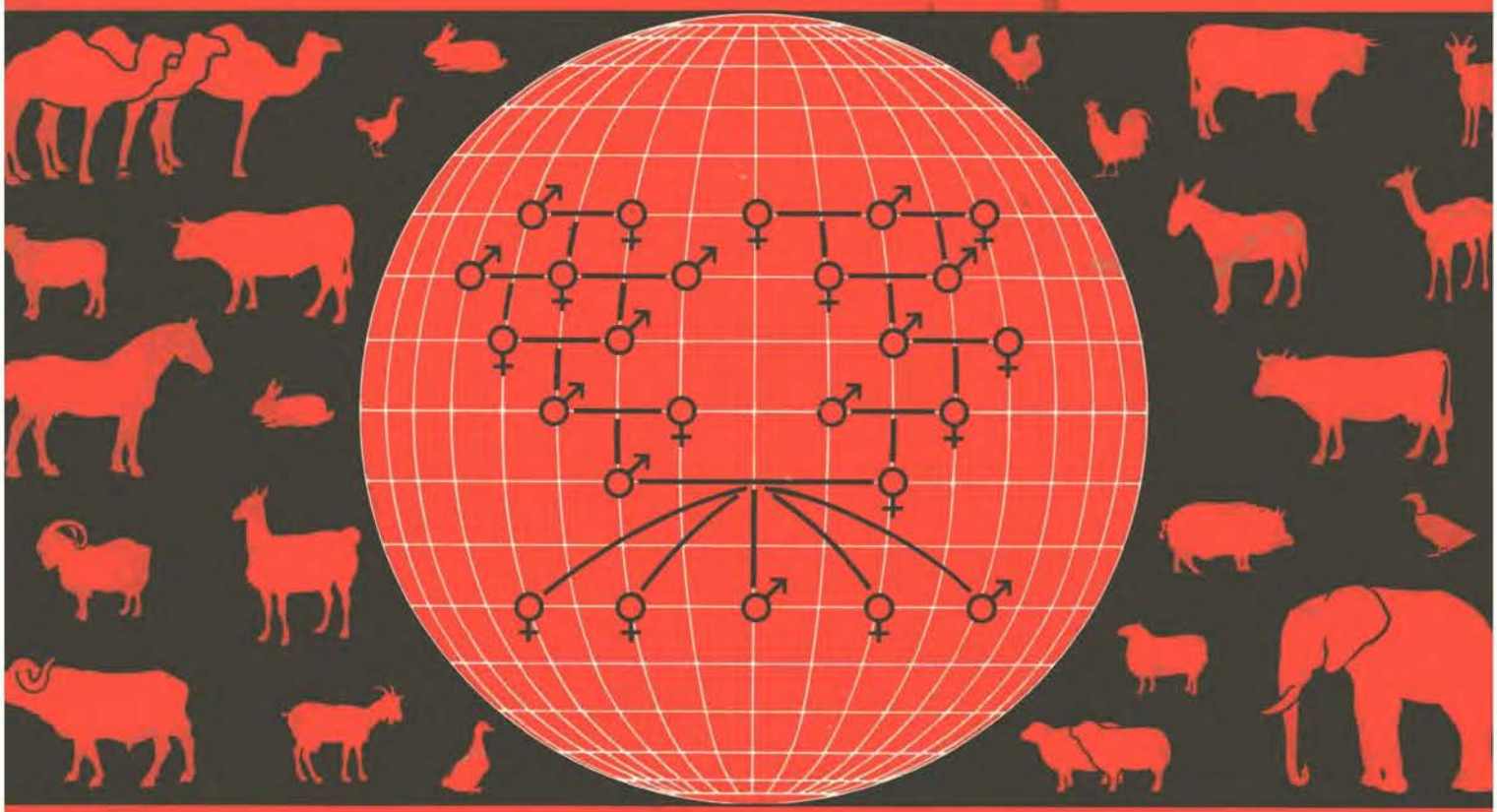
L GENETIC RESOURCES INFORMATION 5

BULLETIN D'INFORMATION SUR LES RESSOURCES GÉNÉTIQUES ANIMALES

BOLETIN DE INFORMACION SOBRE RECURSOS GENETICOS ANIMALES

1986



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ANIMAL GENETIC RESOURCES INFORMATION

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BOLETIN DE INFORMACION SOBRE RECURSOS GENETICOS ANIMALES

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CONTENTS

	Page
Mobilization of the Forces of Society for the Conservation of Animal Genetic Resources, by L. Alderson	1
Recent Articles on Poultry Genetic Resources	6
A Role for Feral Mammals in Conserving the Genetic Diversity of Livestock by M.R. Rudge	7
News Items	24
Recent Publications	31
Reports of Meetings	45

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GUIDE TO CONTRIBUTORS

Animal Genetic Resources Information will be pleased to receive contributions up to 3000 words long in English, French or Spanish. If accepted they will be published in the original language with summaries in the other two. Reports, news and notes about meetings, conservation and evaluation activities, and techniques, would be appreciated. Manuscripts should be typed in double space and accompanied by a summary of not more than 5 percent of the original length. Photographs are acceptable but only high quality black and white prints. AGRI will also review new books on animal genetic resources. Correspondence is invited.

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ANIMAL GENETIC RESOURCES INFORMATION will be sent free of charge to those concerned with the conservation, management or utilization of domestic livestock. Anyone wishing to receive it regularly should send their name and address to The Editor, at the address on page v.

BULLETIN D'INFORMATION SUR LES RESSOURCES GENETIQUES ANIMALES sera envoyé gratuitement aux personnes intéressées par la conservation, l'élevage ou l'exploitation du bétail domestique. Les personnes souhaitant recevoir cette publication régulièrement voudront bien faire parvenir leurs nom et adresse à l'éditeur, à l'adresse indiquée en page v.

BOLETIN DE INFORMACION SOBRE RECURSOS GENETICOS ANIMALES será enviado gratuitamente a aquellos quienes sean interesados en la conservación, gestión o utilización del ganado domésticos. Si se desea recibirlo regularmente, se ruega comunicar nombre, apellido y dirección al Editor a la dirección indicada en la página v.

MOBILIZATION OF THE FORCES OF SOCIETY FOR THE CONSERVATION OF ANIMAL GENETIC RESOURCES [1]

Lawrence Alderson
Rare Breeds Survival Trust
Droitwich, UK

SUMMARY

Increasing awareness of the contribution of native breeds to the quality of human life has created widespread support for conservation of rare breeds in Britain. The organizations concerned with conservation are either commercially oriented or charitable agencies. Public support for the latter is created through radio and television programmes, publications in magazines, demonstrations in agricultural shows and special farm parks for rare breeds.

RESUME

La prise de conscience croissante de la contribution des races autochtones à l'amélioration de la qualité de la vie a surcité un vaste mouvement d'opinion en faveur de la conservation des races rares en Grande-Bretagne. Les organismes qui s'occupent de leur conservation sont soit des entreprises à vocation commerciale soit des organisations charitables. L'appui du grand public est mobilisé par des programmes radiophoniques et télévisés, par la publication d'articles dans des revues, par des démonstrations dans les foires agricoles et par l'aménagement de parcs agricoles spéciaux pour les races rares.

RESUMEN

La conciencia cada ves mayor de la contribución de las razas indigenas a la calidad de la vida humana ha originado en Gran Bretaña un apoyo generalizado a la conservación de las razas raras. Las organizaciones que se ocupan de esas actividades pueden ser comerciales o tener fines benéficos. El apoyo oficial a estas últimas se realiza mediante programas de radio y televisión, artículos en revistas, demostraciones en exposiciones agrícolas y granjas especiales para la cría de razas raras.

The systems of agricultural production in Britain are intensive and advanced technology has been harnessed to achieve high levels of production. Yields of wheat in excess of three tons per acre are frequently achieved and yields in excess of two thousand gallons of milk per cow per lactation are not uncommon.

At present cereal crop and other cash crops are relatively profitable enterprises so that livestock production suffers financially in comparison. In the attempt to make livestock more profitable, new breeds such as British Milksheep and Camborough pigs have been developed, foreign breeds have been imported, and advanced animal breeding technology in the form of artificial insemination and embryo transfer is applied. The result of these forces is that the livestock industry relies increasingly on fewer breeds and many native breeds become rare and endangered. For example, in Britain only six breeds of cattle can be considered major breeds, namely the Hereford, Charolais, Limousin, Aberdeen Angus, Simmental and Holstein/Friesian. Only two of these are truly native breeds.

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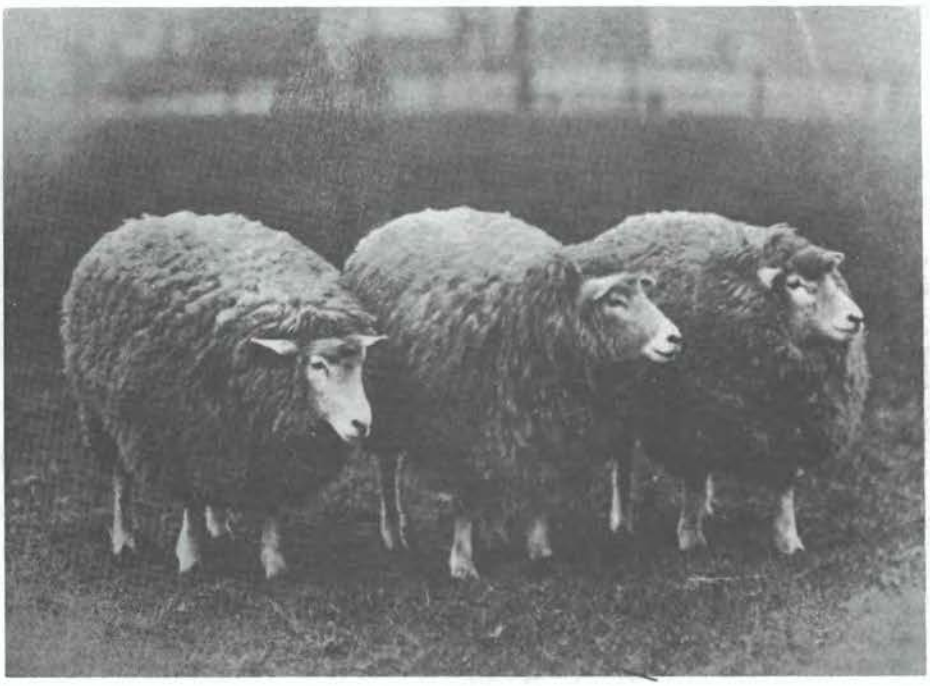
[1] This is the second of two articles by the same author. The first on the Conservation of Animal Genetic Resources in Great Britain was in the previous Newsletter (AGRI 4).



Leicester Longwool ewes. This breed has exerted a strong influence on all British longwool breeds and on many breeds in other countries.

Portland sheep. This breed is very seriously endangered, the population size having fallen to a very low level.

The decline of the native breeds has occurred at the same time as there has been an awakening of the national social conscience. As a part of this process there has been an increasing awareness of conservation as a factor determining the quality of life, and the conservation of animal genetic resources has received widespread publicity. Shorter working hours have given much of the population greater leisure time, so that there has been more opportunity to support recreational facilities.

The combined effect of all these factors has provided a firm foundation on which to build widespread support by the general public for the conservation of rare breeds of domestic livestock. These conditions may not apply in other areas of the world. In some countries the local native breeds have not yet been ousted by popular breeds and imported livestock. In other countrie the majority of the population is still employed in agriculture and rural industries so the livestock are a routine part of their lives. Thus the situation in each country must be assessed as an individual case and policies devised to take advantage of the conditions that apply.

In Britain rare breeds of livestock are as much a part of the national heritage as monuments or castles. The Dynevor herd of White Park cattle was founded in the thirteenth century, long before Dynevor Castle was built. Again old breeds often are associated with traditional aspects of our culture. Old customs and crafts are best demonstrated with authentic native breeds, such as Shetland cattle for hand-milking and Devon or Ayrshire cattle for draught or ploughing work. This applies only in countries with advanced agricultural systems. Where ploughing with cattle remains a normal agricultural practice, it would excite no interest in the general public, but in Britain the majority of people have no direct experience of these skills and customs and yet they are aware of them because their ancestors, perhaps only one or two generations distant, were rural people. Thus, by association, rare breeds evoke an historical and sentimental nostalgia.

In some countries conservation programmes have been coordinated and implemented by central government or local government, but in Britain the main agencies for conservation have been private organizations. These organizations fall into two categories. On one hand there are commercial oganizations which carry out conservation programmes within their main sphere of activity. Their motives may be purely philanthropic, or they may contain an element of far-sighted commercialism. Thus the Milk Marketing Board of England and Wales, a producer cooperative, established the Bank of Genetic Variability for the long-term storage of semen from bulls of rare and minority breeds. Countrywide Livestock Limited, a livestock breeding consultancy company, established registration programmes and published herd, stud and flock books for breeds which did not have a Breed Society.

Other organizations were created specifically to support rare breeds of livestock, and The Rare Breeds Survival Trust is responsible for endangered domestic breeds. Having no commercial background, it relies for its financial support on the subscriptions of members of the general public and other donations. Thus the involvement of a wider public has been actively sought and promoted. The Rare Breeds Survival Trust is a charitable organization, which enables it to accumulate funds without being taxed, and it is a limited company. It is administered by an elected Council assisted by several spcialist committees and sub-committees as shown in Figure 1. A salaried Technical Consultant administers all technical activities through the Technical and Breed Liaison Committees, and a Secretary deals with general administration.

The attention and interest of the general public has been cultivated in several ways:

1. Cooperation with other well-known organizations gives conservation organizations greater respectability and a wider appeal. In Britain, for example, the Rare Breeds Survival Trust has cooperated with various univerisities, the Agricultural Research Council, various zoos, and the Fauna Preservation Society. The interest of commercial organizations has been excited sufficiently to obtain sponsorship for various projects. The Milk Marketing Board and Countrywide Livestock Limited have been mentioned above, but other companies such as Volvo and Shell International have also made significant contributions.

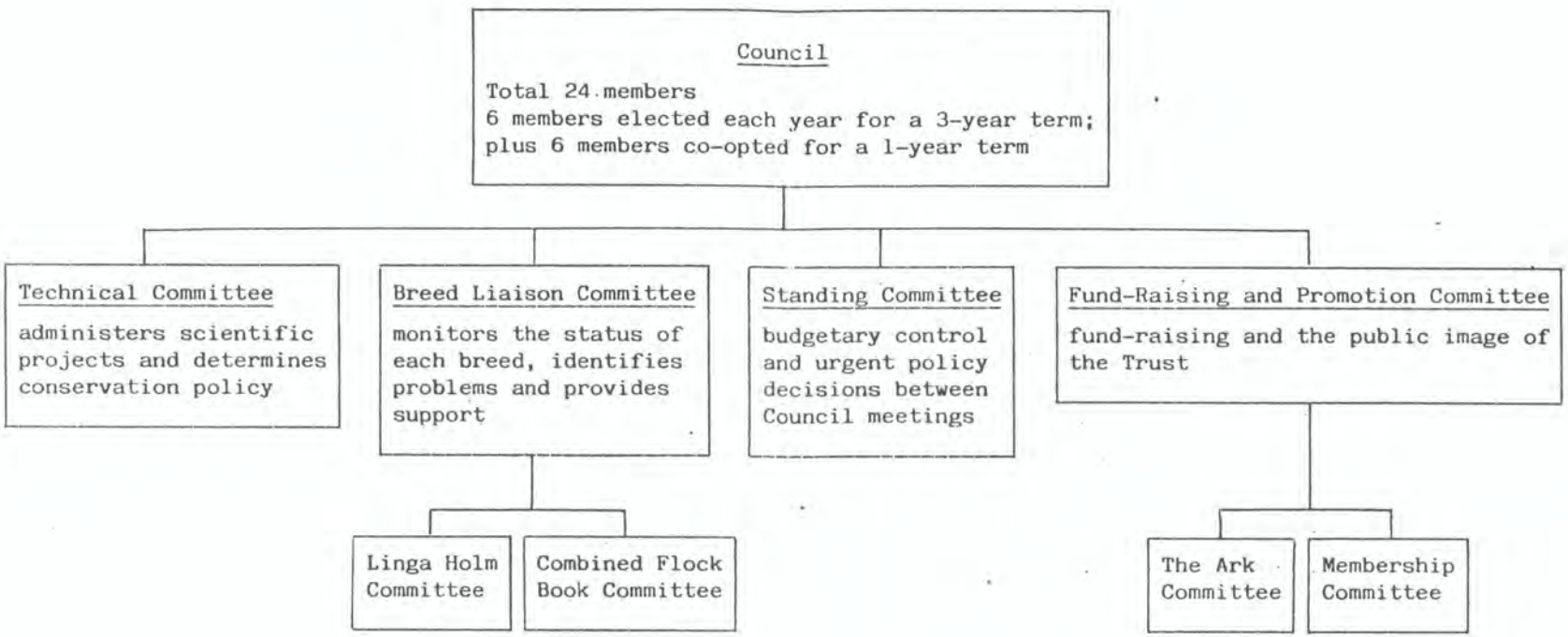


Fig. 1 The administrative structure of the Rare Breeds Survival Trust

ii. Radio and television programmes: Rare breeds conservation is of wide interest and thus is a popular topic on the media. In this sense success breeds success.

iii. The publication of a monthly magazine, The Ark, by the Rare Breeds Survival Trust. This contains both learned articles and items of general interest.

iv. Major demonstrations of rare breeds are presented at agricultural shows and other events which attract a large number of visitors.

v. The approval of amenity centres which keep rare breeds as a feature to attract visitors. The inspection and approval procedure for these centres is strict and rigorous. Close attention is paid to the quality and health of the livestock on display, and centres are encouraged to keep their animals in conditions which simulate as closely as possible their natural environment. In many cases this latter criterion is not fulfilled.

- The use of exotic and unusual features by an amenity centre to attract more visitors who will then be introduced to rare breeds and encouraged to support them.

- Farm parks are a special type of amenity centre which are privately owned and which rely for their income on entrance charges paid by visitors. These parks specialize in rare breeds of domestic livestock. Their value as centres of conservation is that they keep many breeds on the same site thus achieving maximum exposure for each breed. The favourite breeds are those which are attractive visually, such as the Jacob, or historically, such as the Soay. The danger and limitations of farm parks is that the animals are kept in unnatural conditions. They remain in small paddocks with shelters and receive extra feed. In some cases it is entirely the wrong environment, as in the case of the seaweed-eating North Ronaldsay sheep.

As a result of these promotional and publicity activities, a large proportion of the population of Great Britain has been exposed successfully to rare breeds conservation propaganda. Attendance at each of the larger amenity centres and farm parks normally exceeds 100 000 people per annum, and may be as high as 350 000 people. The Milk Marketing Board has stored more than 3000 straws of semen from bulls of seriously endangered breeds in the Bank of Genetic Variability, and Counrywide Livestock Limited has initiated registration programmes and herd/stud/flock books for thirteen endangered breeds. Meanwhile the membership of the Rare Breeds Survival Trust has risen to 4500 and the Trust now has an annual income of about £ 160 000 for conservation programmes.

RECENT ARTICLES ON POULTRY GENETIC RESOURCES

Nwosu C.C., Obioha F.C., Gowen F., Onuora G.I. and Ekwe C.N. **Preliminary observations on egg production of village hatched local chicken pullets raised on deep litter.** (Submitted for publication).

Pullets were collected from three localities before they started laying. Half of them died but 107 survived for a performance test on deep litter at the University of Nigeria, Nsukka. They were innoculated against Newcastle disease and fowl pox; respiratory disease and coccidiosis were controlled. They were fed first on growers' mash. Average number of eggs laid per hen per year was 89 and annual average hen-day production was 24 percent. There were no significant differences in egg production between the three populations. The average consumption of feed per bird per day was 74.6 g. Average water intake per bird per day was 145 and 152 ml for two populations and significantly higher (215 ml) for the third. There was a negative correlation between feed and water intake. The laying mortality for the three populations was 26.1, 23.5 and 2.9 percent respectively. The high mortalities may have been due to infections sustained by the birds before they were collected. An economic analysis showed an average loss per hen (total revenue less total expenditure) of ₦ 2.4.

Obioha F.C., Nwosu C.C. and Igiran G.D. **A study of the egg production capability of the Nigerian native chicken and an exotic strain, under improved management.** (Submitted for publication).

Three unrelated and unselected populations of Nigerian native pullets (NP) were raised on deep litter alongside an exotic Starcross strain (SS) and observed from hatching up to 52 weeks of laying. Age at first egg was 135 days for NP and 145 days for SS. Average annual egg production per hen was 126 for NP and 195 for SS with corresponding hen-day averages of 34.6 and 53.4 percent. Egg weight averaged 42.6 and 59.6 g and annual aggregate egg weight per hen 5.25 and 11.63 kg. Average daily feed intake was significantly higher for SS (152 g) than for NP (103, 105 and 130 for the three populations). When the intakes were expressed per unit of metabolic body weight there was no significant difference between them. The same applied to daily water intake (195, 190, 211 g for NP and 242 for SS). Per unit of metabolic body weight, intake of SS was significantly lower than that of NP. Mortality was similar in both groups - 10.4 for NP and 12 percent for SS. This does not support the view that native chickens are more tolerant of endemic diseases than exotic chickens. Broodiness involved 28 percent of NP although eggs were collected twice daily. Economic analysis showed that while the SS made a small profit the NP made a large loss. While the native chickens showed increases in egg production when reared under improved managment its development into a commercial flock would demand genetic as well as nutritional improvements.

Rao G.V. 1983. **The development of a slow-feathering White Leghorn strain by gene transfer from an Indian indigenous breed.** British Poultry Science 24(2):251-4.

In India at present, while most of the commercial hatcheries with foreign collabortion supply sexed day-old chicks with 98-100 percent accuracy, Government/ICAR farms are unable to do so because they do not possess a high-producing White Leghorn strain with the sex-linked slow-feathering gene. Therefore the Yamuna strain has been developed by introducing the slow-feathering gene from the Kadakanath breed of indigenous chicken into the White Leghorn. This strain is phenotypically similar to the White Leghorn. Four test crosses have shown a 98-100 percent accuracy in sexing. The performance of this strain compared with the Kadakanath is as follows:

	Kadakanath	Yamuna
Age at first egg (days)	187.1	186.6
Body weight at first egg (g)	1393	1400
Egg production to 300 days	37.0	75.5
Egg weight (g)	39.3	53.0

Arrangements are now being made to take up the work of improving egg production in the Yamnua strain at the Central Avian Research Institute, Izatnagar, and at other locations.

A ROLE FOR FERAL MAMMALS IN CONSERVING THE GENETIC DIVERSITY OF LIVESTOCK

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Summary

The rationale for conserving breeds of livestock may be extended to free-living populations which are descended from domestic stock (= feral). An important management difference is that feral animals are not maintained as fixed breeds, but are free to vary and adapt. Many feral populations are pests, and threaten the status of native flora and fauna. This means that they continue to diminish as a result of control operations. Nevertheless, some populations and herds of goats, cattle, horses, sheep and pigs have now been protected. Positive values of commercial and scientific interest are emerging as animals of feral extraction are studied. Further work is needed to assess the contribution that feral animals can make to the cause of conserving genetic diversity in the world's livestock.

RESUME

Le principe de la conservation des races de bétail peut être étendu aux populations vivant en liberté qui descendent d'animaux domestiques (animaux retournés à l'état sauvage). Ils se distinguent essentiellement par le fait qu'il ne s'agit pas de races fixes, mais capables de varier et de s'adapter. Nombre de ces populations sont nuisibles et constituent une menace pour la faune et la flore locales. C'est pourquoi leurs effectifs ne cessent de diminuer à la suite d'opérations de contrôle. Néanmoins, plusieurs populations et troupeaux de caprins, bovins, équins, ovins et porccins sont maintenant protégés. A mesure que l'on étudie de plus près les animaux retournés à l'état sauvage, on s'aperçoit qu'ils présentent un grand intérêt sur le plan commercial et scientifique. Un complément d'étude est nécessaire pour évaluer la contribution que ces animaux pourraient apporter à la conservation de la diversité génétique du cheptel mondial.

RESUMEN

Los fundamentos de la conservación de las razas de ganado pueden extenderse a las poblaciones descendientes del ganado doméstico que vive en libertad (asilvestradas). Una diferencia importante de la ordenación es que los animales asilvestrados no se mantienen como razas fijas, sino que pueden variar o adaptarse libremente. Muchas de las poblaciones asilvestradas constituyen plagas, y son una amenaza para las condiciones de la flora y fauna nativas. Esto significa que continúan disminuyendo, como consecuencia de operaciones de lucha. No obstante, en la actualidad se protegen algunas poblaciones y rebanos de cabras, ganado vacuno, caballos, ovejas y cerdos. A medida que se estudian los animales asilvestrados, van surgiendo valores positivos de interés comercial y científico. Son precisos nuevos estudios para evaluar la posible contribución de los animales asilvestrados a la conservación de la diversidad genética del ganado del mundo.

1. INTRODUCTION

The concept of conserving feral animals is not as widely known as that of conserving domestic breeds or wild animals. Feral animals are those whose forebears had been domesticated by man but which now exist as free-living, unmanaged, and self-sustaining populations. This seemingly simple definition can become complicated for semantic or practical reasons. For instance, some "unmanaged" and "self-sustaining" populations live

in parks (Chillingham cattle), or are rounded up from time to time for marking and cropping (Exmoor ponies). A more serious problem of definitions occurs among the pigs of Asia which co-exist in feral, wild and domestic forms (Oliver 1983). In this case, the question is important because it confounds the designation and conservation of rare wild taxa.

The mammals that have had close associations with man, and which now have free-living feral populations, are listed in Table 1. This essay will be restricted to the ungulates (Artiodactyla and Perissodactyla) which would generally be called "livestock".

Interest in conserving feral mammals has grown out of the efforts to conserve declining breeds of livestock. Because the two causes necessarily share much of the same reasoning, I will review briefly the justification for breed conservation before describing the special features of feral populations. I will then indicate the conservation action that has been taken, the value of the animals, and the constraints attending the conservation of free-living feral populations.

2. THE RATIONALE FOR CONSERVING BREEDS

The need to retain diminishing "minority breeds" has been argued since the 1940's by international agricultural agencies, individual scientists, and rare-breed enthusiasts (Jewell 1971, FAO/UNEP 1975, Ryder 1976, Alderson 1978, Mason 1979, Bowman 1981). The reasons are not solely technical and the topic has strong appeal for the lay public. Societies exist in Britain, France and the Netherlands to preserve rare, diminishing, minority breeds. A thriving journal, "The Ark", is published in Britain by the Rare Breeds Survival Trust to foster such interests.

In summary, the arguments for conservation are as follows: as breeds become extinct, unique combinations of genes are lost; past and present farming or commercial fashions may be a poor guide to future needs; scientific knowledge can advance by studying primitive domestic animals; the distribution of breeds can illuminate historical geography; and they have historic and aesthetic appeal. As far back as 1912, Lydekker pointed out that many local breeds were vanishing (quoted in Ryder 1970). This trend has continued and a survey in Europe showed that today some 240 "country populations" are considered endangered (Maijala et al. 1984). The survey stresses that although modern tissue storage techniques are valuable for conserving genetic material, they are not a substitute for live populations which can be used for research and evaluation. The Governments of France, Spain, Hungary, Poland, Italy, Bulgaria and the Federal Republic of Germany have recognized the problem and are now encouraging breed conservation.

3. THE PARTICULAR CASE OF FERAL LIVESTOCK

For feral animals, whether or not they are rare breeds, there are two additional considerations to those listed above: they may sometimes represent a more primitive stage of domestic evolution (Ryder 1976), and they are free to continue varying in unmanaged conditions. This last point represents the fundamental difference between the conservation of diminishing breeds of livestock and the conservation of feral livestock. For known breeds, the characterization of an authentic type is crucial. It involves maintaining breeding registers, careful out-crossing, culling, and an eye to the status quo. For feral mammals, on the other hand, it is enough that they are feral and free to vary, unconstrained by man's selective pressures or management. If they are also a distinct or significant breed, or have commercially useful attributes, the case for preserving them would no doubt be enhanced, but these are not prerequisites.

Interest in the possible value of feral farm mammals dates more or less from a seminar held in New Zealand in 1976. This was held partly in response to the call by FAO for member governments to examine their stocks for rare and diminishing breeds (Whitaker and Rudge 1976). New Zealand itself had no authenticated rare livestock breeds but did have many populations of free-living feral farm mammals which were diminishing by the year in pest control operations. The seminar discussed the attributes of such animals, exposed some of the conflicts with traditional nature conservation and animal health regulations, and led to some practical conservation action (Rudge 1983b). Subsequently,

feral mammals were included in an FAO inventory of special herds and flocks of farm animals as they were "of particular interest because they have been free from artificial selection since the time the animals escaped from domestication so that their genotype will represent a sample of the breed at that time, often hundreds of years ago, modified only by natural selection and genetic drift" (Mason 1979). Curiously, FAO did not go on to include feral animals in conservation recommendations to member governments (FAO 1980). On the other hand, and in the same year, the Species Survival Commissions of the International Union for the Conservation of Nature and Natural Resources (IUCN) decided to include feral animals in the surveillance duties of their appropriate taxonomic committees. Initially the task was defined as reviewing the status, value, and any management conflicts of feral farm mammals, and then to prepare Position Statements and Action Plans. The Caprinae (goats and sheep) sub-group held a workshop at the Third International Congress of Theriology in Helsinki in August 1982 (IUCN 1984). One of the background papers (Munton et al. 1984) proposed the following courses of action which are probably appropriate for all feral mammals, not just the Caprinae:

"1. Distribution and status of feral populations

1.1 Survey and compile a list of feral populations together with details of their location, numbers and status, and length of time feral. Many domestic types important in the past, no longer exist on farms, but their descendants remain on isolated islands or as isolated feral populations on the major continents. Such a compilation will allow populations of special interest to be identified. This work is in accordance with SSC's declared aim of maintaining genetic diversity; specifically with sub-objective 6.1 of A Conservation Strategy for Sustainable Development 1981-83 "to develop further an information system on the status of the world's genetic resources for use in their conservation; and with the emphasis of activity 6.1.1. in the same document, which emphasises the importance of conserving the wild relatives of domestic animals."

2. Impact of feral populations

2.1 To survey valuable wildlife habitats or native animals threatened by feral (introduced) animals.

2.2 To promote efficacious and humane methods for removing feral animals that are a threat to valuable habitats, their flora and fauna.

2.3 To investigate the extent to which feral animals become "in balance with the natural habitats into which they have been introduced".

3. Genetic distinctiveness and value of feral populations

3.1 To develop theoretical concepts defining feral animals and to clarify the border between truly wild species, domestic animals and feral animals.

3.2 Concepts such as genetic "contamination" of wild populations need to be thought out in detail. Quantitative and qualitative methods for the measurement of genetic mixing between feral, domestic and wild populations need to be developed, see for example Nozawa (1980).

3.3 Application of theoretical ideas to practical conservation problems need to be developed, especially where actions by conservation organizations need to be justified to the public in a rational manner. (A recent problem of this sort involved the proposed release of 35000 captive turtles back into the sea from a turtle farm into an area already occupied by wild turtles.)

4. Conservation and study of feral animals

4.1 To examine the feasibility of maintaining a collection of feral animals, which would furnish a valuable collection of genetic material including ancestors of domestic stock. This collection would be available for public display, for genetic research by individuals and research organizations, and for breeding or re-creating economically useful domestic varieties.

4.2 To encourage conservation of feral populations in situ where it does not jeopardize other conservation values so that reversion and selection processes can be studied.

4.3 Feral animals are a good vehicle for demonstrating the dependency of man on his natural resources. These animals can be used to demonstrate the relationsip between the conservation of habitats, the conservation of species and the way in which man is dependent for his survival upon his use of resources developed from wild habitats and species. At the same time the public can be educated about the importance and delicate natural balance of specific habitats that have been saved by removing the feral species they are looking at in a collection."

These four headings provide a suitable framework on which to assess the present position on the conservation of feral mammals in this essay.

4. DISTRIBUTION AND STATUS

The most comprehensive single summary is by Mason (1979) which incorporates both published and up-to-date (as at 1979) questionnaire information. Even so, it is not exhaustive. More detailed accounts have been compiled for the feral mammals in specific geographical areas, or for particular species. Compilations for all feral mammals in an area are: Douglas (1969) for the Pacific Islands; Lever (1977) for the UK; Wodzicki (1950) and Rudge (1982) for New Zealand; McKnight (1964) for the USA; and Rolls (1969) and McKnight (1976) for Australia. Particular species that have been dealt with are: goats in the UK (Whitehead 1972); the world's sheep and goats (Rudge 1983a); sheep and goats in the Pacific (Rudge 1984); camels in Australia (McKnight 1969); pigs in the USA (Wood and Barrett 1979), Asia (Oliver 1983), and the world (Tisdell 1982). Some of these accounts give details of biological and economic impact and natural history, but as most of them appeared well before interest in conserving feral mammals had emerged they are concerned with feral mammals more as pests than assets. Exceptions, which also examine redeeming qualities, are Whitaker and Rudge (1976), Mason (1979) and Rudge (1984). In Rudge (1984) I attempted to go a stage further and suggest which particular populations of goats and sheep in the Pacific could or could not be preserved. This is a necessary step in advancing the cause of conserving feral mammals.

It should be understood that the inventory of feral mammal distribution, history and status is still incomplete. Even the more recent compilations cited above represent successive approximations which must be refined further. More often than not the history and origin of the populations, which are of course important in assessing genetic value, are not known.

5. IMPACT

Much of the literature on feral mammals concerns their pest status in relation to nature conservation or farming (Bourne 1975, McKnight 1976, Perry 1969, Spatz and Mueller-Dombois 1973, Wodzicki 1950). Conflicts with nature conservation exist because when feral mammals gained their freedom they were often in lands which had not had such animals in the native fauna. This was not invariably the case and in Britain for example, feral goats and sheep inhabit landscapes that have seen thousands of years of human modification and which have plant communities resilient to grazing and browsing. However, in other island countries such as New Zealand, Hawaii, or the Galapagos islands, the vegetation, fauna, and landforms had never, in millions of years, been subjected to the influence of browsing mammals. Remote islands are particularly valuable as refuges

of relict or locally adapted plants and animals, and have sometimes been catastrophically affected by the introduction of browsing mammals. Because of this conflict with well-reasoned conservation practices, feral mammals have seldom been seen as deserving protection. That being so, the case for now preserving them has to be not only well founded, but must acknowledge that precedence will still be given to international obligations (which are well understood and generally accepted both in principle and practice) for the conservation of native flora and fauna, and of soil and water. The conservation of aliens in native communities, particularly if they are actual or potential pests, will almost always be seen as a special case. The principles contained in the IUCN view of new introductions can be applied to established introduced animals.

> "Given the extreme difficulty of eliminating introduced species every effort should be made to prevent all introductions except those that can be proven harmless and over which complete control can be exercised. Governments should ensure that, by law, the onus of proof that an introduction will not be harmful and can be controlled is on the introducer" (IUCN/UNEP/WWF 1978).

6. CONSERVATION ACTIVITY

Table 2 shows countries in which feral mammal populations have been preserved in the wild or in some form of captivity. There is a wide range of status represented, including the totally free-living (e.g. goats in Snowdonia); free but occasionally mustered (e.g. Exmoor ponies); and unmanaged but restricted (e.g. sheep on Pitt Island, (New Zealand) and Chillingham Park cattle). Some of these populations have been considered semi-feral (Mason 1979), but the essential point is that they are all unmanaged and free to vary without human selective pressure. "Protected" in this table is not an absolute or even a positive management commitment. Feral goats in the UK are "protected" more by benign neglect and local sentiment than any overt official policy. However, such forms of tolerance can serve as effecive protection so long as there are no obvious threats from pest control agencies or from changing land uses.

"Captive" feral mammals is almost a contradiction in terms. They are listed here because they demonstrate the wide range of interest from public display in zoos and wildlife parks, to scientific or commercial evaluation herds. Some, such as the Soay sheep, have become quite celebrated animals on all of these counts (Jewell et al. 1974).

7. GENETIC DISTINCTIVENESS AND "VALUE"

Table 3 shows a range of known values for feral mammals and some others which have been suggested. In many cases, "value" has been simply a matter of putting available feral animals to some use, as for example in cropping them for meat, or for controlling weeds and scrub. Genetic distinctiveness barely enters into those applications except that the acquired hardiness of feral goats allows an easy-care management system. When domestic sheep and feral goats were combined in controlled trials in New Zealand, hill pastures were improved without the cost of herbicides and there was more potential revenue from meat (Rolston et al. 1981). There may even be greater scope for such types of management in Scotland (Cooper 1979) and other regions of marginal farming.

Some uses do depend more upon genetic distinctiveness. These include the re-domestication of locally adapted bantengs and water buffalo in Australia; and re-domesticating feral fibre goats, Angoras, that had proved unthrifty when originally introduced to new environments in both Australia and New Zealand. If this range of actual uses seems as yet to be almost trivial, it should be remembered that very few systematic studies have so far been made into the particular characteristics of feral mammals. Where studies have been undertaken, as on feral sheep in New Zealand, unsuspected attributes have emerged such as early hogget oestrus and good lamb survival both of which have commercial significance (Table 3).

Feral sheep on Pitt Island in the Chathams grous (N.Z.)
A system of fences maintains this feral population alongside a Nature Reserve and farmland. The island has already been greatly modified by human activity so this population can be accommodated in perpetuity in this special area. This population was predominantly white in the 1940's and is now almost all black.

Feral goats on Auckland Island in the subantarctic.
This population has existed since late last century and has not spread beyond a limited area of the island. Recent research shows that they are instrumental in modifying the vegetation of this Nature Reserve, and may be on the verge of spreading. Plans are being prepared to exterminate the population in 1986, and it is doubtful whether any will be conserved.

8. FUTURE PROSPECTS

Underlying the urge to conserve breeds of domestic or feral livestock is the wish to maintain as much genetic diversity as possible - a genetic insurance policy. Feral mammals have already been through a sifting and selection process to concentrate genetic traits of use to man. While they are unlikely to have any genes that their forebears did not have, the selection processes in feral conditions may make manifest features that would be obscured or culled in managed herds and flocks. Ryder (1976) has argued that one cannot base a genetic conservation policy on perceived or even foreseen values; the essence of the exercise is to provide scope for the unexpected by preserving as wide a range of genetic diversity as possible. The Drysdale sheep, although not from a feral population, illustrates this. When Dry first bred his flock of hairy sheep during studies on wool faults (Dry 1955), he endured years of ribaldry and official lack of interest. The breed has since come to contribute a great deal to the New Zealand carpet manufacturing industry. Such a salutary story has yet to emerge from the conservation of rare breeds or feral livestock and it will not of course unless provision is made to retain some and to evaluate them.

Ryder (1976) was quite emphatic that for his long series of studies on wool growth and the influence of domestication, the feral Soay sheep of St. Kilda were indispensable. The eventual application of his work may be subtle and undramatic. In other sutdies there are already indications that basic work on mother care, foraging patterns, disease resistance, physiological adaptation, food conversion, fat deposition, wool tenderness and breeding patterns in feral animals might give new insights into commercial management practices. For this work, advantage can be taken of comparisons between populations that have been feral for different lengths of time (e.g. Orwin and Whitaker 1984). Developed countries, which are best able to afford such studies and to conserve feral mammals, probably consider they have least use of such work or such animals. However, it has been emphasized that Asia-Oceania needs animals which can prosper on low-grade management and even the detritus from human society (SABRAO 1980). In the longer term there are predictions that high-energy farming cannot be sustained. Even if that is still debatable, there is no question that low-energy farming systems will remain in many parts of the world, even in developed nations (Cooper 1979). Unmanaged feral populations, because they must be good survivors rather than high producers, will have lessons to teach that cannot come from intensively managed animals. It may also cost money to preserve them, and administrators will naturally look for good examples of commercial benefits. However, these are likely to be slow in coming because fundamental research often enters into management practices unobtrusively rather than spectacularly. Without some initial acts of faith to promote the principle of saving a range of feral mammals, populations will continue to vanish and the research opportunities and commercial applications with them.

Conserving feral mammals would in many places be a novel reversal of established management practice, and for wholly justifiable reasons the extermination of feral populations will continue. Island populations are particularly vulnerable because of the prime importance of islands as refuges for native flora and fauna (Bourne 1975). However, now that the possible values of feral mammals are being mooted more widely, it is fair to expect some critical assessment of supposed conflicts before irrevocable decisions are taken. Ideally, for natural selection to operate, the animals should remain *in situ*. In many places this conflicts with other values, but remnant populations may be protected by fencing them off from the sensitive area. This has now been done with the feral sheep in the Campbell Island Nature Reserve. If it is quite out of the question to maintain free-living populations then government conservation farms, private collections and wildlife parks may be the only way to preserve the type. Such collections can also serve a useful public relations role, but they remove scope for continuing variation, and introduce risks of disease, misguided management, escapes, crossing, and changing interests of the custodians.

The lists in this paper can go out of date in two ways: by being augmented with additional information, and by the continued loss of feral populations. Since work began on these summaries, sheep have been exterminated from Mauna Loa, Hawaii; goats from San Clemente I, California (Prof. Clarke Brooke pers. comm.) and Raoul Island, New Zealand (pers. obs.); and the sheep on Campbell Island have been reduced from 3000 to 500. Hitherto, conservation action has perhaps been constrained by the absence of any summari-

zing statements such as this on the overall status and prospects of feral mammals. Unfortunately, an uncertain factor in this topic is the seeming lack of interest of agricultural agencies. Even in New Zealand, whose economy is largely dependent on agriculture, there is virtually no sponsorship from agricultural interests in conserving a range of feral mammals. Where populations have been maintained it has been through the cooperation and effort of a government department (Lands and Survey) whose primary responsibility is towards preserving a beleaguered native biota. To add to the irony, this very essay has emerged from research activity to advise on and preside over, the control and extermination of introduced mammals.

The nations with feral mammal populations have to decide whether they have assets to be conserved, or unfortunate historical and geographical accidents. If they are indeed assets the task then becomes the practical one of deciding which populations should be kept, how they should be managed, and how to promote research on them.

Author's note: I will welcome any further information on interesting feral populations and those which have some protected status. Examples of feral mammals being put to practical use will be particularly appreciated.

Postscript: In New Zealand feral goats have proved so successful in establishing a mohair and cashmere fibre industry that animals mustered out of the forest were fetching NZ $140 per head in saleyards in January and February 1985. Feral goats with obvious Angora traits sold for over NZ $200.

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TABLE 1. The following mammal species have given rise to feral populations (modified from Munton *et al.* 1984).

ARTIODACTYLA		
Bovidae	*Bos javanicus* (banteng)	Bali cattle
	Bos gaurus (gaur)	gayal or mithan
	Bos primigenius (aurochs extinct)	'common' cattle
	Bubalus arnee (water buffalo)	buffalo or arni
	Capra aegagrus (bezoar or wild goat)	domestic goat
	Ovis orientalis	sheep
Camelidae	*Camelus ferus*	camel
Cervidae	*Rangifer tarandus*	reindeer
Suidae	*Sus scrofa* (wild boar)	pig
PERISSODACTYLA		
Equidae	*Equus africanus* (African wild ass)	ass or donkey
	Equus ferus	horse
CARNIVORA		
Canidae	*Canis lupus* (wolf)	dog, dingo
Felidae	*Felis silvestris* (wild cat)	domestic cat
Mustelidae	*Mustela putorius* (polecat)	ferret
	Mustela vison (Ameican mink)	mink
Rodentia	*Cavia aperea*	guinea pig
	Mesocricetus auratus	golden hamster
	Ondatra zibethica	muskrat
	Mus domesticus (house mouse)	laboratory mouse
	Rattus norvegicus (Norway rat)	laboratory rat
	Myocastor coypus	coypu or nutria
Lagomorpha	*Oryctolagus cuniculus*	rabbit

TABLE 2. Protected free-living populations, and captive flocks or herds of feral origin.

	Breed	Location of free-living population**	Captive flocks or herds	Reference
AUSTRALIA				
Goats	Angora	Faure Island	On Faure I. Breeding up for commercial fleece	(2)
	Angora	Many mainland herds, none protected	Private commercial herds	(3)
Bovines	Banteng	Northern Territory, not protected	Breeding herds on Government research farm at Humpty Doo	(1)
	Water-Buffalo	Northern Territory, not protected		
CHILE				
Goats	Unknown (presumed from Spain)	Juan Fernandez Island, not protected	A small number on a Conservation Department farm	(1)
FRANCE				
Cattle	Massanaise*	Alberes mountains (see Spain)	-	(1)
	Bêtiso	Pyrenees " "	-	(1)
Horses	Potiok	Basque Country	-	(1)
GREECE				
Goat	'Agrimi'	Cretan National Park Moni Island, off Aegina	Kept in zoos around the world	(2)
JAPAN				
Goats	Tokara	Tokara Island	Kagoshima University	(2)
	Unkown	Bonin Island	-	(1)
Cattle	Kuchinoshima	Kuchinoshima (Tokara Islands)	-	(1)
NEW ZEALAND				
Sheep	Merino	Pitt Island	Research flock, Ministry of Agriculture & Fisheries (MAF) Private flocks, Wildlife Parks	
	Merino	Arapawa Island	Private flocks	
	Merino cross	Campbell Island	Research flock (MAF)	
	Romney	Extinct in wild	Research flock (MAF)	
	Merino	Hokonui Hills, not protected	Research flock (MAF)	

Goats	Supposed Old English	Arapawa Island	Research herd (MAF)	
	Unknown	Auckland Island (future uncertain)	-	
Pigs	Kune-kune (?Asian)	Urewera forests (N. Island), not protected	Wildlife parks	
Horses	Exmoor and Welsh ponies, and locally bred horses of British origin	Kaimanawa Range (N. Island) protected	-	
PORTUGAL				
Horses	Lusitanian-Galician	Peneda Gerês National Park		(1)
SPAIN				
Cattle	Betizuak (Betiso of France)	North Navarre	Private herds	(1)
	Cachena	Entrino (Galicia)	-	(1)
	Alberes (Massanaise of France)	Alberes mountains, Catalonia	-	(1)
Horses	Asturcón*	Sueve mountains, Asturias	-	(1)
	Galician pony*	Galicia (3 localities, each a distinct variety)		
SRI LANKA				
Horses	Mannar ponies	Northwest	Herd in Colombo Zoo	(1)
Asses	Pygmy donkeys	Northwest	Herd in Colombo Zoo	(1)
UNITED KINGDOM				
Sheep	Soay	Soay and Hirta (St Kilda) Cardigan & Ailsa Craig Islands	Numerous private and research flocks	(2)
	Orkney	North Ronaldsay, Linga Holm, and Lihou Islands	Numerous private flocks	(1)
Goats	mixed	Wales, Scottish Highlands and Borders (tolerated)	-	(1)
Cattle	Chillingham	Unmanaged Park herd	-	(1)
Horses	Exmoor pony*	Exmoor and Cumbria	Many kept privately	(1)

USA				
Sheep	Merino (with Leicester and Rambouillet?)	Santa Cruz Island not protected	Research flocks	(2)
Goats	Unknown	San Clemente not protected	Private flocks. Protective Legislation sought.	(2)
Horses Asses (Burros))	)	Widely distributed in 8 States, protected by specific law	Many privately owned	(4)
Pigs	Ossabaw	?	Research herds at Pennsylvania State University and University of Georgia	(1)

** Unless otherwise stated these free-living populations have some protection.
* Free living and unmanaged but rounded up periodically for cropping or marking.

References (1) Mason 1979; (2) Rudge 1983(a); (3) Rudge 1984; (4) Howard and Marsh 1983.
All New Zealand information from Rudge 1982.

TABLE 3. Uses and values of feral mammals that have been recognized or postulated.

		References
BANTENG		
(Australia)	Re-domesticated for crossing with Brahman cattle. Studied for production characteristics and performance when variously crossed.	Mason 1979 Anon. 1972
WATER BUFFALO		
(Australia)	Harvested for meat. Re-domesticated and exported to Papua New Guinea, Nigeria, Guyana, Venezuela. Research herd maintained by Northern Territory Government.	Mason 1979
SHEEP		
(NZ)	Good lamb survival, early hogget oestrus	Bigham and Cockrem 1982
	Basic studies of fleece tenderness and wool	Regnault 1976 Orwin and Whitaker 1984
	Possible resistance to foot rot and facial eczema	Cockrem pers. comm.
	Commercial value of naturally pigmented fleeces	Wickham 1976
	Re-interpretation of periodontal diseases of commercial sheep	Suckling and Rudge 1977
	Feral merino x domestic Merino produces a hardier sheep	Johns 1980, McKinnon 1983
(UK)	Soay used as a lightfooted grazer on reclaimed land	Quoted in Bigham and Cockrem 1982
	Soay thrive upon and control rank pasture	Sheppy 1975
	Indispensable for fundamental work on fleeces and influence of domestication	Ryder 1976
	Soay cross gives easy lambing, vigorous lambs	Morgan 1982
GOATS		
(Australia)	Used for producing cashmere fibre	Smith *et al*. 1973
	Upgrading for Angora fibre industry	Clarke 1976
	Used for scrub control	Campbell *et al*. 1979

	Meat export potential	Host and Whitelaw 1980
(NZ)	Combined pasture weed control and meat production	Kirton *et al.* 1977
	Used for scrub control and pasture improvement	Batten 1979, Rolston *et al.* 1981
	Meat export potential	Crouchley 1980
	Feral Angoras used in breeding up a commercial herd	Wickham 1976
	Strong foot conformation needed in dairy herds with inbred ligament defects	Batten pers. comm.
PIGS		
(Asia)	Valuable general purpose stock animal on low planes nutrition	Oliver 1983, Whitaker and Rudge 1976
(Australia)	Recreational hunting asset and game meat industry	Tisdell 1982
	Feral pigs useful for biomedical research	McIntosh and Pointon 1981
GENERAL		
	Feral animals valuable for studying effects of parasite treatment in unmanaged populations	Hutton 1976
	Possible value for studying drug therapy and for breeding animals to suit drugs	Jewell 1971
	Could be valuable stock animals in habitats where economics are marginal and 'improved' animals do not prosper (Scotland)	Cooper 1979
	Diversification of 'wild' fauna	Greig and Cooper 1970

NEWS ITEMS

FORTHCOMING CONFERENCES

IVth International Conference on Goats
8-13 March 1987. EMBRAPA, Brasilia, Brazil
(The Conference Secretariat, IV International Conference on Goats, c/o Dr. Odor P. Santana, EMBRAPA/DPP, Supercenter Venancio 2000, 7 andar, sala 725, 70333 Brasilia, DF, Brazil)

Symposium on Applied Ovine Sciences
15-26 February 1987. Perth, Australia.
(Annie Ottaway, GPO Box T1777, Perth, Western Australia)

4th AAAP CONGRESS

The 4th Congress of the Asian Australasian Association of Animal Production Societies will be held from 1 to 6 February 1987 at Hamilton, New Zealand. Further information may be obtained from the Secretary, Organizing Committee, 4th AAAP Congress, c/o Ruakura Animal Research Station, Private Bag, Hamilton, New Zealand.

THE SMALL RUMINANT AND CAMEL GROUP OF THE INTERNATIONAL LIVESTOCK CENTRE FOR AFRICA

This group has been set up within the Central Research Units structure at ILCA Headquarters in Addis Ababa, Ethiopia. Its aims are as follows:

"i. The encouragement of research on all respects of productivity of goats, sheep and camels.

ii. Providing help in the organization of regional or national training needed to meet research objectives.

iii. The collection and collation of analysed data with a view to suggesting solutions to production constraints in the light of available results.

iv. To help national or regional organizations in the analysis of unpublished data on reproduction, growth and disease in the various ecological zones of sub-Saharan Africa and to relate these to prevailing nutritional and management conditions.

v. The development of a manual of survey techniques (including sampling procedures, sample sizes and diagnostic methods) for use in research, particularly in relation to traditional systems.

vi. Helping to organize and to participate in national and regional research meetings and seminars with a view to improving the means of communication between researchers.

vii. Publishing a Newsletter to disseminate information, research results and development experience and to maintain contact between researchers and officials.

The identification of existing national, regional and international research programmes on Small Ruminants and Camels will be one of the Group's first tasks. Once this is well under way it will be possible to identify, at least tentatively, gaps in existing research and to attempt to promote new research to fill these gaps or to extend current research to the same end."

The Group issues a regular mimeographed Newsletter. The first issue (2pp) appeared in October 1984; it announced the formation of the Group and requested cooperation and contributions to the Newsletter. The second (12pp) appeared in February 1985; it contains a variety of news items and notes on conferences and research on sheep, goats and camels, not only in Africa but also in Europe and Australia.

The third issue of this circular was despatched in June 1985. It is now 16 pages packed with useful and interesting information. Subjects covered include the following: CRSP workshop in Kenya, goat crossbreeding project in Zimbabwe, analysis of Rwanda data, goats and sheep in Mozambique, camels on commercial ranches in Kenya, ILCA monograph on West African Dwarf goat, indigenous sheep and goat breeds in Cameroon, productivity of the Burundi goat, small ruminant research at University of Zimbabwe, Black Bedouin goats in Kenya.

The Newsletter may be obtained by applying to:
The Editor
The Small Ruminant and Camel Group Newsletter
International Livestock Centre for Africa
P.O. Box 5689
Addis Ababa
ETHIOPIA

THE AUSTRALIAN ASSOCIATION OF ANIMAL BREEDING AND GENETICS (AAABG)

This Association was formally inaugurated at a conference in 1979, and as its objectives and constitution are different from the usual 'scientific' society, it may be of interest to readers of this Newsletter who are interested in fostering mechanisms to promote the conservation and utilization of animal genetic resources. The particular feature of the Association is the emphasis that is placed on increasing communication between research workers and individual livestock breeders and producers and their organizations (breed societies, artificial breeding organizations, etc.).

Objectives

1. To promote communication among all those interested in the application of genetics to animal production, particularly breeders and their organizations, consultants, extension workers, educators and geneticists.

2. To foster the application of genetics in animal production.

3. To promote the scientific study of animal breeding.

4. To hold regular Conferences to provide a forum for:

   a) presentation of papers and in-depth discussions of general and industry-specific topics concerning the application of genetics in commercial animal production.

   b) scientific discussions, and presentation of papers on completed research work and on proposed research projects.

5. To publish the proceedings of each Conference and circulate them to all members.

Benefits

To Individual Members:

* While it is not possible to produce specific recommendations or 'recipes' for breeding plans that are applicable for all herd/flock sizes and management systems, principles for the development of breeding plans can be specified. Discussion of these principles, consideration of particular case studies and demonstration of breeding programmes that are in use will all be of benefit to breeders.

* Geneticists will benefit from the continuing contact with other research workers in refreshing and updating their knowledge.

* The opportunity for contact and discussions between breeders and geneticists will be of benefit to both - for breeders as above and through the opportunity to involve geneticists in individual members' programmes, and for geneticists in allowing for detailed discussion and appreciation of the pratical management factors that often restrict full application of optimum breeding programmes.

To Member Organizations:

* Many of the benefits to individual breeders will apply also to breeding organizations. In addition, there are benefits to be gained through coordination and integration of their efforts. Recognition of this should follow from understanding of common problems, and would lead to increased effectiveness of action and initiatives.

* Corporate and sustaining members can use the Association as a forum to float ideas aimed at improving and/or increasing services to their members.

General Benefits:

* Membership of the Association may be expected to provide a variety of benefits, and through the members, indirect benefits to all the animal industries.

* All members should benefit through increased recognition of problems both at the level of research and of application, and increased understanding of current approaches to their solution.

* Well documented communication of gains to be realized through effective breeding programmes will stimulate breeders and breeding organizations, allowing increased effectiveness of application and consequently increased efficiency of operation.

* Increased recognition of practical problems and specific areas of major concern to individual industries should lead to increased relevance of applied research.

* All breeders will benefit indirectly because of improved services offered by the organizations which service them.

* The existence of the Association will increase appreciably the amount and use of factual information in public relations in the animal industries.

* Association members will comprise a pool of expertise - at both the applied and research levels - and as such, individual members and the Association itself must have an impact on administrators at all levels of the animal industries and on Government organizations, leading to wiser decisions on all aspects of livestock improvement, and increased efficiency of animal production.

Conferences

Each Conference (held at 1-2 year intervals) is designed to focus on a particular theme, and both practical breeders and scientists are invited to present papers relating to the theme, in general terms and for each livestock industry. The themes for the past Conferences have been:

1979 Definition, Measurement and Recording in Livestock Improvement
1981 Selection and Mating Programmes to Maximize Animal Productivity
1982 Efficiency and Livestock Improvement
1984 Implementation of Selection Programmes.

GENETIC NOMENCLATURE OF SHEEP AND GOATS

As reported in AGRI 3 the Committee on Genetic Nomenclature of Sheep and Goats (COGNOSAG) was founded at the coloured sheep conference held in New Zealand in 1984. A preliminary report on "Rules for genetic nomenclature of genes with visible effects in sheep and goats" was circulated by J.J. Lauvergne in 1984. As a result of comments received a second version of this report was prepared and circulated in February 1985. The major change in the second version is that the scheme is now based on the Human Gene Nomenclature System instead of on the Mouse Nomenclature Rules.

The rules are illustrated by applying them to the Agouti locus and to the known or postulated alleles at that locus e.g. white or tan (A*WI), badger face (A*BF), wild mouflon (A*WM), reversed badger (A*RB), eumelanic (A*E) (=black) and so on.

Further comments are invited by J.J. Lauvergne, Institut National de la Recherche Agronomique, Département de Génétique Animale, C.N.R.Z., 78350 Jouy en Josas, France.

RESEARCH ON TRYPANOTOLERANT LIVESTOCK

Two international organizations - the International Laboratory for Research on Animal Diseases (ILRAD) and the International Livestock Centre for Africa (ILCA) have established a trypanosomiasis research and training network with national programmes in 11 African countries. The countries involved are Gabon, Ivory Coast, Zaire, Nigeria, Togo, Senegal, Gambia, Benin, Tanzania, Kenya and Ethiopia. Network personnel include specialists in animal health, animal production and scientists knowledgeable about the role of tsetse flies as disease vectors. They will evaluate trypanotolerant breeds of cattle, sheep and goats to assess genetic and acquired resistance, environmental factors that affect susceptibility and the usefulness of existing control measures. Comparisons will also be done with non-trypanotolerant types. The breeds of cattle included in the study are N'dama, Ngani, Drakensberger, Baoule, Zebu, Local breed, Borgou, Samba, East African Zebu and Sheko. Sheep breeds are Djallonke, Sahel, Dwarf West African and Local breeds and goats Djallonke, Dwarf West African and Makonde. The ultimate purpose of this work is to turn over the results to national policy makers who will then evaluate the cost effectiveness of promising control measures.

As a further step towards improving the productivity of trypanotolerant breeds, an International Trypanotolerance Research Centre is being set up in Gambia to which staff from ILCA and ILRAD will make a major contribution. The new centre's mandate is to understand the mechanism(s) of trypanotolerance in order to develop methods for enhancing it (them). Research at the centre is being funded (through ILCA and ILRAD) by the EEC and ODA (UK) to the tune of $2.5 million for the first 3 years of operation. UNDP and FAO are providing funds for training and project design. The African Development Bank has lent the Gambian government $10 million to construct a headquarters for the centre.

STORING GENES OF ABORIGINAL TRIBES

A technique has recently been developed for long term storage of human genes. It is used primarily to store genes of aboriginal tribes who are in danger of extinction. The method involves injection of the white blood cells with Epstein Barr virus which causes the cells to divide indefinitely in culture. Thus, an infinite supply of DNA becomes available which can be stored in a gene bank and also used for research. Using this technique, workers at Stanford University have stored genes from a population of African Pygmies and from the Melanisian people of New Hebrides.

RECONSTRUCTION OF EXTINCT ANIMALS

Exciting possibilities of wholly or partly reconstructing extinct animals exist using recombinant DNA technology in combination with the technique of injecting DNA or a whole nucleus into eggs or early embryos. It has been possible to obtain live DNA of comparatively recent extinct animals, for example, of the marsupial Tasmanian wolf from microscope slides and of the South African quagga from pelts preserved in salt.

Scientists have recently scavenged some DNA from the still attached muscle tissue of a 140 year old quagga pelt and cloned them in bacteria. There is therefore the possibility of partly resurrecting this animal by incorporating its genes into its close relatives such as the zebra or the horse. Scientists are also studying the possibilities of growing the whole nuclei of the Alaskan Steppe bison from either the sex cells (by fusing two sperm nuclei) or somatic cells through embryo injection, into a living relative.

TRANSGENIC RABBITS, SHEEP AND PIGS

The success achieved with introduction of foreign DNA into the genome of mice has prompted similar experiments with farm animals. A key to the successful introduction of foreign DNA is that it should be injected into the nucleus. This is difficult in most domestic animals because they have an opaque cytoplasm. However, more complex procedures involving centrifugation of the embryos (in the case of the pig) have made it possible to carry out similar introductions in the rabbit, sheep and the pig. The foreign DNA used was a fusion between the mouse metallothionein promoter/regulator region and either the rat or human growth hormone structural gene. This was injected into the pronuclei or nuclei of eggs from superovulated animals and the embryos re-implanted in recipient dams. Only about 10% of the embryos survived and even among the survivors, in only a small proportion was the gene integrated (12.8% in the rabbit, 10.4 in the pig and 1.3 in sheep). Although only limited success has been achieved, the possibility exists of applying this technique for making rapid genetic changes in domestic animals through gene transfer between breeds and even between species.

PRIORITIES IN ANIMAL BREEDING IN AFRICA

The International Livestock Centre for Africa (ILCA) arranges biennial meetings of national livestock research leaders from African countries to identify priority areas for research and to assess the effectiveness of ILCA's contribution in meeting these national needs. At the meeting held in October 1984 at ILCA headquarters in Addis Ababa, Ethiopia, the following recommendations were made by the specialist group on animal breeding:

- ILCA should expand its breed characterization work in different environments, in close collaboration with national groups;
- ILCA should train animal geneticists;
- Standardized system for recording livestock data needed;
- Systems research must ensure on-station breeding results are transferred to potential beneficiaries;
- Social and economic advisability of raising dairy cows in controlled environments in subhumid zones need investigating;
- ILCA should help clarify policy issues to aid decision makers regarding imports of temperate breeds.

ILCA has responded to some of these recommendations. Important among these is its work on breed productivity undertaken with the major cattle and small ruminant breeds in Ethiopia, Tanzania, Senegal and Zimbabwe. These studies have provided information on the performance ability of some African breeds and also demonstrated the importance of genotype by environment interaction. Recently, ILCA has also released a major software package to be used in breed comparison studies and in selection and improvement programmes, designed for adoption by national institutions.

DATA BANKS FOR ANIMAL GENETIC RESOURCES

Following the trials held during 1983-85 in different countries of Asia, Africa and Latin America, FAO/UNEP held an Expert Consultation in Rome in June 1985 to consider the results of the trials and to recommend a methodology for the establishment of regional data banks. The methodology is published in English by FAO and UNEP in 3 volumes as follows:

1. Computer systems study for regional data banks
2. Descriptor Lists for cattle, buffalo, pigs, sheep and goats
3. Descriptor Lists for poultry.

Copies may be obtained from FAO Animal Production and Health Division, Rome, Italy.

The Descriptor Lists are also to be printed in French and Spanish, and will be available shortly. It is hoped that funding for the establishment of the regional data banks will be obtained in the near future.

RESTORATION OF PRZEWALSKI HORSE TO MONGOLIA

An Expert Consultation was held in the USSR in June 1985, organized by FAO and UNEP and the Centre for International Projects of the USSR, to design an action plan for the restoration of the Przewalski Horse to the wild in Mongolia. The last wild horses were seen in Mongolia about 15 years ago. About 600 Przewalski Horses now exist in captivity in zoos and wildlife parks in east and west Europe, in the Ukraine and in North America. The captive breeding community, who were well represented at the meeting offered to donate a small group of horses to the project when it is operational. The action plan is now being considered for funding. The report of the meeting is published by FAO and UNEP in English and in Russian by the Centre for International Projects in Moscow. Copies of the English edition may be obtained by writing to FAO Animal Production and Health Division, Rome, Italy.

RECENT PUBLICATIONS

1ST PROCEEDINGS OF THE SOCIETY AND NATIONAL SEMINAR ON SHEEP & GOAT PRODUCTION AND UTILISATION 1981. Compiled by A.K. Basuthakur and R.M. Acharya, Indian Society for Sheep and Goat Production and Utilisation, Jaipur. 436 pp.

This seminar was jointly organized by the newly formed sheep and goat society (whose inaugural meeting took place at the seminar and is briefly reported in these proceedings) and the Indian Council of Agricultural Research acting through its Central Sheep and Wool Research Institute. The new Central Goat Research Institute and other research institutes also participated in the seminar. The main sections of these proceedings are: 2 welcome addresses; 2 keynote addresses; 30 invited review papers under the headings: Genetics and Breeding, Nutrition, Physiology, Health, Technology and Development; 72 abstracts of research papers under similar headings; and recommendations.

From the point of view of AGRI the most interesting papers are the keynote addresses and the invited papers on genetics and breeding. These are as follows:

Status of sheep production in India by R.M. Acharya
Status of goat production in India by K.L. Sahni
Breeding sheep for fine wool production by A.K. Basuthakur
Breeding sheep for carpet wool production by A.L. Chaudhary
Genetic basis for improving sheep for mutton production by C.L. Arora
Exploitation of indigenous goat genetic resources for chevon production by R.K. Mishra
Breeding goats for milk production by D.S. Chawla and D.S. Bhatnagar
Breeding goats for mohair production by V.K. Patil
Breeding sheep for pelt production by A.L. Arora and R.S. Dhillon.

These papers contain very extensive reviews of their various subjects. of particular interest are the detailed tables (up to 15 per article) giving figures on genetic parameters and on the performance (growth and meat production, milk yield, fibre and pelt production, and reproduction) for some of all of the 40 breeds of Indian sheep and 19 breeds of Indian goats. Also tabulated are many results of crossbreeding with imported breeds. The chief breeds used for crossing are the Merino, Corriedale, Karakul and British mutton breeds of sheep and the Saanen, Alpine and Angora breeds of goat. These articles are well referenced with up to 81 references each.

There are many recommendations. The most relevant under the heading "Breeding" are as follows:

"1.3 Some surveys on genetic resources in sheep and goats in the country have been carried out recently. There is a need for more detailed surveys to be carried out by the ICAR.

1.4 Valuable breeds such as Magra, Mandya, Hissardale and Nilgiri in sheep and Barbari, Jhakrana and Jamunapari in goats which are showing fast decline in their numbers, should be conserved, further multiplied and utilised in genetic improvement programmes through the establishment of large scale farms and private flocks.

1.8 Since the embargo on the export of Australian Merinos has now been lifted sufficient number of Australian Merino stud rams should be imported and utilised for breeding.

1.9 Soviet pashmina goats should be imported and their performance studied relative to our indigenous breeds in Leh, Ladakh.

1.13 Large scale farms with research programmes for evaluation and further improvement through selection of important indigenous carpet wool and mutton breeds should be instituted by the State and Union Government.

1.14 The work being done under All India Co-ordinated Research Project on sheep breeding for improving mutton production through crossing coarse wool and hairy breeds with exotic mutton breeds should be intensified....."

The remaining breeding recommendations refer to further importations and to general principles of breeding and research programmes.

This book is encyclopaedic. Quite apart from the chapters on nutrition, physiology, etc., it is the best available source of exact and detailed information on Indian sheep and goat breeds and on crossbreeding programmes for their improvement.

I.L. Mason

ANIMAL GENETICS. F.B. Hutt and B.A. Rasmussen. Wiley, New York. 582 pp. 2nd edition. 1982.

The first edition of this college textbook was published in 1964 by F.D. Hutt. For the second edition it has been thoroughly revised by both authors and a chapter on blood groups and protein polymorphisms has been added by B.A. Rasmussen. The practical emphasis has been enhanced by replacing most of the illustrative examples from plants and man by material from domestic animals.

The chapter on the genetics of disease resistance merits particular attention. This subject has always been one of Professor Hutt's special fields of interest (he published a whole book on it in 1958) and the present chapter is a very useful up-date on the whole subject. Specific cases dealt with include: resistance of honey bees to American foulbrood, of cattle to mastitis, to ticks, and to trypanosomiasis, of poultry to pullorum disease, to Marek's disease, to lymphoid leucosis and to Eimeria, and of sheep to gastro-intestinal parasites. Examples of indicators of genetic resistance include: body temperature as an indicator of resistance to pullorum disease in poultry, fatty acid content of lactosebum and indicator of resistance to mastitis in dairy cattle, eyelid pigmentation as indicator of resistance to eye cancer in cattle and presence of B^{21} red blood antigen as indicator of resistance to Marek's disease in poultry.

The book is written in Professor Hutt's well known limpid style which is such a pleasure to read - especially after the turgid style of all too many textbooks.

I.L. Mason

INDO-SWISS PROJECT KERAL For livestock and fodder development. Kerala Livestock Development Board, Sasthamangalam, Trivandrum-695 010 (?1984)

This brochure was produced to mark the 20th anniversary (in September 1983) of the bilateral project on cattle improvement between the Governments of India and Switzerland. Its 48 lavishly illustrated pages include 16 articles by 27 authors on various aspects of the project: breeding, reproduction, artificial insemination, fodder production and training.

Kerala is chiefly a State of crop production on small farms. The local nondescript (or desi) zebus are of no specific breed. They are used primarily for draught; milk production is secondary. Many farms have no cattle and herds are very small: the average number of cows per farm overall is 0.5 and average herd size is 1.37. Any improvement programme has to bear in mind the importance of draught ability and of increasing fodder production for the needs of an improved breed.

The project began at Matupatti farm at 1800m in the Western Ghats. 22 bulls and 45 cows of the Swiss Brown breed were imported from Switzerland. The bulls were used on local cows (143) and the first crosses were backcrossed to the Swiss Brown. The resulting 3/4 breds were backcrossed to the 1/2-breds to produce 5/8-breds and these were

mated inter se to produce a new breed - the Sunandini, which was recognized in 1979. The local cows were purchased during 1963-4 and phased out during 1968-9. The Swiss Brown were imported during 1966-7; the cows were phased out during 1974-5 and the bulls during 1977-82. Frozen semen of Swiss Brown bulls was also imported.

The crossing started at Matupatti but it was later extended to other government farms and then, by A.I., to the whole country. There are now 5 govenment farms involved - 2 are bull breeding farms and semen production centres, one is a bull station for semen production only, one is a bull breeding farm and one is for the production of fodder seed. Of the 3 million cattle in the State 1.35 million are now crossbred and among breeding cows the proportion is even higher - half of 1.37 million. There are 154 breeding bulls at the 3 bull stations and they perform over a million inseminations per year. About half the cattle-owning households in the State now use A.I. 95% of cows are located in areas where A.I. is available and will eventually be covered by the service. A.I. will soon be performed entirely with frozen semen. 60% of crossbred bulls are culled because of poor libido or poor semen quality.

The crossbred cows calve at an earlier age than the local cows and they have a shorter calving interval and a much higher yield. They are also superior in these performance traits to the purebred Swiss Brown under Kerala conditions. Size and growth rate increase as the proportion of Swiss Brown blood increases. The crossbred bullock is as good a draught animal as the desi bullock. The combination of crossbreeding and better feeding and management has increased the daily milk yield per cow in the State from 1.1 litres in 1964-5 to 2.7 litres in 1977-8. As a result total milk production in Kerala increased from 100 000 t in 1964-5 to 950 000 t in 1981-2.

Bulls are now selected on the basis of a progeny test. To achieve 50 daughters per bull 1500 inseminations per bull are required because of low conception rate (2.5 inseminations per conception), low claving rate (66% of successful inseminations), loss of cows from milk recording by migration or death (40% and high age at first calving (15% calve only 5.5 years after the intitial insemination by their sires). Milk recording has been organized to give the progeny testing results. Each recorder is able to deal with only 2-3 cows per day and each cow is recorded by a personal visit every 10 months. Only the milk milked into the pail is recorded; that sucked by the calf to stimulate milk let-down is ignored. So far 71 crossbred bulls have been tested.

BREEDING FOR FEED EFFICIENCY

Two papers on genetic improvement in efficiency of feed conversion were presented under this title at the Canadian Society of Animal Science Symposium entitled Reducing Feed Costs held on 12 July 1983 at Truro, Nova Scotia. One was on Swine and Dairy Cattle by B.W. Kennedy and the other on Poultry by R.W. Fairfull and J.R. Chambers. They are published in the Canadian Journal of Animal Science 64: 505-512 and 513-527.

Selection for feed efficiency (milk produced per unit of feed consumed) in dairy cattle should be effective, judging by its moderate heritability, and it should be possible since feed consumption (at least of concentrates) is measured in many milk recording programmes. Nevertheless, although feed represents the chief cost in milk production, direct selection for feed efficiency is not practised. Correlated response to selection for milk yield, however, probably results in 70-95% of the improvement in feed efficiency that could be achieved by direct selection. Selection for increased body size, on the other hand, may reduce feed efficiency.

In pigs direct selection for feed efficiency has been less successful than estimated from the genetic parameters but selection on an index which includes growth rate and backfat thickness has been as effective in increasing feed efficiency as direct selection. Development of automated feeding devices which allow measurement of individual feed intake under group penning will facilitate selection for improved feed efficiency but more research is needed before its use can be economically justified.

In poultry past selection for egg mass in egg stocks and for rate of gain in meat stocks has resulted in a correlated improvement in feed efficiency. Heterosis in breed or strain crosses contributes an average of 6% to efficiency in both stocks. There is

evidence of variation in feed consumption not attributable to economic traits at present under selection. The best prospects for improving feed efficiency involve reducing feed requirements for maintenance in both egg and meat stocks and the reduction of body fat in meat stocks. The time has come to explore: the effectiveness of direct selection for feed efficiency as compared to other methods of improving it genetically; the relative economic viability of various methods; exactly what selection criteria should be used in direct selection; and what methods of multi-trait selection should be employed.

EVALUATION OF LARGE RUMINANTS IN THE TROPICS. Proceedings of an International Workshop held at the C.S.I.R.O., Rockhampton, Queensland, Australia, 19-23 March, 1984. Edited by J.W. Copland. Published by the Australian Centre for International Agricultural Research.

Crucial to any programme of animal genetic conservation is an evaluation of livestock breeds to characterize their productivity, special qualities and the environments in which they live. It is with a view to providing a framework for evaluation studies that FAO set up pilot data bank projects in Asia, Africa and Latin America. In this context, it is gratifying to note that the importance of breed evaluation has also been recognised by the Australian Centre for International Agricultural Research (ACIAR) which has now held a workshop on this subject. The purpose of the workshop was to (i) identify the needs, priorities, and specific problems of large ruminant production in developing countries and areas of possible cooperative research between Australian and overseas institutions (ii) collate existing information that seeks to characterize specific breeds on a comprehensive basis in terms of their overall productivity, specific productive and adaptive traits and the influence of various environmental factors on productivity (iii) formulate requirements and procedures for more effective evaluation of indigenous and introduced large ruminant resources, and (iv) advise ACIAR of their findings.

The workshop was attended by thirteen overseas scientists from Africa, South-East Asia and the South Pacific and many Australian scientists. The proceedings are in two parts. The first deals with the current status and future development needs of buffaloes and cattle. These are contained in country reports from Malaysia, Philippines, Thailand, Papua New Guinea, Indonesia, Ethiopia, Sudan and Nigeria. They give an account of the local breeds, their performance, present status of research and development and future plans. Comparative breed performances are given, but in most cases, interpretation is made difficult by location differences and sample size. Very little work appears to be going on with genetic improvement of indigenous breeds which is in contrast to the considerable information on crossbreeding with exotic breeds.

The second part deals with Australian research on breed evaluation and its possible application to other areas in the tropics and sub-tropics. Of the ten papers, eight deal with breed evaluation studies carried out with British breeds, Zebu and their crosses in South Australia, NSW, Queensland, North West Australia and the Northern territories. Of the last two, one discusses the criteria to be used in identifying breeds for evaluation studies and the other, information systems for animal breeding. There is a final section on conclusions and recommendations in which Asia and Africa are dealt with separately and for each region, traditional and ranch systems are considered separately.

Although the coverage is not extensive and is limited to those countries where ACIAR has research interests, the book is a valuable contribution to the meagre literature on animal genetic resources in the tropics.

INTERNATIONAL REGISTRY OF POULTRY GENETIC STOCKS. R.G. Somes. Storrs Agricultural Experimental Station, The University of Connecticut, Storrs.

The last edition of Dr. Somes' Registry of Poultry Genetic Stocks published in 1981 listed stocks from seventeen countries. A review of this edition was included in Crawford's paper "Cataloguing of poultry stocks in North America" published in Animal Genetic Resources Information 1/83, pp 27-28. A new edition has now appeared which updates lists of the 17 countries included in the last edition and includes material from three more. The countries included are Austria, Brazil, Canada, Czechoslovakia, Denmark,

Dominican Republic, Finland, France, Germany, Hungary, Japan, Mexico, Netherlands, Norway, Poland, South Africa, Spain, Sweden, Switzerland, United Kingdom and United States. The present edition has 1157 listings of stocks held by institutions and individuals. Of these, 1005 are chicken, 98 quail and 58 turkey. As in the earlier edition, the stocks are classified into specialized lines or strains and described by their characteristics. Mutant strains are also described separately. In addition, there is a list of known single gene traits and their symbols, a linkage map for each species and a description of breeds and varieties by their morphological characters. The registry has information useful to a wide range of people, particularly poultry geneticists, biomedical scientists and poultry enthusiasts.

ANIMAL GERMPLASM PRESERVATION AND UTILIZATION IN AGRICULTURE. Report No. 101, Council for Agricultural Science and Technology (CAST). September 1984. 35 pp.

This report concerns the preservation and utilization of the animal germplasm resources required to assure future supplies of animal products. Attention is given to global germplasm resources of chickens, turkeys, pigs, sheep, goats, and cattle.

It has been prepared by a task force of 27 scientists (including also those who prepared a companion report on plants) with Keith Gregory as chairman and Gordon Dickerson as co-chairman, both of the U.S. Meat Animal Research Center, Nebraska. The Task Force was set up be CAST which is an organizaiton representing 25 professional societies in the agricultural sciences. Copies of the report can be obtained by applying to: CAST, 250 Memorial Union, Ames, Iowa 500011, U.S.A.

The contents of the main chapters of the report are summarized below.

Potential loss of animal germplasm resources.

This gives an excellent account of the U.S. situation and is reproduced here almost complete. Illustrations and references have been omitted.

In several species, the United States lacks the genetic diversity that will be needed to meet the potential challenge of the new diseases and the production requirements associated with anticipated changes in production resources and market requirements. Access to animal germplasm from other parts of the world is important for the future of U.S. animal production.

Loss of genetic variability may involve either entire breeds and strains, or the chance loss of genes by inbreeding and strong selection pressure. The chance loss of genes becomes more likely when the population of less competitive breeds is reduced or when the number of breeding animals in any breed is reduced with the intensive use of artificial insemination and embryo transfer. In western Europe, selective elimination or near loss of local breeds or of strains within breeds has occurred frequently during recent decades (Maijala, 1974; Maijala et al., 1984).

Poultry. The genetic base of poultry breeding stocks has been reduced substantially with the emergence of a limited number of breeding firms as major suppliers of meat chickens, egg chickens, and turkeys for intensive commercial poultry production systems throughout the world. If the need arises, however, it should be possible to extract genes for disease resistance or other specific traits from the large and diverse populations of "village chickens" available in much of Asia, Africa, and Latin America. Some improved, noncommercial stocks of poultry which would make this process easier and quicker probably have been lost. Efforts are needed to preserve improved stocks not presently used by large commercial poultry breeding firms.

Swine. The swine industry has been evolving over the past 35 years toward a breeding structure similar to that of poultry. Even though several large commercial swine-breeding organizations have evolved, swine breeding stock still is managed predominantly by a large number of farmer breeders. Many farmer breeders maintain more than one breed to meet the needs of commercial crossbreeding programmes for male or female breeding stock.

If the swine industry continues to move in the direction of the poultry industry, the risk of losing swine germplasm resources will increase. Canada and western Europe have swine industries, breeding goals, and breeding stocks similar to those of the United States. Swine breeding has involved greater central management in western Europe than in Canada and the United States. The situation thus may justify a more systematic effort to maintain stocks of minor breeds of swine that still exist in the United States, supplemented by importation of special swine germplasm from other parts of the world, such as high fecundity stocks from mainland China.

Sheep. Moderate genetic variation already exists in the sheep germplasm resources within the United States. Moreover, the extensive breeding structure of the sheep industry helps to maintain genetic diversity. Nevertheless, U.S. sheep production could benefit substantially from access to exotic stocks with higher fecundity (such as the recently imported Finnsheep), greater milk production, leaner carcasses, and longer breeding season. Although such germplasm exists in other countries where it is not threatened with serious loss, its availability to U.S. breeders is restricted by animal health constraints.

Dairy Cattle. The lack of genetic diversity and the loss of germplasm resources could become serious in dairy cattle, both nationally and internationally. In the United States, there is a continuing trend toward the use of only one breed, the Holstein, primarily because of superiority in whole-milk production per cow. The proportion of Holsteins in all U.S. dairy cattle registrations was 79% in 1981. The increase in number of Holsteins is likely to continue because genetic improvement programmes in dairy cattle are heavily dependent upon artifical insemination and progeny testing, which results in a strong relationship between population size and rate of genetic improvement. Artificial insemination reduces the number of sires per breed, especially in the declining minor dairy breeds. The increasing use of embryo transfer also reduces the effective number of female breeders (11% of the Holstein bulls registered in 1982 were the result of embryo transfer).

Although the Holstein breed is clearly superior in whole-milk production per cow, this advantage is dependent upon a high level of concentrate feeding and a pricing policy that inadvertently favors low milk-solids content. Thus, a marked increase in the price of concentrate and by-product feeds relative to forages or whole milk could reduce the economic advantage of the Holstein breed. Similarly, a change in milk-pricing policy favoring higher total solids content would reduce the superiority of the Holstein breed and increase the advantage from crossbreeding. Genetic resistance to mastitis or other diseases could increase in importance as a result of withdrawal of specific antibiotic or other therapeutic agents from the market, or the development of resistant strains of pathogens. Any one or a combination of these factors could create a need for dairy cattle germplasm not available within a single dominant breed.

The demonstrated superiority of the Holstein breed for whole-milk production, together with aggressive sales efforts, have stimulated extensive importation of semen from North Amercian Holstein bulls by most European countries and many semitropical countries wehre the dairy industry is important. Although loss of global diversity of dairy cattle germplasm may not be an immediate problem, the success of Canadian and U.S. dairy cattle breeding is contributing to future risk of loss because Holsteins are replacing other breeds, particularly in Europe. The trend in Europe is an extension of the earlier replacement of other dairy breeds by Friesians in both the United States and Europe.

Beef Cattle. Germplasm resources available for U.S. beef production have expanded recently as a result of importation of beef and dual-purpose breeds (Bos taurus) from Europe into Canada starting in the mid-1960s and the more recent importation of Bos indicus breeds from Brazil into the United States starting in 1979.

Global Risk of Germplasm Loss. The greatest global risk of losing potentially valuable germplasm is the estensive and, in some cases, indiscriminate crossing of indigenous stocks in developing countries with breeds from North America and western Europe. The prime example is the widespread crossing of cattle kept primarily for milk with the North American Holstein or with the European Friesian breeds. Most countries have imported Holstein semen, and many countries have invested large sums of money to import both males

and females of the "Black and White" breeds from North America and from Europe. Consequently, many distinct native stocks now carry some percentage of "Black and White" inheritance. Such crossing may not improve life-cycle production efficiency unless there are commensurate improvements in production environments. In addition, crossing threatens the maintenance of indigenous stocks as sources of germplasm for disease and parasite resistance and heat tolerance.

The crossing of indigenous hair sheep with exotic wool sheep provides another example of genetic erosion and loss. Hair sheep appear to be better adapted than wool sheep to tropical conditions, especially the humid tropics, and possibly to hot, arid regions such as the Sahel of Africa. Crosses between hair and wool sheep have a wool coat which is not shed but which has little or no commercial value for fiber because of the mixture of wool and hair fibers. Considering adaptability and productivity, such crosses are less useful than either parent and represent a loss of the discrete hair-sheep germplasm. Such losses have occurred in Asia, Africa, Latin America, and the Caribbean. Hair sheep may be more productive in southern and southeastern United States than the breeds of wool sheep now available for production.

Need for preserving genetic variation in food and fiber animals. After some general introductory paragraphs each species is treated separately repeating much of the same material as in the first chapter. 31 breeds of the U.S.A. are illustrated. The final section "Trends in breed numbers" and the conclusion of the chapter are worth reproducing in toto.

"An unpublished survey questionnaire was mailed in 1983 by G.E. Bradford of the University of California at Davis to about 40 breed record societies responsible for maintaining ancestral records for breeds of dairy cattle, beef cattle, sheep, and swine in the United States. Replies were received from 21 breed associations believed to represent more than 50% of the pedigreed livestock. Some conclusions for the returns are as follows:

1. Substantial numbers of individual breeders are involved in the production of pedigreed livestock, particularly in beef cattle, sheep and swine. For example, in 1981 six swine breed associations reported memberships of from 400 to 5,000 breeders each, with annual registrations totaling 660,000 animals. Comparable figures for beef cattle were six associations with 3,300 to 32,000 breeders each and 569,000 animals registered; for sheep there were six associations with 800 to 10,000 breeders each and 145,000 animals registered. Both the numbers of breeds and of breeders per breed are important factors in maintaining genetic diversity within species.

2. The average number of animals registered per breed society is increasing, but some associations report declines in numbers registered. In beef cattle, British breeds (Angus, Hereford, and Shorthorn) now register fewer animals than during the 1950s and 1960s, but still register relatively large numbers of animals. Some of the beef and dual-purpose European breeds imported through Canada in the late 1960s and early 1970s have established large populations of registered purebreds. Brahman and Braham-derived breeds and the Texas Longhorn breed report increasing registrations.

3. Dairy cattle registrations confirm that the Holstein breed predominates and continues to increase, while numbers of other breeds are small and decreasing. However, wide use of frozen semen and increasing use of embryo transfer make numbers of registrations an inadequate measure of effective population size.

4. The Landrace, Spot, Yorkshire, and Duroc breeds of swine each report registrations exceeding 60,000 per year, with numbers increasing. Numbers of Poland Chinas declined after 1960 but now are increasing. The Hampshire and Chester White breed associations have substantial numbers but did not return data. Several proprietary breed composites maintained by commercial breeding companies contribute additional genetic diversity.

5. In sheep, numbers registered have expanded in the Suffolk and Dorset breeds but have declined significantly in the Hampshire and Corriedale breeds, while some other breeds have nearly disappeared.

6. Numbers of dairy goats registered (six breeds combined, reported by the Amercian Dairy Goat Association) have increased from 3,000 in 1950 to 57,000 in 1981. It is not known whether this reflects increases in numbers or increased interest in registrations to meet requirements for exhibition at shows.

The overall U.S. picture is one of declining diversity in dairy cattle, but a significant increase in genetic resources available in beef cattle. Other species are maintaining genetic variability in the breeds presently available, but do not adequately represent global genetic resources, particularly in sheep and swine."

Global assessment of food and fibre animal germplasm resources. The world genetic resources of poultry, pigs, sheep, goats and cattle are briefly outlined and illustrated by a series of over 50 photographs with particular attention to those breeds recently imported into U.S.A. or which might be worth trying out.

Accessibility of world animal germplasm resources. Animal health and trade barriers are reviewed. The conclusions (as well as from the two short following chapters on priorities and methods in preserving animal germplasm resources) are well covered in the general summary of the report.

> "The high level of animal health maintained by the livestock and poultry industries has contributed greatly to the efficiency of producing animal products and to availability of generous quantities at reasonable prices. Current animal health constraints in the Unted States are highly effective in preventing serious losses from exotic animal disease, but they have the undesired side effect of excluding potentially valuable genetic stocks of poultry, swine, sheep, goats, and cattle that could make substantial contributions to U.S. animal agriculture.
>
> Satisfactorily joining the opposing objectives of excluding exotic germplasm to avoid introducing diseases and of admitting it to permit livestock and poultry improvement involves consideration of the following issues:
>
> - The national interest will be served by preserving representative samples of promising germplasm from all food and fiber animal species of the world and by establishing procedures for evaluating the genetic potential of this germplasm.
>
> - When animal germplasm is introduced from other countries for animal improvement, a low risk of introducing associated exotic diseases is desirable.
>
> - The risk to animal health from exotic diseases can be reduced by research programmes that develop (1) techniques for successfully freezing semen and embryos from all food and fiber animal species to eliminate the greater disease risk associated with movement of animals and (2) highly sensitive tests for the presence of infectious agents in live animals and in frozen semen or frozen embryos that may be introduced.
>
> - The current policy on importing animal germplasm for agriculture focuses on disease exclusion and largely overlooks the purpose of the importation, which is animal improvement."

Comprehensive programmes for evaluating, preserving and utilizing animal germplasm resources. Again the general summary is quoted.

> "No organized programme exists, either in the United States or internationally, to sample, evaluate, preserve, and utilize exotic and endangered sources of chicken, turkey, swine, sheep, goat, and cattle germplasm. Existing research and service organizations do not have the financial resources to undertake this expensive long-term programme which is of vital importance to the United States and the world.

The Consultative Group on International Agricultural Research is a logical organization to establish an International Board for Animal Genetic Resources comparable in structure to the International Board for Plant Genetic Resources. The animal counterpart would provide technical assistance to national programmes and would provide for their integration in an international network to preserve and use the animal germplasm resources that can contribute to present and future draft, food and fiber needs.

If an International Board for Animal Genetic Resources were established, it would be logical for appropriate U.S. organizations and agencies, including the U.S. Department of Agriculture, to establish a complementary National Animal Genetic Resources Board (similar in structure to the existing National Plant Genetic Resources Board) to collaborate with the International Board. National objectives and operating procedures would be established by the Board and participating groups. The overall goal of both the International Board and satellite National Boards would be establishing optimum levels for preserving and utilizing animal genetic resources, and implementing programmes to achieve these levels."

THE CAMELID. AN ALL-PURPOSE ANIMAL. VOL. I. Proceedings of the Khartoum Workshop on Camels December 1979. Editor: W. Ross Cockrill. Scandinavian Institute of African Studies, Uppsala. 1984.

This workshop was arranged by the Swedish International Foundation for Science in cooperation with the Agricultural Research Council of the Sudan National Council for Research. The papers presented at the meeting were published in 1980 as Provisional Report No. 6 of the International Foundation for Science. Because the demand for copies was high contributors were invited to revise, update and expand their manuscripts which were then edited and published as the present volume. The editor has written an introduction and some new papers have been added. Volume II will take the form of a bibliography.

The authors come from Africa, America, Asia, Australia and Europe, China and Saudi Arabia represent Asia; there are no contributions from India or Pakistan. Apart from the papers from China and South Amercia and two general papers on feeding habits and digestive physiology the majority of papers refer only to the dromedary. They cover all aspects of history, husbandry, physiology, products, reproduction, and diseases. Some are in the form of reviews and some are reports of original research.

This book will take its place beside the several other books on the camel which the recent revival of interest in this animal has stimulated during the last 10 years. (For a list see AGRI No. 4, page.) It will not have the readability of the single author books in this list but it will be an invaluable source of information on some specialized aspects of the camel and about its husbandry, especially in Africa.

I.L. Mason

CONTROLLED BREEDING IN FARM ANIMALS. I. Gordon. Pergamon Press, Oxford.

This book is written for students in veterinary medicine and animal science pursuing advanced undergraduate studies. Graduate students in reproductive physiology will also find the book valuable as a concise source of information of the recent developments in reproductive technology. The book is divided into four parts, each of which is devoted to a species; the ones covered are cattle, sheep, pigs and horses. The parts on cattle, sheep and pigs have chapters on (1) oestrous cycle; (2) artificial control of oestrus and ovulation; (3) pregnancy testing; (4) control of parturition; (5) reduction of inter-parturition interval; (6) embryo transfer; (7) induction of multiple births, in addition to an introductory chapter. The one on horses has fewer chapters. Of interest to animal breeders are those sections concerned with artificial control of oestrus, embryo transfer and induction of multiple births.

The emphasis of the book is on reproductive physiology and readers concerned with infertility will find little of interest. However, on reproductive physiology and techniques of controlling breeding, it is very up-to-date in its coverage and there is also a lot of information on areas where research is yet going on. Thus, it will be some time before the book is out of date although reproductive physiology is a rapidly expanding field.

The emphasis throughout is on European breeds of livestock and there is hardly any reference to tropical breeds. Although this is not unexpected because of the author's interests, some references to the work on oestrus synchronisation in zebu breeds, and to tropical sheep breeds in relation to seasonal breeding would have added to its value for readers in the tropics.

The book is very well illustrated with good captions and has a large number of tables where experimental data are clearly presented.

The flexicover version sent for review costs only £ 15.00 which is a good value for money.

ANIMAL BREEDING AND PRODUCTION OF AMERICAN CAMELIDS by R.C. Escobar (Ron Hennig-Patience, Lima, Peru, 1984 English Edition 1985)

There are four types of American camelids, two, alpaca and llama, having long been domesticated, while the vicuña and guanaco still exist only in the wild. The importance of the alpaca (for fibre and meat) and the llama (for fibre, meat and transport) to the Andean peasant was discussed by Dr. Cesar Novoa M. in a paper to the FAO/UNEP Technical Consultation on Animal Genetic Resources in Rome (FAO Animal Production and Health Paper No. 24, pp 349-63, Rome 1981). According to him, their value lies in their efficient use of the Andean Altiplano ecosystem, where conditions are severe for many other livestock.

Little detailed information has been published in English about these fascinating animals, so the present book is welcome, as it contains an extensive review of work done in South Amercia and published in Spanish, as well as drawing on the wide practical experience of the author himself. Aimed mainly at growers of alpaca and llama, it challenges some of the conventional wisdom concerning exploitation of these animals, and urges that, with improved husbandry, they could be of much greater value to the whole Peruvian economy.

All four types are discussed; since fertile crosses can occur, the author queries whether they are separate species, though they have distinct differences which are described in detail.

The vicuña, smallest in body size, occurs only in wild populations at high altitudes. It was harvested for its very fine (10-15 microns) fibre in Inca times, but because of its high value the fleece was reserved for royalty. Numbers have been so reduced by hunting in modern times, because of high financial returns, that finally protection measures were taken. International agreements were signed in 1969 and 1979, and sale of the fibre on foreign markets has been prohibited. In 1964, the Peruvian Government established a National Reservation at Ayacucho, and instituted a conservation plan. The present book discusses conservation and harvesting plans, and stresses the value of commercial use of vicuña males in crossing with alpaca females to produce finer fibres.

The alpaca has been most exploited of the four types, and receives greatest attention in the book. Methods of improving production through many avenues are discussed - feeding, breeding, management, disease control.

The main product is the fibre, whose special processing qualities enable it to yield a lightweight fabric and give it a high value. Meat is currently not very important, but the author urges greater use should be made of it.

There are detailed descriptions of the alpaca's biological characteristics, including patterns of reproduction. These are of particular interest to workers accustomed to sheep and goats. The alpaca has a gestation period of 11 months and will mate again as soon as 5 days after parturition. As it is usually mated annually, the female has to cope simultaneously with lactation, mating and pregnancy. These additional stresses call for expert management, which is fully discussed. So are mating procedures; coitus stimulates ovulation and may last up to half-an-hour. Interrruption, which can be caused by other males if the male:female ratio is too high, may lead to failure of conception with subsequent lowered calving percentage.

Alpacas live to 11-12 years; there is some discussion of changes in productivity with age, but also a call for collection of more extensive data so that calculations of optimal age structure can be made.

Fleece characteristics receive considerable attention. Selection against excess medullation is recommended; considerable crossing with the llama in the past has resulted in undesirable "hairiness". Shearing every two years is currently common practice, but it is urged that with adequate feeding and good management, an annual fleece would have sufficient staple length to meet processing requirements.

Alpaca fleeces come in a wide range of colours; as with sheep, white usually fetches the highest price on the world market, but other colours are sometimes sought. No detailed analysis has been done on colour inheritance, but from personal observations and analogy with sheep the author gives some practical suggestions about how to sub-divide a flock and work towards colour segregation. And anyone familiar with wool markets in other developing countries will heartily agree with the plea for some sorting of the fleece as soon as it is shorn; this is part of a much-needed rationalization of current marketing systems which militate against good commercial returns to livestock owners in so many countries.

Livestock production in Peru since the Agrarian Reform Law of 1969 is carried out in the large SAIS (Sociedades Agricolas de Interes Social - cooperative farms based on the former vast privately-owned haciendas) or in small peasant communities. The SAIS may run alpacas as well as other livestock, in flocks large enough to make selection possible. Llamas, on the other hand, are usually maintained in small flocks in the peasant communities, making within-flock improvement more difficult. The llama fleece is double-coated, with a "hair" coat of 50-70 micron diameter and a finer inner coat of 25-30 microns (the latter similar to the alpaca). It is not of great commercial value because of the mixture, but is hand-processed to give strong, durable and warm textiles. The author suggests there should be some attempt to select towards lower percentages of "hair", in spite of the small flock sizes.

English-speaking readers should not be discouraged by words in this edition which, though technically correct, are not those commonly used - for example, 'fecundation' instead of 'conception'.

In one or two cases, some technical points seem to have lost clarity in translation (for example, in the discussion on selection response, page 286) but mostly the meaning is plain, and the whole book gives a wide-ranging account of all aspects of production for these interesting animals, unfamiliar in the Old World.

H. Newton-Turner

GENETIC IMPROVEMENT OF BUFFALOES by S.B. Basu (Kalyani Publishers, New Delhi) 1985

This book is a most valuable addition to knowledge on the neglected buffalo. The author brings together the well established genetic evaluation methodology and selection procedures used for dairy cattle, and considers their application and use for the buffalo. This takes him through a useful review of literature summarizing the basic facts about the cytogenetics, growth pattern, puberty, reproduction and lactation of the buffalo. He then studies the use with buffalo of available techniques developed for

dairy cattle for selection and sire evaluation including the lactation curve, milk composition, part lactations and alternative methods of selection. He considers progeny testing procedures and sire evaluation alternatives including BLUP. There is a brief consideration of crossbreeding. The reader is thus made aware in one small volume of the existing work in these fields with buffalo, and at the same time realizes how little, relatively, has yet been published on the genetic improvement of this species.

MERINOS MYTHS AND MACARTHURS AUSTRALIAN GRAZIERS AND THEIR SHEEP, 1788-1900 by J.C. Garran and L. White (Australian National University Press, 1985)

Australia in 1985 had 151 million sheep, only about 7 percent of which were non-Merino, over 70 percent being Merino and the remainder Merino crosses of various kinds. There have been earlier histories of how sheep developed in this, the world's leading Merino country, but the present book is the first to go back to the beginning and trace the contribution of the breeds which were here before the Merino.

Traditional stud-breeders have been wont to boast of the "purity" of their flocks, and history has tended to ignore the possible influence of those first sheep. Further, every Australian schoolchild is still taught that John Macarthur "founded" our famous wool industry. These are the two "myths" which the authors set out to explode.

Europeans first settled in Australia in 1788 at what is now Sydney, and settlement later spread to other parts of the country. The book outlines the way sheep moved out from the first settlement at Port Jackson, and these chapters will interest Australians. Of greater value to all those concerned with sheep or genetics are the discussions on the overlooked early sheep, and their influence on the development of the Australian industry.

The First Fleet came from England via the Cape of Good Hope, where livestock for rations were collected, among them about 100 sheep. These did not thrive, and further supplies of "Cape" sheep came later. Of greater importance are the "Bengal" sheep, shipped at Calcutta. Twelve of these came on a storeship in 1791, and a further 100 on the "Shah Hormuzear" in 1793. This latter shipload was not officially recorded at the time, as the "Shah" did not belong to the East India Company, which had a transport monopoly. The story of their arrival and performance can be gathered from diaries and later official records. They were small, but had the virtue of high prolificacy, being capable of lambing twice in 13 months, with up to 4 lambs at a time.

Both early breeds were described as "hairy". Garran White distinguish between what are now called "hair" sheep, which have an outer coat of medullated fibres, (with a core of air) and a shorter inner coat of fine wool, both coats being shed annually, and "coarse-woolled" sheep, which have a continuously growing fleece consisting of a mixture of wool and wholly or partially medullated fibres. They speculate that the Cape sheep were of a hair type, similar to the present Ronderib, but are not clear about those from Bengal. My own suggestion is quoted, that these could have been similar to a small, coarse-woolled, prolific local breed which still exists in Bangladesh. Also listed as candidates are the South Indian hair breeds; these are not prolific, and their coats are very short. The only known fleece sample for the "hairy" sheep is a single staple, held in Sydney's Museum of Applied Arts and Sciences, which is said to be "from the Cape or Bengal breed", and is about 8cm long.

The early records also mention Irish, Southdown and Teeswater sheep, with no indication of origin, time of arrival, or numbers, which were probably small.

The first fully-documented Merinos arrived in 1797 from the Cape of Good Hope. They came from the deceased estate of Captain Gordon, formerly garrison commander, and were descended from a few given to him from the Netherlands in 1789, which derived in turn from Spanish Merinos of the famous Escurial cabana donated to Holland by the King of Spain in 1787. The sheep at the Cape were offered on sale to a commissary from Port Jackson sent to collect rations, but he considered them unsuitable and they were bought privately by the captains of the two storeships, Waterhouse and Kent.

Garran and White tried to determine how many Merinos were involved, as accounts vary widely; they concluded that 5 rams and 7 or 8 ewes reached the colony, and were distributed among various sheepowners, including John Macarthur, William Cox and Samuel Marsden. Waterhouse also kept some himself, and Macarthur probably acquired a few of these when Waterhouse left the colony in 1800. As Gordon received only 2 rams and 4 ewes from Holland, he must have crossed the Merinos with local sheep, perhaps the same "Cape" breed as those supplied to Port Jackson. Those famous first "Merinos" were therefore probably crossbred.

Further Merinos from the flock of King George III in England came into the colony in the early 19th century: 4 rams and an aged ewe brought by Macarthur in 1805 and 4 ewes and 2 rams by Marsden in 1809.

All early observers noted that the fleece was greatly improved in the first cross between Cape or Bengal and woolled sheep, whether Merino or British. Garran and White postulate that in the case of the Cape sheep, the change was due to a single gene for "woolliness", dominant to the gene for "hair". Whether this is always true is not certain; all first-cross progeny of British woolled rams and the Mexican Tabasco which I saw in Mexico appeared to be woolled, as did those of Corriedale rams and Nellore sheep in South India, both the Tabasco and the Nellore being hair sheep, but no measurements were available. Crosses between the Merino and hair sheep in Nigeria, however, failed to produce satisfactorily woolled progeny. Garran and White go further and suggest that the Cape sheep probably had a very fine undercoat, which could have contributed to the subsequent fineness of the Australian Merino. This is an interesting speculation, but requires experimental evidence. (I have speculated that the gene responsible for high fecundity in the Booroola Merino may have come down from the Bengal sheep - but that cannot be proved either.)

For crosses between Merinos and breeds with coarse, medullated fleeces there is plenty of evidence of reduced incidence of medullation and decrease in average fibre diameter, as many countries growing such breeds have introduced finewool rams to improve wool production.

Garran and White quote the rapid increase of sheep numbers in New South Wales in the early years as evidence of the prolificacy of the Bengal sheep and their crosses. At the first muster in May 1788 there were only 17, but by the time the first Merinos arrived in 1797 thee were 2,500. By 1800 only 300 sheep had been imported, but the total had reached 6,000, and by 1821 it was 120,000 - and up to that time only 30 Merinos had come into the country.

During the 1820's about 5,000 Merinos were imported, mainly Saxon. Even this is a small proportion of the total, and the authors argue there must still have been a considerable amount of crossing with the existing sheep. Imports of various breeds continued throughout the century.

The next major change in sheep type came in the mid-1800's with the work of the Peppin brothers in the Riverina, in the south-west of New South Wales. From about 6,000 ewes on their property, "Wanganella", they selected 200, aiming at large size and heavy fleeces; an additional 100 came from 100 miles away, where there had been an admixture of Rambouillet which increased size. The original 6,000 were mixed dealers' mobs, and probably had infusions of Leicester, Lincoln, Rambouillet, Negretti (Spanish Merino) and Vermont (American Merino). The Peppins were aiming at larger sheep suited to the drier areas of the country. They were so successful that the majority of sheep in Australia now have at least some Peppin genes, though various studs originally derived from Peppin stock are now genetically distinct and differ in such characteristics as size, average fibre diameter and amount of skin wrinkle.

Garran and White have made out a convincing case to demonstrate the mixture of genes from which the "Australian Merino" developed. It is, of course, a fallacy to speak of the "Australian Merino" as an entity, since stud-breeders over the last 120 years have developed strains varying from the small-bodied Tasmanian and Mudgee finewools, through medium wools, (some Peppin, some non-Peppin) to the large-bodied strong-woolled South Australians - all classed as Merino.

As to the other myth they set out to explode - anyone who goes with an open mind to the historical records, as I have also done, ends by concluding that John Macarthur was not alone in founding the Australian sheep industry. Many others made notable contributions - not least Macarthur's wife Elizabeth, who ran the flocks while he was in England for many years, unable to return because of a threat of court-martial. Macarthur sent the first lot of 8 fleeces to England for examination in 1800, but Marsden sent the first commercial lot of wool in 1807. Macarthur had the ability to make out a good case, and was able to secure a large grant of land against the wishes of people like Sir Joseph Banks, who was adviser to George III for the royal Merino flock, and who had a keen interest in New South Wales since his visit with the explorer Captain Cook before European settlement. The grant was also contrary to the wishes of Governor King, who himself had a vision of Australia as a wool-producing land.

Macarthur was certainly not alone, though perhaps in their wish to counter-balance the influence of previous biographers Garran and White have been a little hard on him in trying to eliminate his influence entirely. The Macarthurs did make some contribution, and the advice sent from England by John Jnr. on the importance of clip preparation not only makes absorbing reading, but the principles could be taken to heart today, though we can no longer afford to scrub the sheep with soap in a stream before shearing!

Garran and White are to be congratulated on painstaking search of records and the accomplishment of a fascinating account of the development of Merino sheep in Australia.

Helen Newton-Turner

REPORTS OF MEETINGS

EVALUATION OF BUFFALO BREEDS FOR PRODUCTIVITY CHARACTERS

The Australian Centre for International Agricultural Research (ACIAR) is sponsoring a project "Comparative Evaluation of Buffalo Breeds for Productivity Characters" in South East Asian countries. The first Planning and Coordination Meeting for this project was hosted recently (2-5 December 1985) by Professor Syed Jalaludin and the staff of the Veterinary and Animal Science Faculty at the University Pertanian, Malaysia. Scientists from Sri Lanka, Thailand, Malaysia, Indonesia, the Philippines and Australia participated.

The aim of the project is to support research at various institutes in South East Asia that is comparing different buffalo breeds, particularly riverine and swamp types and their crosses for reproductive performance, feed utilization and adaptive traits, and the relative responsiveness of these breeds to environmental changes including work load.

Research institutions from Sri Lanka, Thailand, Malaysia, Indonesia and the Philippines are participating. Investigations are simulating village management conditions and some are being carried out in the villages. There is a balance between those concerned mainly with reproductive performance and those related to growth rate. The interactions between breed and environmental factors is of prime interest.

In addition, the meeting discussed the importance of karyotyping and the use of biochemical markers to determine genetic distances between the buffalo populations in the region and recommended that ACIAR support a project in this area.

ACIAR support for this cooperative project arose out of a Workshop on the Evaluation of Large Ruminants held at CSIRO Tropical Cattle Research Centre, Rockhampton, Australia in 1984. The proceedings of this workshop are reviewed in this issue.

Drs. J.E. Vercoe and J.E. Frisch from CSIRO, Division of Tropical Animal Science, Rockhampton, Australia, are co-ordinating the project on behalf of ACIAR.

36TH ANNUAL MEETING OF THE EUROPEAN ASSOCIATION FOR ANIMAL PRODUCTION
Kallithea Halkidiki, Greece, October 1985

The working party on Animal Genetic Resources reported the results of a new survey of the breed situation in five species of livestock at the 36th meeting of the EAAP held at Kallithea, Halkidiki, Greece from 30 September to 3 October 1985. The questionnaire type survey called for information on the origin and development of breeds, breed description, qualification of breeds and performance records. Sixteen countries responded to the questionnaires and provided information on 120 breeds of cattle, 92 of sheep, 16 of goats, 55 of pigs and 51 of horses. Data on changes in population size was provided for about 80% of the breeds. It showed, that of the breeds that were on the endangered list in the previous survey of 1983, nearly 5% has disappeared, while a similar proportion that was not endangered earlier has now qualified for inclusion in this category. Population sizes have increased in 26% of the breeds, decreased in 37% and are stable in 36%. Information on chromosomal aberrations is available for about 20% of the breeds while about 25% has data on blood groups. Performance data for economic traits is given for about 70% of the breeds. Other useful information on specific traits, adaptability to adverse environments and disease resistance is also given for some breeds.

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