

The Linnean Society of London

18th April 2013

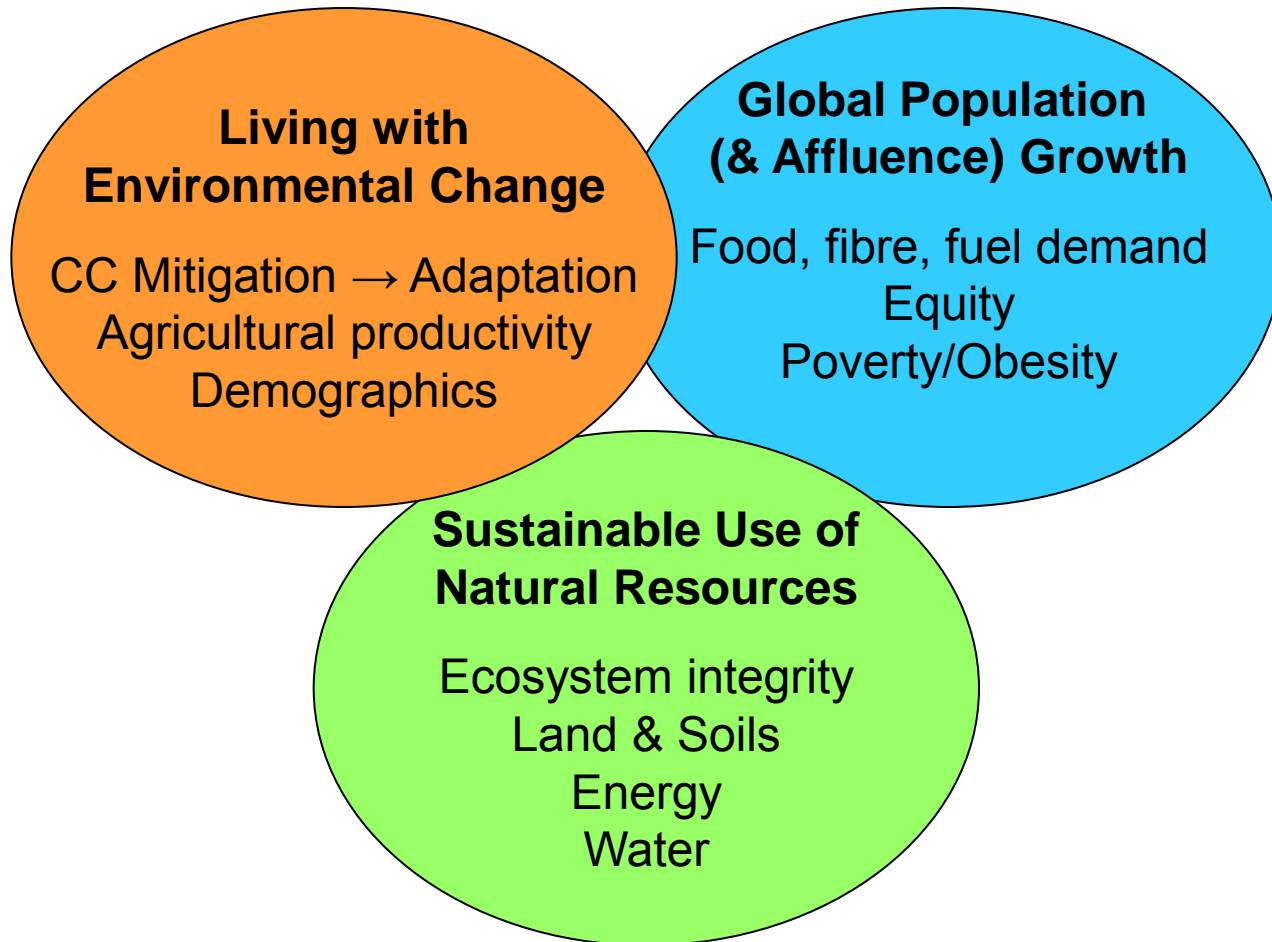
Agricultural Biodiversity – will *Homo sapiens* live up to its name ?

Julian Hosking

Perfect harmony ?



Major challenges ahead



Challenges for agriculture and food

- Competition for land, water, and funds.
- Over reliance on narrowing food base.
- Declining diversity of genetic resources.
- Increasing off-farm impacts (e.g. N, P, GHGs, soil erosion, wild biodiversity).
- Climate change effects (e.g. droughts, floods, sea level rise, pests and diseases).
- Human population growth and nutrition.

Old English Pheasant fowl



Our own species

- **Homo sapiens**, (Latin: “wise man”) the species to which all modern human beings belong. *Homo sapiens* is one of several species grouped into the genus Homo, but it is the only one that is not extinct.
- The name *Homo sapiens* was applied in 1758 by the father of modern biological classification, Carl Linnaeus. It was well known that human beings physically resemble the primates more closely than any other living organisms, but it was a daring act to classify human beings within the same framework.

Broad outline

- What is “Agricultural Biodiversity” ?
- Why is Agric Biodiversity important ?
- What are the trends and risks ?
- Components of, and policy ‘drivers’, for Agricultural Biodiversity.
- How is Agricultural Biodiversity supported ?
- Opportunities to demonstrate wisdom.



What is “Agricultural Biodiversity”?

- Convention on Biological Diversity and UN-FAO definitions.
- Farm Animal Genetic Resources (FAnGR) (livestock species & breeds), Plant Genetic Resources (PGR) (cultivated plant species), & Crop Wild Relatives.
- Also Forest, Aquatic, Microbial, Fungal, and Pollinator/Invertebrate Genetic Resources.
- Links to ‘Wild Biodiversity’ as part of SPECIES biodiversity, for habitat & landscape mgt., for ecosystem ‘provisioning’ services, and for economic & traditional/cultural values.

Relevance of components of “Agricultural Biodiversity”?

- *Only 14 of the more than 30 domesticated mammalian and bird species provide 90% of human food supply from livestock (principally cattle, pigs, fowls, sheep, and goats).*
- *Plants account for over 80% of the human diet.*
- *30 000 terrestrial plants are known to be edible.*
- *7 000 are cultivated or collected by humans for food.*
- *30 crops feed the world, and 5 cereal crops (rice, wheat, maize, millet and sorghum) provide 60% of the energy intake of the world population.*



Why is Agricultural Biodiversity important ?

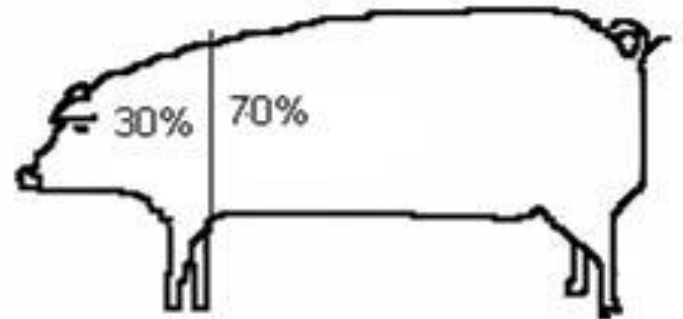
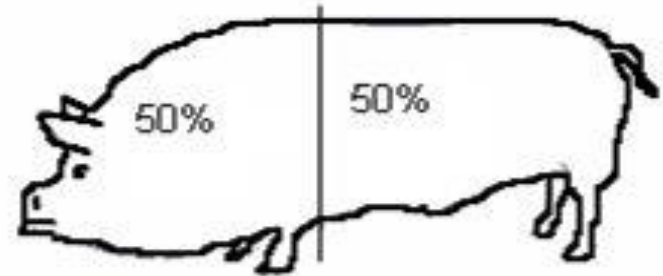
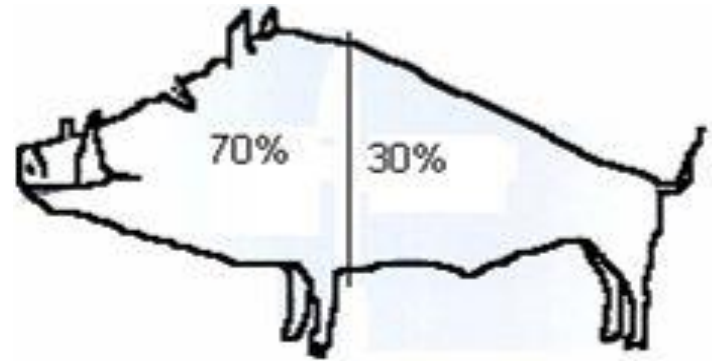
- Basic needs of *Homo sapiens*: Food, freshwater, oxygen, and shelter/clothing; Plus the “securities”.
- Includes all components of biological diversity of relevance to food, farming, horticulture, and woodland management.
- Renewable supplies of food, fibre, other raw materials, medicines, fuels, draught power, fertiliser, other energy & ecosystem services, ‘recycling’, etc.
- It is the ‘bridge’ between real farming husbandry and wild biodiversity conservation/enhancement.

How to produce a commercial pig from a wild boar

From fighter to porker (!)

The wild boar shows natural evolutionary adaptations for fighting, with big heavy shoulders;

Modern selectively-bred pigs have heavy hindquarters, where the highest value meat is found.



Oxford Sandy and Black pig



What are the trends and risks ?

- Relying on ever fewer species, breeds, landraces, varieties, and crosses/hybrids; plus less 'owners'.
- New breeds - v - Breed 'improvements'.
- Monocultures and specialisation at increasing scales - v - Stable mixed and rotational farming systems.
- Climate change; New animal & plant diseases/pests.
- Market, economic, social, human diet, knowledge, and demographic developments.
- Short term unsustainable intensification - v – Long term sustainable optimisation.
- Efficiencies of utilisation and 'zero waste' objectives.

Herdwick sheep



Components of, and policy ‘drivers’ for, Agricultural Biodiversity

- ❖ Major livestock species (e.g. Cattle, sheep, goats, pigs, ponies, horses, poultry) and their UK native breeds.
- ❖ Plant species in arable, horticultural and pastoral systems – their UK landraces and varieties (e.g. cereals, vegetables, fruit & nuts, forage crops); plus their ‘crop wild relatives’.
- ❖ Valuation of non-market benefits (e. g. of ecosystem services) and Natural Capital.
- ✓ Convention on Biological Diversity Strategic Plan: Target 13.
- ✓ EU Biodiversity Strategy to 2020 – Action 10.
- ✓ England’s biodiversity and ecosystems strategy to 2020 – Priority action to conserve and enhance ‘agricultural’ genetic and species diversity.

International commitments

Convention on Biological Diversity

Strategic Plan for Biodiversity 2011-2020, including Aichi Target 13 :

By 2020, the genetic diversity of cultivated plants & farmed & domesticated animals & of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, & strategies have been developed & implemented for minimizing genetic erosion & safeguarding their genetic diversity.

EU Biodiversity Strategy to 2020

Action 10: Conserve Europe's agricultural genetic diversity

The Commission & Member States will encourage the uptake of agri-environmental measures to support genetic diversity in agriculture & explore the scope for developing a strategy for the conservation of genetic diversity.

Traditional orchard



Orchard network



ORCHARD
NETWORK

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Celebrate Traditional Orchards

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Val Corbett

Orchard Network

Welcome to **Orchard Network** - website of the Habitat Action Plan (HAP) group for Traditional Orchards. We are a partnership of organisations working together for the conservation of Traditional Orchards as a wildlife habitat. We hope you find this site a useful resource for finding out about the wildlife that thrives within our orchards, the issues that surround their conservation, and ways that you can get involved.

Orchard Biodiversity



- The Orchard Habitat
- Noble Chafer beetles
- Biodiversity Action Plan

[More about Orchard Biodiversity](#)

Wild ancestors and relatives

- ❖ For major livestock species (e.g. Aurochs, mouflon, bezoar goat , wild boar, red jungle fowl, etc).
- ❖ ‘Crop wild relatives’ (e.g. in the UK, CWRs of barley, sugar beet, cabbage, radish, asparagus, leek, apple, pear, etc).
- ❖ Homo sapiens sapiens (E.g. Primates, Hominidae (great apes), Homininae, Hominina, Homo erectus, etc.)
- ❖ We share 95-99% of our DNA with our closest living evolutionary relative, the chimpanzees.
- ❖ Ancestors and relatives, especially the wild ones, are very important for our future as a sustained and resilient species – so look after them while they are still here (!).

Crop wild relatives

There are between 50,000-60,000 crop wild relatives ([Maxted & Kell, 2009](#)).

11,000 of these are important for food and agriculture.

700 (less than 0.26% of the world's flora) require urgent conservation because they are considered the most important in terms of global food security and are most threatened by climate change and habitat loss.

Scottish landrace protection scheme

Landraces are locally adapted populations which are actively maintained by growers/crofters; each population may be different and very diverse. Five landraces in the SLPS:-

Bere barley:

- considerable diversity between populations, within populations and between island groups.
- development of niche market products with regional branding (Orkney): flour, whisky and beer

Shetland cabbage.

Small oat.

Hebridean rye.

Scots timothy.



Diversity of control ?

Corporate concentration in the seed sector:-

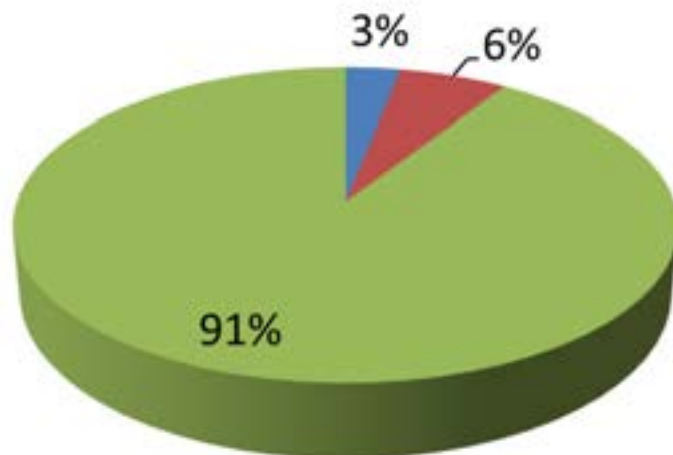
- Six multinational seed companies (Syngenta, Bayer, BASF, Dow, Monsanto and DuPont) control 59.8% of commercial seeds and 76.1 % of agrochemicals.
- The same 6 companies account for at least 76 % of all private sector R&D in these two sectors.
- Monsanto, the world's largest seed company and fourth largest pesticide company, now controls more than one-quarter (27%) of the commercial seed market.

ETC Group (March 2013)

Status of UK FAnGR

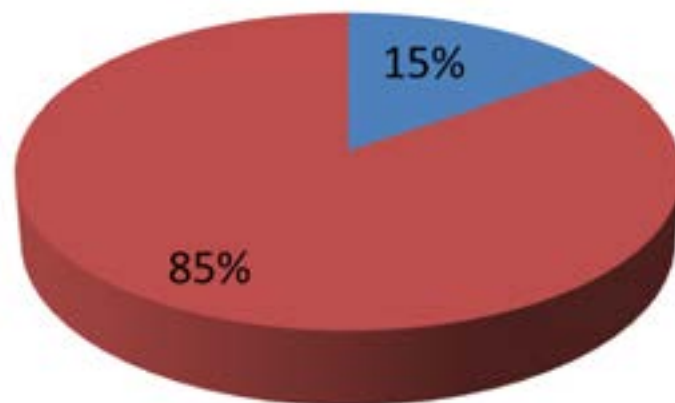
Global FAnGR: 7634 breeds

- UK native breeds
- Other breeds in UK
- Other breeds globally



UK FAnGR: 235 breeds

- Other UK native breeds
- UK native breeds at risk



What does “at risk” mean ?

- Numerical scarcity.
- Geographic concentration, and specific locational density.
- Inbreeding.
- Introgression.
- Lack of within-breed genetic variation.
- Poor breed management and/or structure of breed.
- Absence of comprehensive and viable *ex situ* ‘collections’ of PGR and FAnGR. (75% PGR diversity lost in last 100 years).
- Inability to adapt to changing climatic or other environmental conditions.
- Going out of use in commercial enterprises or simply ‘out of fashion’ with modern humans.



How is Agricultural Biodiversity supported?

- Defra GRFA team; UK FAnGR and PGR Committees.
- Rare Breeds Survival Trust, Sheep Trust, Millennium Seed Bank, Global Seed Vault, National Fruit Collection (Brogdale), Vegetable Gene Bank (HRI), Pea Gene Bank (JIC).
- UK Rural Development Programmes (RDPs) – E.g. Environmental Stewardship (HLS) NBAR grazing & trad. orchards; Glastir in Wales; NI Countryside Mgt Scheme; Scottish Landrace Protection Scheme.
- ✓ Traditional Breeds Initiative -> HLS and Glastir.
- ✓ UK Breeds At [especial] Risk lists – re. exotic disease control.
- ✓ UK Native Breeds at Risk lists – re. RDPs eligibility.
- ✓ Ex situ 'collections' of PGR and FAnGR.

Exmoor ponies



Opportunities to demonstrate wisdom

- ❖ CAP promotion of sustainable farming SYSTEMS.
- ❖ Equality of priority with other 'wild' biodiversity.
- ❖ **Improved range of Rural Development measures** –
E.g. NBAR re-introduction for grazing & 'working',
Livestock species grazing, Hefted/Closed systems, *Ex situ* germplasm storage, Conservation breeding programmes, Unique individual (E) ID, DNA 'fingerprinting', product traceability (incl. by breed, variety, animal), expand scope of 'at risk' criteria.
- ❖ Payments for ecosystems/environmental services and conservation of these 'natural resources'.



Discussion

- ❑ Ways to integrate agricultural biodiversity with all other biodiversity? Include in 'protected areas' ?
- ❑ How to ensure complete and viable inventories of agricultural genetic biodiversity (*in situ* & *ex situ*)?
- ❑ Methods of utilising agric. biodiversity evolution, adaptation and selection to increase sustainability?
- ❑ Are efficient food, water, nutritional and environmental, etc. securities possible in the 21st century UK?
- ❑ Ensuring access and benefit-sharing.
- ❑ Answers to the title question (!).

FLS with Dexter cattle



13 OCT. 1925

4281



FORM OF RECOMMENDATION

FOR A FELLOW OF THE LINNEAN SOCIETY OF LONDON.

(Mr.) JOHN EVERARD HOSKING,

College Diploma of Agricultural Science & Practice

National Diploma of Agricultural Science & Practice

a Research Worker attached to the study of Natural History, especially ~~Botany~~ (Plant

Breeding for Agriculture) specialising in Crops

address - Lavadra, Brahampton, Devon.

being desirous of becoming a Fellow of the LINNEAN SOCIETY OF LONDON, we, whose names are underwritten, beg leave to recommend him to that Honour.

Agricultural Biodiversity in Action (!)



Thank you for listening !



Bagot goat



Buff Orpington fowl



Silver Appleyard duck

