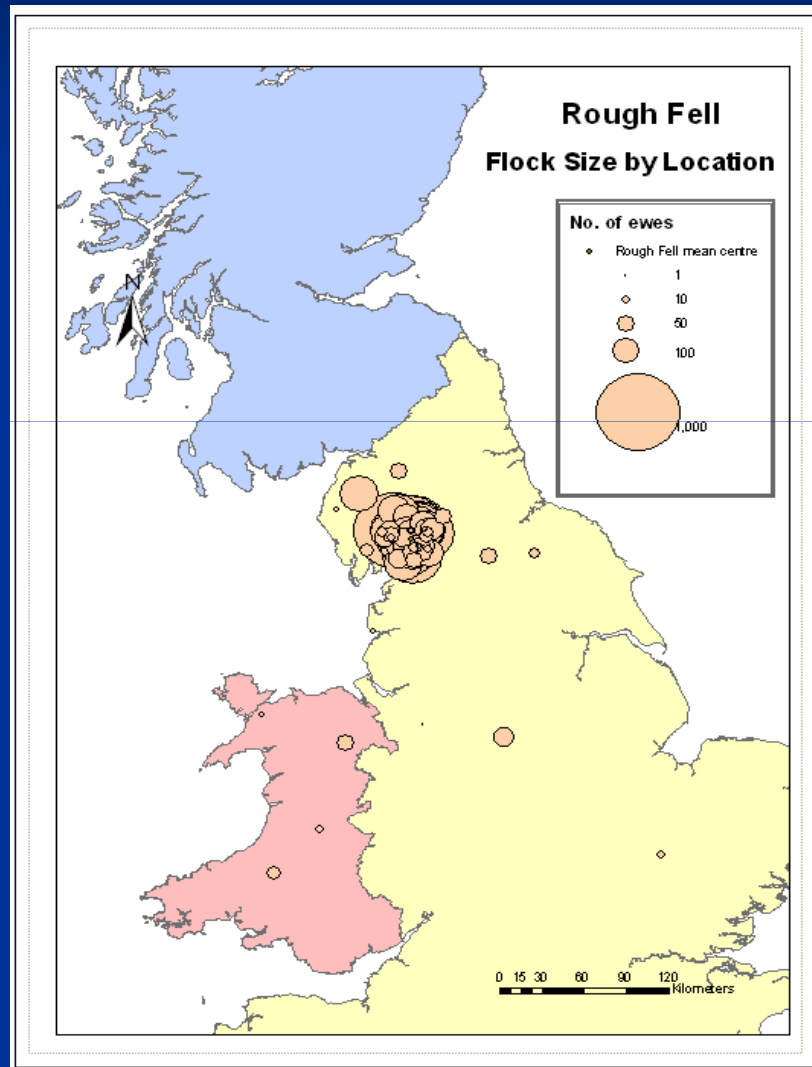threat from disease outbreaks

Procedure:

- developed in the UK by the Univ of Worcs and CLL; based on GIS and herd/flock data

Criterion:

- geographical concentration: **>75% population** found within **50 km** of the (MWC) mean weighted centre of the breed

Rough Fell sheep

Rough Fell
Flock Size by Location

No. of ewes
- Rough Fell mean centre
- 1
- 10
- 50
- 100
- 1,000

0 15 30   60   90   120
Kilometers

Geographical concentration of Rough Fell sheep

% Total breeding ewes

Distance from mean centre

Example Breeds – UK sheep

Boreray

- **221** breeding ewes; **180 km** radius
- Numerically at risk (1)
- Not threatened geographically

Rough Fell

- **15134** breeding ewes; **15 km** radius
- Not threatened numerically
- Geographically at risk (2)

Genetic

Genetic erosion – most severe in small populations and those with an acute hierarchical breed structure

Small populations

■ Traditional Hereford loss of 18% alleles from 1960s to 1990s

■ Vaynol cattle: (N_e 3.8); homozygous 7/16 markers

Inbred populations –

■ TB horses (CGI 28.15)

■ Holstein cattle (N_e <100), O-Man effect

Genetic

Inbreeding:

- **Threshold:** rate of inbreeding of
  1% per generation (N_e 50)

Introgression:

- **Threshold:** introgression of
  2.5% in any generation (12.5% critical
  threshold – effectively a new breed)

Threshold for Indicators of Endangerment

The threshold acts to identify 'breeds at risk'

Category	Numerical: breeding females"	Geographical: concentration^ km	Genetic: inbreeding* %	Genetic: introgression %
3	<2000-6000	<50	>1	>2.5

" varies according to species

^ radius of circle containing 75% of the breed

* rate of inbreeding per generation

Prioritisation

determined by Probability of Extinction and categorisation of indicators of endangerment

Category	Numerical: breeding females "	Geographical: concentration^ km	Genetic: inbreeding * %	Genetic: introgression %
1	<100-300	<12.5	>3	>12.5
2	<1000-3000	<25	>2	>7.5
3	<2000-6000	<50	>1	>2.5

" varies according to species

^ radius of circle containing 75% of the breed

* rate of inbreeding per generation

Other Factors of Prioritisation

Loss of genetic diversity

- measured by various applications of population genetics and/or molecular genetics

Other factors

- distinctive traits – commercial, behavioural
- socio-ecological – cultural, landscape
- catastrophic events

Genetic Diversity

Genetic distance

■ White Park cattle (distinctiveness and heterosis benefit)

Between-breed v within-breed diversity

■ PigBioDiv1 – Basque (highest 'between' and lowest 'within')

Core set of breeds

■ Breeds ranked by contribution to extra diversity

Local Breeds

Special traits:

- Local adaptation (N'dama and North Ronaldsay)
- Product quality
- ~ White Park beef – Sir Loin
- ~ Basque pig – Oteiza business
- Landscape management – conservation grazing

Undesirable traits: VRQ scrapie allele

Historical value (many native breeds):

- Local tradition and history
- Tourism and local crafts

Factors of Prioritisation

Take all factors into account

- **<u>Probability of extinction</u>** – essential

- **<u>Genetic diversity</u>** across species (maybe based on index of between- and within-breed diversity) – modifying

- **<u>Special traits</u>** of local breeds – modifying

Standardisation in Europe

Breed definitions

- standardisation possible and agreed

Indicators of endangerment

- standardisation possible and recommended

Factors of prioritisation

- standardisation possible but further clarification required on some details

Lawrence Alderson

lawrence@clltd.demon.co.uk

www.lawrencealderson.com