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Pilot Study on

CONSERVATION OF ANIMAL GENETIC RESOURCES

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Genetic Resources"
(Pilot Study)
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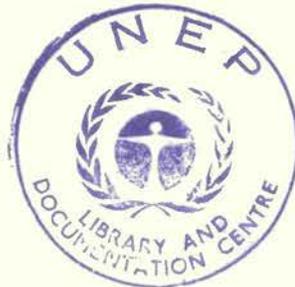
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Summary

For the moment, the problem of the conservation of domestic breeds in danger of extinction, as well as animal genetic resources in general, can only be tackled empirically because we do not have enough basic knowledge.

The present report proposes remedies for this gap, which is due largely to lack of coordination rather than to lack of competent people and scientific institutions. However, certain urgent practical measures can be undertaken immediately.

The solutions recommended vary widely according to local policy and methods of husbandry. If intensive animal production is the aim then the native breeds are sentenced to death. One can foresee only a few small herds kept, for cultural reasons in zoos and regional parks, and, for scientific reasons in order to conserve genes already isolated.

If the aim is an improvement in productivity of livestock which are to continue to be extensively raised then we must set about saving a series of native breeds with herd numbers large enough to exploit difficult environments and to provide the greatest possible hybrid vigour when crossed.

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I. INTRODUCTION

FAO has taken an interest in animal genetic resources since 1946. This has led to a number of publications: one on the zebu cattle of India and Pakistan (Joshi and Phillips, 1953), one on African cattle (Joshi et al., 1957), and one on European cattle (French et al., 1966). A book cataloguing the sheep breeds of the Mediterranean was published jointly with the Commonwealth Agricultural Bureaux of Great Britain (Mason, 1967). A monograph on buffaloes has recently appeared (Cockrill, 1974).

From 1950 onwards a number of intergovernmental meetings have been held in which varying levels of attention have been given to the evaluation, conservation and effective use of animal genetic resources. More recently, expert consultations have been arranged: 1966: general aspects of the problem; 1968: cattle; 1971: pigs; 1973: poultry.

FAO also advises governments on the drawing up of their breeding plans, encouraging them to use their own national genetic resources to the full.

To facilitate the transfer of bull semen of high genetic quality from advanced countries to less developed ones capable of using improved strains, the AGA Division has initiated the International Bull Semen Donation Scheme.

As Friesian cattle are the most important dairy breed in the world, FAO has started, in cooperation with research institutions and governmental bodies in a number of countries, a project to evaluate and compare the genetic merits of semen from Canada, Denmark, Germany (Federal Republic), Israel, Netherlands, New Zealand, Sweden, United Kingdom and U.S.A. The comparison is being carried out in Poland where large numbers of suitable Friesian females are available. The first inseminations took place at the beginning of 1974. Similar tests on strains of other important dual-purpose breeds, such as the Simmental and Brown Swiss, are being planned in other East European countries.

An FAO consultation of animal production and health experts was held in August 1974 at Copenhagen. It recommended that "FAO should initiate international action to establish cooperative research programmes", especially in a number of fields which included "breed comparisons and crossbreeding". A working group charged with this task is at present being set up.

All these activities of the Division of Animal Production and Health of FAO (AGA) have enabled useful contacts to be made at many levels and have made international opinion aware of the necessity for managing declining and rare genetic resources intelligently. In fact it is part of a more general activity of FAO, namely, the conservation of all animal and plant genetic resources which are useful to man. The Stockholm Conference on the Environment (1972) in its Recommendation No. 40, recommended that governments, in cooperation with the U.N. Secretary General and FAO, should make inventories of the genetic resources most endangered by depletion or extinction.

The United Nations Environmental Programme (UNEP) was a result of the Stockholm decisions. Included in its objectives and priorities, stated in 1973, are:

- to promote the protection and conservation of plants and animals, especially rare or endangered species;

- to initiate the preparation of a comprehensive catalogue of threatened species and varieties of crop plants, fish, domestic animals and micro-organisms, and to cooperate with FAO in its programmes for genetic resource conservation; and

- to support regional and national institutions in developing countries for promoting the collection, evaluation and conservation of gene pools of plants and animals for maintaining genetic diversity for the future use of mankind.

For animal resources UNEP decided, in 1973, in cooperation with FAO, to launch a first pilot project on whose results we are reporting here. This project, No. 0604-73-002, is entitled Conservation of Animal Genetic Resources (Pilot Study). It has been carried out, as planned, during 1974. The objectives were:-

1. To prepare a preliminary list of breeds of farm animals which are in danger of extinction together with an account of any measures which have been recommended or taken to prevent this extinction;
2. To assist the Lake Chad Basin Commission in finalizing the preparation of a project for the preservation of the Kuri cattle breed with the possible support of UNEP.

The first objective was the logical result of Recommendation No. 40 by the Stockholm Conference. The survey had to be made from the available literature, by correspondence and by visits to selected sources of information in specific countries or regions. As much information as time would allow was to be included on numbers, distribution, characteristics and economic value of each breed and especially on any unique genetic features such as disease resistance or environmental adaptation, but, in general, this detailed information would have to wait for the definitive inventory. The survey would also reveal what action is being taken in individual countries to keep track of disappearing breeds and to preserve them.

The second part of the project was designed to move immediately from survey to action. The humpless Kuri breed of Lake Chad is unique in its habitat and morphology. Its buoy-shaped spongy horns are unknown in any other breed. Its habitat is, for cattle, a very special one, namely the islands and shores of Lake Chad. To this environment it is remarkably adapted and animals are quite accustomed to swim for their food. It is also an excellent beef animal. Nevertheless a curious combination of climatic vagaries and economic circumstances may be leading to the decline in numbers of the purebred. The rise of the water level of the lake in 1960 reduced the grazing area. Because two zebus can be obtained for one Kuri, bartering is leading to extensive crossbreeding with neighbouring zebu breeds. This case is also interesting because it is international - the four riparian states of Lake Chad are all involved, namely Niger, Nigeria, Chad and Cameroon. If a suitable project for the preservation of this breed can be formulated it would act as a model for preserving other unique breeds in developing countries which are declining because of external circumstances.

II. ACCOUNT OF WORK DONE

A. Evaluation of the threat to genetic variability

1. List of existing literature. This was made at FAO headquarters at the start of the project. It is an indispensable basis but gaps and publication delays make it insufficient.
2. Conferences of experts. Within the framework of the First World Congress of Genetics applied to Livestock Production (Madrid, 11-16 October, 1974) the Animal Breeding Officer in FAO organized a round table called "Conservation of Animal Genetic Resources" with twelve contributors and more than seventy participants. A report of this meeting (Mason, 1974) sets out its main findings. Another round table at the same congress, on the adaptability of farm animals to tropical conditions, included some accounts of the value of tropical breeds (Rendel, 1974).
3. Study of an example of species and breed dynamics in a specific environment. The environment chosen was the two Mediterranean islands of Sardinia and Corsica. The Consultant made two visits, one lasting a fortnight and the other a week. Although the islands are very close to each other, their livestock situations are extremely different: this fact has helped to identify the ways in which species and breed replacement occur (see Annex 1).
4. Contacts with other organizations interested in breed conservation. The Consultant attended the Conference on Archaeozoology held in Groningen, Netherlands, in April 1974 and

presented a paper (Lauvergne, 1975).

Visits were also made to the International Union for the Conservation of Nature and Natural Resources (IUCN), at Morges, Switzerland, in order to discuss wild species, and to the Division of Ecological Sciences of UNESCO in Paris. For details see Annex 5.

5. Exploring the potential of laboratories working on genetic variants and their effects. We needed to know the reasons why current research takes certain directions and whether studies relevant to our field might be coordinated. With this in mind the Consultant visited laboratories of karyology, biochemical and serological polymorphisms, metabolic studies and population genetics (see Annex 5).

B. Preparation of lists of breeds in danger of extinction

This has proved to be very difficult because the list of threatened wild species included in IUCN's Red Data Book, which inspired the people who drew up the UNEP project, is very different from a list of breeds threatened within a domestic species. The frontiers between domestic breeds are much more fluid. Thus any account of endangered breeds within a given species must be presented in the general context of a given region and a given breeding policy. To prepare such an account involves much more work than a simple list. In the light of limited time and money available, we decided to restrict such a detailed study to a single species within a defined range, that is to cattle in Europe and the Mediterranean basin (see Annex 2). For cattle in the rest of the world and for sheep, goats and pigs throughout the world we have made a preliminary list from data in the literature and from information collected at FAO headquarters (Annex 3).

The situation is quite different for domestic species which, unlike ruminants and especially cattle, have a short generation interval and high female fertility (poultry, rabbits and, to some extent, pigs). In developed countries the traditional husbandry of these species has practically disappeared to make way for intensive units entirely independent of the natural environment and using selected strains which are themselves produced industrially. Fortunately, in the case of poultry, some mutants have been conserved in universities and research stations. Their cataloguing resembles that of lines of laboratory animals and it has already been undertaken for the United States by one of the contributors to the Madrid Congress (Somes, 1971). For pigs the only thing to do is to list populations which are still raised extensively and of whose genetics and productivity we are still largely ignorant. In this connection we can learn from the interesting work done over the last fifteen years by a group of Japanese research workers who have catalogued the domestic animals of east Asia. Dr. C. Brooke of Portland University, Oregon, U.S.A., in liaison with the people responsible for the present project, is currently preparing such a compendium for the disappearing sheep breeds of the Mediterranean.

C. Study of endangered cattle breeds in Europe and the Mediterranean basin

In May 1974, the Consultant sent out a questionnaire to thirty-five countries. This enquiry has been continued during his meeting with people on the spot (in France, Italy, Spain, Portugal, Switzerland, German Federal Republic and the Netherlands), then at FAO headquarters (mainly with FAO specialists from the various Mediterranean countries), and in his own research station in France (Annex 2).

D. Study of practical measures to be taken in order to preserve the Kuri breed of Lake Chad

This has been carried out by the FAO Animal Breeding Officer (I.L. Mason) during his visit in May 1974 (Annex 4).

III. SUMMARY OF CONCLUSIONS

A. Domestication, breed formation, genetic variability

Domestication has resulted in the accumulation of certain mutants which, under wild conditions, would be eliminated. In the case of colour mutants this phenomenon is quite spectacular (cf., for example, the colours of primitive goats or of African zebus with those of selected populations).

When breeding conditions remain primitive and breed cleavages are made purely by chance, this variability remains deep in the population and is often scarcely obvious.

When husbandry improves (feeding, control of reproduction, hygiene etc.) the breeders start to practise some degree of selection and keep the best producers for reproduction. Thus lines are formed whose genetic isolation becomes more and more strict. Breeders using the same lines come together to found a society whose chief duty is to keep a herdbook in which only animals conforming to established standards of colour, size, conformation and performance will be registered. After a while there is a tendency to "close" the herdbook; that is, no new animals are entered. Constituted in this way, the breed with a herdbook is an easily defined isolate.

In this report we will use the term "breed" for the more primitive type of population as well as for the clearly differentiated breeds, following the list given by Mason (1969).

B. Competition between breeds and between species and threats to genetic variability

Once formed, breeds with a herdbook tend to prevail over the more primitive and less organized populations which surround them, for a variety of reasons: fashion, commercial activity, real productive advantage and deliberate policy.

At this first stage in the replacement of primitive populations by pedigree breeds there is already a risk that part of the genetic variability accumulated during centuries of domestication will disappear. However, in a developed country where pedigree breeds have been formed in great numbers a long time ago one might think that the essential part of variability had been conserved (cf., for example, the cattle breeds of Europe). On the other hand, in developing countries and in some marginal zones, too often one sees uncontrolled crossings which, in the absence of improved husbandry, create crossbred populations in which the qualities of the improved breeds cannot show themselves and those of the native breeds are masked. For example, what is the use of introducing Large White blood into the Corsican pig breed as long as the husbandry remains completely extensive? Even the existence of pedigree breeds is not guaranteed; the most productive can oust the others as husbandry and feeding improve. Furthermore, for some species, breed replacement can be very rapid. Artificial insemination with frozen semen allows us to obtain thousands of descendants from a single male, especially in the case of cattle. Used for injudicious crossing such a powerful technique can lead to extremely rapid disappearance of ancient genetic variability.

Besides these dangers from inside a species there are those which assail it from without. There has always been inter-specific competition amongst domestic animals for the use of pasture. For example pig husbandry in France and England during the middle ages was of the generalized type still to be found in Corsica and in Spain (Extremadura). Then came the era of the sheep. In this field, too, all change is now speeded up and made more radical by modern civilization. It is scarcely necessary to recall the disappearance of draught species under pressure from mechanization. Donkeys, to whom no one has ever paid much attention, have almost disappeared in France and, even in the Mediterranean basin where they were formerly so numerous, they are declining. It is the same for the horse (see Annex 1).

Competition is no less intense between the species which man uses to convert fodder into food for himself. The rivalry it creates among breeders causes even more rapid elimination of the ancient breeds. The classic example is that of the competition between poultry and

pigs in the field of cheap meat production. Changes in customs and techniques also affect species living in unimproved environments. Thus goats are disappearing from some Mediterranean countries for health reasons (because of brucellosis), human reasons (because the small breeders are disappearing) or simply because no one has included them in a development programme. In some places, such as Greece, sheep are replacing cattle, while the opposite is happening in some parts of the French Alps.

C. Reasons for conserving genetic variability

1. Cultural reasons

Keeping ancient breeds is very like keeping ancient buildings. They are part of our cultural and aesthetic heritage. One can truly appreciate the present only if one is aware of the achievements of the past and one can only assess the ancient breeds from living examples.

2. Scientific reasons

The large domestic species have already played, and can still play, a role as experimental animals. It is easy to take samples of milk, blood and various tissues for modern biochemical studies; note, for example, the scientific interest of the locus for blood group B in cattle, with its extraordinary multiallelism. The possibilities offered by cattle for the study of milk proteins are obvious. For the study of colour genetics in mammals, domestic animals provide interesting material which proved the existence of gene homologies between species long before the discovery of the connection between genes and polypeptide chains. One should also mention the pilot role played by cattle in the study of ruminant chromosomes.

3. Practical reasons

i. The usefulness of single genes. For a long time selection has ignored single genes. Now, after the success of the gene for dwarfism in poultry, of the Piétrain gene in pigs, the double-muscling gene in cattle and the N gene in the New Zealand Romney sheep (Drysedale), they are beginning to be introduced into commercial stocks. Mérat (1972) thinks that in poultry genes with a visible effect could be widely used because they all have an influence on production.

ii. The usefulness of hardy local stocks. We know that, in difficult tropical environments, improved European breeds can be used only in crossbreeding. Production increases are then spectacular. The important thing is to keep enough purebred females of the local breed to produce the F₁ and to avoid dilution. But the requirements of unimproved temperate environments are less clearly recognized, although commercial crossing is commonly practised there. Recently, however, areas which can be improved only uneconomically are increasing and the lack of manual labour makes it imperative that their livestock should be hardy. Besides which, modern crossing systems are stratified and thus require several breeds. For example, crossing for beef production may use a local hardy foundation stock, a moderately improved dairy breed, and a specialized beef breed (see Annex 2).

D. Conservation methods

In a few cases private, voluntary efforts begun a very long time ago, have safeguarded a certain amount of genetic variability. They concern the cultural aspects of conservation and, up to a point, the scientific. These initiatives are now being improved and modernized. Conservation measures for practical purposes, already taken and still to be taken, are of a different order and must be considered separately.

1. Traditional methods of conservation

The most famous and one of the most ancient of these is undoubtedly the preservation, generation after generation, of the White Park cattle by landed gentry in several estates in Great Britain (Whitehead, 1953). More often, however, these private efforts have been made by societies which carry on after their breed has lost its economic importance. For instance,

in England and in the United States there are societies which keep the Dexter breed of cattle going, and in the Netherlands there is a club of "fanciers" of the colour-sided Witrik breed. In recent years there has been a tendency to federate these efforts, illustrated in Great Britain by the formation of the Rare Breeds Survival Trust⁽¹⁾ (RBST) which registers animals of threatened breeds, advises breeders, organizes temporary or permanent exhibitions and, since⁽²⁾ 1974 publishes a bi-monthly periodical called "The Ark". In France, the Société d'Ethnozootéchnie,

founded in 1971, is trying to coordinate these private efforts in the same way. There are also examples of state enterprise in conservation; for example, in France, the Merino flock of the Bergerie Nationale at Rambouillet and the various national horse breeding studs.

2. Modern methods of conservation for cultural and scientific purposes

Since the setting up of national parks devoted to safeguarding wild animals and plants, regional parks are now being developed charged with preserving habitats already moulded by man and his traditional domestic animals.

All these enterprises provide scientists with genetic variants which would otherwise be lost or masked. At the same time, solely from the point of view of conserving visible genes, these methods are often not very systematic. In the first place they are repetitive and in the second each line generally keeps only a single gene. In certain species such as poultry more rational directions for conserving genetic material are being taken (see Somes, op. cit.), and even multisegregating lines are being established (for example, at INRA, Jouy-en-Josas). One can readily imagine this type of action for the larger species. There are already lines of dwarf pigs and goats, now used for other purposes, but easily convertible, which would be economical to maintain and feed. There is even a miniature horse. The cost of maintaining such lines of cattle is reduced by storing frozen semen (for example, the albino mutants of Swiss Brown and Simmental kept at the veterinary faculty of Zurich). In the extreme case, if a herd of females can no longer be kept, a specific mutant can be kept in frozen semen. Until the physiologists can perfect a method of storing live fertilized ova, the establishment of a homozygous line will continue to require at least two generations.

3. Conservation methods for practical purposes

Given the present dynamics of breeding, when the numbers of a breed fall below a certain threshold it loses its zootechnical usefulness. The longer the generation interval and the lower the fecundity, the sooner the critical level is reached (see Annex 2 for the example of cattle). So we must intervene as soon as possible, not only to store the semen of species in which artificial insemination is used (note, for example, the semen banks of the English Milk Marketing Board) but also to keep a sufficient number of females, and that is more difficult and more costly. Direct action supported by pedigree breed societies has for long been pursued, by subsidies for the maintenance of herdbooks and premiums to breeders (some cattle breeds in Spain, the Solognote sheep breed in France).

A very powerful psychological weapon is example. If it can be proved that a declining traditional breed has its place in a modern system of husbandry, then it is already half saved. We have seen this with the Sardinian cattle. When the crossing trials for meat production revealed the advantages of this breed some breeders stopped crossing their animals with the Brown Swiss in favour of raising only purebreds. But such psycho-economic appeals are not effective everywhere. It is clear, for example, that in tropical developing countries government action is indispensable. In some countries, for example in India, there is a tradition of military dairy farms which breed zebus.

As modern plans for using native breeds in stratified crossing systems are often complicated and the rewards are received only at the end of the chain, it is very important that

- (1) Rare Breeds Survival Trust, President: J.L. Henson
Secretariat: c/o The Ark, Winkleigh, Devon, England
- (2) Société d'Ethnozootéchnie, President: R. Laurans
Secrétariat: Mlle. C. Duerot, MNE, 147 Rue de Beroy, 75013 Paris

the people who produce the purebreds be paid for their labours. On their side the producers and users of the crossbreds must be sure that they will find the purebreds they need. Such groups of breeders and feeders which already exist (see the example of the Aubrac in France in Annex 2) must be encouraged.

We should also take account of the fact that nuclei of some breeds have been established abroad and are sometimes flourishing. For example the two English sheep breeds Cotswold and Lincoln, practically extinct in their country of origin, still exist in South America and in New Zealand. Another example, this time from North America, where herds have recently been established of almost all the European beef and dual-purpose cattle breeds some of which are declining in their countries of origin (Tarentais, Romagnola, Pinzgau, Gelbvieh, Red Poll).

Finally, in view of the cost of these methods of conservation for practical purposes, especially in the case of the large ruminants, they can only be applied to a few native breeds. So we must choose which breeds to keep and the final choice must be made from the small number of breeds which it has been possible to test in comparative crossing trials.

E. Practical lessons of the European cattle enquiry and of the mission to Chad

The mission to the Kuri zone of Lake Chad, undertaken with the idea of exploring the possibilities for practical action there, has been very informative.

In the first place this breed is not quite the type of example of a threatened breed in a developing country which it had been considered. Certainly, a breeding programme to improve its productivity while retaining its typical characteristics would be extremely useful, but this is more a matter of routine animal husbandry policy than an urgent salvage plan.

In the second place, even if the threat to the whole breed does not appear to be as serious as was thought, action is recommended to safeguard a particular genetic feature of the Kuri which is being neglected, namely its characteristic horns.

It is thus quite clear that, before proposing and undertaking action, preliminary enquiries are necessary and these must set the threatened breeds or lines firmly in a national or international context. Such an enquiry must be entrusted to a small number of people and limited to a single species and to a restricted area. The enquiry carried out on the cattle of Europe and the Mediterranean basin, although it covered too large an area, satisfied these requirements in some degree.

F. The need for knowledge and information

Our current knowledge of local situations is inadequate. We cannot embark on safeguarding operations without preliminary enquiries. Knowledge is lacking at all levels and information, such as it is, does not circulate.

1. Population data

The quality of census data is very variable. The length of time between counts varies from country to country. Publication delays are generally very long. Up-to-date information is scattered and only really available on the spot. The general demographic approach is extremely summary. The idea of the age pyramid is neglected, and the generation interval and number of females per male are practically never recorded. Data on the numbers of different breeds, even from specialists, must often be treated with caution even in supposedly developed countries. What then of places where neither breed societies nor herdbooks exist?

2. Basic genetic knowledge

The classification of the most important domestic species is based on outmoded criteria and is therefore extremely questionable. What do we mean, for example, by "the tribe Bovinae" or "the genus Bos"? The disciplines which could shed light on phylogeny

and taxonomy, particularly karyology and the study of polypeptide chains, are not sufficiently developed. Up till now there has been no international coordination in this field and, at this moment, nobody, either at UNESCO, at FAO or at IUCN, seems to care about establishing one. On the one hand zoologists do not concern themselves with domestic breeds while, on the other, livestock geneticists - who should have much greater resources than university zoologists, financed as they are by governments - do not concern themselves with taxonomy or phylogeny. Added to that is the fact that the simple gathering of representative samples is difficult for the wild species and even for some domesticated lines.

However, the interest of such an investigation is considerable. For example there is every reason to think that, for gene mutations, domesticated populations have a much stronger tendency to keep chromosomal mutations than wild populations. Nevertheless, a study of wild sheep in Iran has revealed a quite astonishing degree of karyological variation (Nadler et al. 1971).

Within species one can only confirm the absence of knowledge on the genetic determination of visible characters like colour, coat type and horn shape, which must be due largely to major mendelian genes which can be isolated. Our knowledge of those interesting characteristics which are partly linked to visible effects, such as the qualities of the zebu, is even more defective. In the past, attempts to extend very promising research (for example, the effect of the polled gene in goats on sex determination) have been cut short (Seminar held in 1969, see Ann. Génét. Sél. anim. Vol. 1).

Another characteristic of this gap in our knowledge is that it affects some species more than others. The "Atlas of protein sequence and structure" (Dayhoff, 1972) makes it clear that 80 cattle sequences have been studied against 22 in poultry, 23 in pigs and only 15 in sheep, 11 in horses, 7 in goats, 2 in buffaloes and a single one in a limited number of wild related species including the ibex and the European bison. At this rate rational directions for phylogeny are not yet open.

The contrast presented by the knowledge already accumulated for the conservation of the gene pool of cultivated plants is enormous.

3. Zootechnical knowledge

As for getting a clear picture of world resources, without worrying about defending them, we must state that, in spite of the efforts of FAO, the work still to be done is immense. For only a few species are monographs available and these are often incomplete. Most of these are out-of-print or out-of-date (like the FAO publications on African, Indian and European cattle). The more recent accounts of Epstein on China (1969) and Africa (1971) are interesting but still very general. Mason (1967) covers only the sheep of the Mediterranean basin.

Turton (1974), reviewing bibliographical possibilities at the round table in Madrid, concluded, rather pessimistically, that information does exist but to a large extent in non-conventional forms, difficult to get at and full of gaps. Furthermore, information even within a breed often lacks objectivity. This is one reason why, in order to compare the genetic merit of Friesian strains from different countries FAO has organized its comparison for the world's premier dairy breed in Poland, a "neutral" country.

IV. RECOMMENDATIONS

The commercial breed of today may be the rare breed of tomorrow; occasionally the reverse is also true. Therefore these recommendations cover not only rare breeds but also the whole field of animal genetic resources.

In the preceding chapter, it was shown that information is necessary before action can be initiated. With the data collected in the current project, it is also possible to take action in the short term. A series of missions is proposed in the zones where specially

interesting breeds appear to be in danger. In the long term a complete but articulated programme is proposed.

A. Immediate action

1. Mediterranean and Balkan breeds of cattle

The brachyceros and Grey Steppe populations characteristic of several countries of the Mediterranean and the Balkans are everywhere declining in number. The brachyceros group includes the Corsican, Sardinian, Busa, Greek Shorthorn, Rhodope, Anatolian and Brown Atlas. The Grey Steppe, with long horns, was formerly common in the Balkans and still exists in Italy. It is recommended that trials be organized in several countries of the utility of these breeds in a systematic crossbreeding programme for beef production, e.g. to utilize any hybrid vigour on crossing with improved beef breeds. A continuous crossing programme would require the preservation of the pure breeds.

2. Breeds of eastern Asia

Contact should be established with the Japanese "Society for Researches on Native Livestock" in order to learn about their current and future programme of activity and to encourage the publication of a synthesis of their findings to date on the livestock of eastern Asia.

3. Kuri cattle of Lake Chad

The plan for the preservation of the typical horn forms in the Kuri breed should be carried out (see Annex 4). This would become a pilot example of saving spectacular genetic variants for cultural and scientific purposes.

4. Collaboration with Man and Biosphere (MAB)

The expert panel working on MAB Project No. 8: "Conservation of natural areas and of the genetic material they contain" have submitted their report. When the working groups which it proposes are set up they should include experts conversant with the present FAO/UNEP project on the genetic resources of domestic animals.

B. Short-term action

1. Criollo cattle

This Latin American breed is declining in numbers although it is extremely interesting for meat production by crossbreeding. It is recommended that funds be made available to publish a monograph on this type. The preparation of such a booklet is at present under active planning in FAO.

2. Prolific tropical sheep

A mission should be mounted to study the woolless sheep of north-east Brazil and the Caribbean area with particular attention to the Barbados Black-belly which is known to be highly prolific but whose population is small. Contact should be established with any other sheep projects in the humid tropics, e.g. West Africa, southern India, Java.

3. Mediterranean pigs

A mission should be mounted to study the areas in Corsica, Sardinia, Spain and Portugal where the ancient type of pig still exists with the greatest amount of genetic variation and to propose a plan for conserving them in situ combined with a programme of genetic studies, if possible in cooperation with those responsible for the different isolated nuclei.

4. West African Dwarf Shorthorn cattle

A mission should be mounted to establish the present status of this trypanotolerant breed and, if necessary, to prepare a project for its preservation as an example of a local adapted breed in danger of disappearing because it is not fully exploited agriculturally.

5. Expert consultation on sheep and goat genetic resources

FAO should organize an expert consultation on sheep and goat genetic resources in the series which has already covered cattle, pigs and poultry. It should concentrate on (1) Central Asia and the Near East and (2) the humid tropics.

6. Breeding programmes and crossbreeding in tropical Africa

Bearing in mind the importance of maintaining populations of locally adapted cattle as foundation stock in crossbreeding programmes for the exploitation of hybrid vigour, a survey should be made of the status and use of the local breeds in those countries of tropical Africa in which a crossbreeding policy has been adopted.

7. Dairy cattle crossbreeding in southern Asia

A survey should be made of the crossbreeding programmes in India and neighbouring countries to compare the results of the various breeding systems and different breeds in use, and to ensure that conservation and improvement of the local zebu breeds is also taking place in order to maintain a stock of dairy zebu for use in systematic crossing programmes.

C. Long-term programme

Here it is a question of improving genetic and practical knowledge in the field, at present so sadly lacking.

1. Rare breeds and special herds A list should be prepared and published of herds and flocks of rare and relic breeds and of genetically interesting lines maintained in zoological gardens, nature reserves, parks (national, regional or private), research stations or under the control of special societies. The list should also include stores of semen. It would cover cattle, buffaloes, sheep, goats, pigs and equines, and would include, in so far as it is possible, the closely related wild species.

A consultant working chiefly by correspondence and in close cooperation with UNESCO, IUCN, and the Zoological Society of London (as editor of the International Zoo Yearbook), will be required.

When the list is distributed, those responsible for the herds should be encouraged to permit sampling of their herds for scientific purposes and governments and other organizations should be urged to establish herds of any other disappearing breeds with unique genetic characteristics. This list should also be distributed to the scientific laboratories which will be listed under recommendation C.2.

2. Scientific laboratories A list should be prepared of laboratories which are working in fields which can throw light on the taxonomy and phylogeny of domestic species, on the relationships between breeds and on the knowledge of marker genes. These will include laboratories working on chromosomes, on blood groups and other biochemical polymorphisms, on the metabolism of certain other processes, e.g. melanin-formation, connective tissue, and on the analysis of gene frequencies.

A consultant will be required who will work closely with the European Society for Animal Blood Group Research and with other organisers of scientific meetings on these subjects.

3. Projects for setting up experimental genetic herds

For sheep, goats and pigs these projects should eventually be on an international basis and should include detailed suggestions for choice of initial animals (dwarf stocks preferably), choice of variants and how they should be introduced, facilities for sampling (blood and other tissues), management, health measures, formation of herds, breeding and crossing plans and type budgets according to the number of variants it is decided to conserve.

4. General inventory of breeds

The work of FAO on the systematic description of breeds, species by species and region by region, should be continued. This cataloguing should be done in cooperation with such organizations as the Commonwealth Agricultural Bureaux which have already published jointly with FAO. The detailed, objective characteristics of each breed should be summarized in a standardized form.

A start should be made with the species and countries not already covered by FAO, CAB, Epstein and the Japanese Group, as follows:

Cattle	-	Asia (except India, China and Eastern Asia)
Sheep	-	Asia (except China); Latin America; North and Central Europe
Goats	-	Asia (except China and Eastern Asia); Latin America; Europe
Pig	-	Asia (except China and Eastern Asia); Latin America; Europe

Camels and the South American Camelidae - this would be a companion volume to the FAO publication on the Health and Husbandry of the Domestic Buffalo (Cookrill, 1974) and would be devoted to an animal of great economic importance in harsh environments which, even more than the buffalo, has been neglected by science.

Poultry and all the other species of domestic birds require a similar inventory to cover the whole world except, perhaps, Europe and North America.

D. Organization

1. International Board

To plan and guide a global cooperation programme an International Board on Animal Genetic Resources should be established parallel with the International Board on Plant Genetic Resources which has been formed by the Consultative Group on International Agricultural Research.

2. Applied research

The establishment is recommended of an International Network of Research Institutes which are concerned with animal genetic resources, with particular reference to the tropics. These institutes will carry out coordinated work on breed evaluation and conservation. They will cooperate in missions to those areas where exact knowledge of local breeds and of their economic value, pure or crossbred, is poor. Such missions would review the present breed situation, identify breeds which merit special programmes to ensure their survival, review crossbreeding work, and organize breed comparisons and cross-breeding trials where these appear desirable. They should also assist in formulating breeding plans for concerted livestock development.

Funds will be needed so that financial support can be given for the initiation of such research.

3. FAO Secretariat

In order to ensure continuity and coordination in an overall programme which will be carried out by many international and national organizations, a central secretariat is necessary. It is proposed that this be situated within the Livestock Research and Education Service of

the Animal Production and Health Division of FAO. It should take the form of an Animal Genetic Resources Unit staffed by an Animal Genetic Resources Officer with adequate clerical and secretarial assistance.

Such a unit would naturally also house the Secretariat of an eventual International Board on Animal Genetic Resources.

It would also form a central point for coordinating the work of information services in this field. In particular, it would keep in contact with the sources of non-conventional literature (e.g. unpublished reports); such sources include research institutes, universities, government livestock departments, aid and development bodies, breed societies, export organizations and, of course, other information centres. In addition, FAO is in a position to obtain much information by personal contact from experts, consultants, mission members and other visitors.

An Animal Genetic Resources Information Sheet should be produced regularly and circulated to all cooperators and other interested bodies. Later, in cooperation with other genetic resources units within FAO (plants, fish, forests) it may be possible to produce a more formal regular publication; e.g. a Genetic Resources Newsletter might replace the present Plant Genetic Resources Newsletter.

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A COMPARISON OF THE BREED SITUATION IN CORSICA AND SARDINIA IN 1974:
CATTLE, SHEEP, GOATS, PIGS AND EQUINES

by

J.J. Lauvergne

A. General livestock situation in the two islands

In the middle of the last century production in these two Mediterranean islands was very similar: extensive mixed production of cattle, sheep, goats and pigs for local consumption with only a small surplus for export, for example beef on the hoof.

Towards the end of the last century the first dairies making sheep cheese for export were established. In Sardinia it was a question of making a new type of cheese, pecorino romano, and in Corsica of making cheeses which would go into the Roquefort caves for maturing.

The success of the Sardinian pecorino romano enterprise continued, so that the sheep flock which had numbered about a million head in 1900 had increased to more than two and a half millions in 1970. In Corsica, on the other hand, over the same period, 400 000 head had fallen to 100 000, although, during the interval, the dairies of the Roquefort societies had become firmly established and were taking 90 percent of sheep milk production.

The sheep breeding situation in the large Mediterranean islands is a good indicator of the prosperity of their animal production in general. Sheep cheese is a semi-luxury product, with assured outlets, which provides an adequate return for effort and capital expended.

In fact, two other domestic species have undergone a development which confirms this first impression, namely cattle and pigs. While animal husbandry in Corsica has remained extensive, in Sardinia it is becoming more intensive. (On the other hand, the numbers of goats and equines are declining in both islands).

Since the immediate post-war period this divergence has continued. Sardinia, now an autonomous region, has an institute for animal husbandry and cheese making (Istituto Zootecnico e Caseario per la Sardegna: IZCS), for the study of production problems peculiar to the island. Its efforts have been directed mainly towards sheep and cattle. Thus a selection plan for the Sardinian breed of sheep, including a ram progeny test, has been in operation for the last ten years. This is already one of the best milking sheep breeds in the world.

For cattle, while milk yields are constantly increasing in the improved areas, with the introduction of the Friesian, the meat sector is not being neglected. Research begun ten years ago has demonstrated the use of the local hardy breeds in schemes of controlled crossing. Although the size of the Sardinian herd varies little (it fluctuates between 200 and 300 000 head), the average yield per cow is increasing. In Corsica, on the other hand, the number of local cattle remains about 30 000 head and husbandry remains traditional.

Traditional methods of producing pigs have almost disappeared in Sardinia where industrial-type units are making their appearance. In Corsica, however, grazing pigs remain but at a lower stocking rate because of the poor maintenance of the oak and chestnut forests.

Goat production is the poor relation in both islands where reduction in herd numbers has continued for half a century. In both islands, except for goat meat in Sardinia, goat products do not find modern commercial outlets. However, while in Sardinia all technical and commercial promotion efforts have been concentrated on cattle and sheep, Corsica is importing some improved

goat stocks.

The numbers of horses, both pack and draught, and donkeys, have shown spectacular falls in the last fifteen years as a result of mechanization. Because its agriculture has remained more extensive, Corsica has kept more donkeys than Sardinia.

The explanation of this difference between the two islands must be sought in the interaction between human population and available space. In Corsica the size of the population, which is almost entirely rural, grew rapidly up till 1881 and then decreased until, in 1950, it reached a level below that of 1850. Sardinia, whose population density in 1881 was scarcely less than that of Corsica (27 persons per square kilometre as against 30), possesses a relatively larger plain (the Campidano) and wooded areas more easily convertible to pasture, and the population is steadily increasing. At the moment it is about a million and a half while Corsica has nearly eight times fewer (about 200 000) for a surface area only two and a half times smaller.

B. Breed situation species by species

Sheep By means of the network of selection centres which covers the whole island, the genes of rams selected according to the most modern criteria are being spread, more or less rapidly, so that the entire sheep population of Sardinia is in process of complete transformation. The small type has practically disappeared, as well as all colours other than white. In certain districts the present intensification is leading to improved milk production by bringing in blood from breeds like the East Friesian.

In Corsica, on the other hand, the sheep flock is one of exceptional cultural and scientific interest because it is largely traditional, comprising a type of sheep which was formerly much more widely spread over western Europe and around the Mediterranean.

Together with the Iceland sheep, the Gotland sheep and some relic flocks, it is the only European breed in which there is still a great colour variation including types which seem never to have been described and which have not been studied genetically. This great externally visible variability is certainly an indication of a great variability of invisible genetic factors.

However, in the most favoured districts, for example around Aléria, the transhumant flocks are already beginning to settle down, with the introduction of improved rams, especially the Sardinian.

Cattle In Sardinia the small traditional breed, very like the Corsican in appearance, made way during the last century in the Campidano (in the south) for the Modicana - a triple-purpose animal from Sicily. Then, as everywhere in Italy, came the Brown Swiss from which improved milk production was expected. The position of the native breeds has thus been considerably eroded. In recent years the Italian Friesian has established itself, replacing the Brown Swiss in the most intensively farmed areas. The problem of supplying meat (of which the island has not nearly enough) has been present for a long time and we are likely to see unregulated introductions of bulls from specialized breeds such as the Piemontese, Limousin and Charolais. Since 1961 the Istituto Zootechnico e Caseario has been doing experiments to compare paternal and maternal breeds under local conditions in order to direct attention to more elaborate crossing schemes. From these trials we can conclude that the Sardinian and Modicana, and their crosses, are of great interest as maternal breeds able to utilize to the maximum fluctuating feed resources for the production of crossbred veal calves with greatly improved carcass qualities. The IZCS has set an example of conservation by establishing herds of Sardinian and of Modicana cattle which is being followed by the breeders who will soon discover its advantages. Thus, by finding a modern economically viable use, the Sardinian breed, threatened for so long, seems to be saved. It now numbers about 30 000 head.

In Corsica attempts to improve the local breed by crossing have hung fire. Its

husbandry has even become more extensive. Poorly productive and unpopular with the butchers, it keeps pretty nearly to the ancestral type with its range of colour variants. It now numbers about 15 000 cows and heifers.

Pigs The historical and scientific interest of the Sardinian and Corsican pigs is considerable. In the first place, although the domestic type differs from the wild boar and back crossings to it have not been made for a long time, it is possible that the Sardinian and the Corsican breeds derive from the wild boar by domestication on the spot.

In the second place, the traditional husbandry, almost totally dead in Sardinia, still alive in Corsica, is the continuation of the husbandry which flourished throughout Europe in the Middle Ages: a free ranging pig seeking its food in the forest and in the stubble fields. One can find this type of husbandry in Spain (Extremadura) and in Portugal, with considerable improvements (planting and maintenance of oak forests, building of piggeries, semi-industrialization of the pork butchery trade, beginning of selection in the Iberian breed), but, at the same time, there is the threat of disappearance under the pressures of economic forces and the persistence of swine fever.

The Corsican herd is still abundant (perhaps 20 000 head) but managed very extensively. Unfortunately, it is partly mixed with the Large White which can scarcely manifest its genetic superiority in the way of growth rate and carcass quality in the absence of suitable feeding. It would, however, no doubt be possible to pinpoint nuclei still representative of the traditional type with all the motley which, just as in sheep, has disappeared from modern breeds. Unhappily, in Corsica swine fever also rages.

As for the native Sardinian pig herd it seems difficult to find many truly representative examples.

Goats A very dispersed but still abundant herd exists in both islands. It has kept, in the main, its original genetic character. Corsica has 30 000 goats, with some recent introduction of improved breeds. Sardinia, on the other hand, has about 250 000 head, almost entirely purebred native.

Horses Already very mixed, the local Sardinian population of small horses had practically disappeared when the conservation effort (of which more later) was started.

Also in Corsica there is a native population of small stature but it is already severely threatened by the fact that the national breeding studs do not wish to use Corsican stallions.

Donkeys The little Sardinian donkey was crossed with larger varieties coming from the mainland. Animals of very small stature still exist, especially in the island of Asinara, but in very reduced numbers.

For Corsica precise information is lacking.

C. The safeguarding of threatened genetic resources

a) Measures already taken

In view of the threat of disappearance of certain breeds, even of certain species, the Sardinians have become aware of the danger. A regional law of 1969 created an Institute for Improving the Horse (Istituto d'Incremento Ippico: I.I.I.) one of whose specific missions is to safeguard the Sardinian breed. Already a purebred nucleus of breeding animals has been formed at Foresta di Burgos (SS). The budget of I.I.I. provides for the distribution of subsidies for conservation. The institute has also collected some specimens of the Sardinian donkey.

The Istituto Zootecnico e Casario per la Sardegna is concerned with the problem of the disappearance of the ancient sheep types. Already some examples of the large variety have

been collected. It now intends to assemble a flock of the small variety; these animals will be of assorted colours and of the most traditional type, very similar to the Corsican breed.

As for cattle, we have seen that experiments in meat production have opened to the native Sardinian breed and to the Modicana breed (from Sicily) commercial prospects which should ensure their survival. Certain practical measures of support and promotion currently being studied will however be necessary.

In Corsica, on the other hand, nothing in the way of conservation has yet been undertaken.

b) Measures recommended

In Corsica Because everything there remains to be done there is every reason to think that this situation, so interesting to the breeder and geneticist, may very quickly collapse.

For sheep the SOMIVAC (Société de Mise en Valeur Agricole de la Corse) project to create an experimental husbandry centre near Corte should start as soon as possible and the necessary genetic and husbandry studies should be undertaken. It is no doubt too late to think of making the Corsican breed into an improved milking type solely by selection within the breed, but one can envisage conservation (e.g. inside the Natural Park) of traditional nuclei for scientific study and for the diversion of tourists.

For cattle the Sardinian example proves that the traditional breed has a real economic interest. Already in Corsica there have been some trials. It would be desirable that, with the help of the beef specialists of INRA, experiments be undertaken similar to those in Aubrac, in Sardinia or in Portugal.

For pigs there is a recent report on reviving production (Fraloran, 1972). In the light of this it is recommended that the free range Corsican breed should be kept as pure as possible in some areas to maintain a type of husbandry which, besides its cultural and scientific interest, has a limited but real economic potential. Selection for these requirements would be made within the purebred herd. Demonstration herds for detailed genetic study could be set up within the Regional Natural Park.

For goats it is desirable that typical herds be installed in the same park - which covers one quarter of the island - and detailed studies made of variation. The first essential is, however, a goat revival plan.

For donkeys and horses, in the absence of precise information, it would be unwise to risk recommendations.

In Sardinia The impetus seems already to have been given - but only just in time. It is to be hoped that the IZCS turns its attention to goats and, very speedily, to pigs, while continuing its work of setting up flocks of traditional sheep.

Related studies There is a need for a parallel study of population genetics, which is relatively easy with cattle, to determine the genetic profile of a population by the frequency of alleles at different loci, in order to be able to measure the genetic distance which separates the Sardinian from the Corsican population. Research into the relationships of these two breeds with the other small, brachyceros breeds around the Mediterranean could follow.

Related studies of the same type are strongly recommended for the sheep and goat populations.

Essential recommendation In order to avoid constant repetition, the lack of precise statistics, especially for the numbers of breeds and types, has not been sufficiently emphasized. It would be very desirable, especially in Corsica, where the resources in traditional varieties are greatest, that accurate population counts be made. Unfortunately the obstacles in this island, especially the psychological ones, are enormous.

In Sardinia the IZCS has already proved that it can gather reliable information on animal numbers. One can only hope that it will extend its field of activity to all the indigenous populations now threatened.

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b) Places visited and people interviewed

Istituto Zooteconico e Caseario per la Sardegna at Bonassai (17 km from Sassari).
Director: Dr. S. Casù; staff: A. Sanna, G. Ruda, P. Carta, G. Piocinelli, who accompanied us on our tour.

Experimental farm of the Institute at Bonassai. Experimental flock of ewes of different types: improved Sardinian and crosses with the East Friesian.

Experimental dairy of the Institute at Bonassai.

Experimental farm of the Institute at Foresta de Burgos (SS)⁽¹⁾ in the uplands.
Improved Sardinian ewes; Sardinian, Modicana and crossbred cows in the beef crossing experiment. Farm manager: P. Carta.

Experimental farm of the Institute at Monastir (CA)⁽²⁾ in the Campidano of Cagliari.
Sardinian ewes of different types. Farm manager: G. Sanna.

Assessorato all'Agricoltura della Regione Sarda (Cagliari)
Animal Husbandry Department: Dr. V. Mulas.

(1)SS = Sassari province (2)CA = Cagliari province

Flock of native ewes in the deforested zone of the high hills between Foresta di Burgos and Bonorva (SS).

Flock of native ewes (black and small varieties), and herds of goats and pigs at Dorgali (NU),⁽¹⁾ in the maquis zone of the granite hills and on the banks of the Cedrino.

Herds of native goats, native pigs and Sardinian cows in a mountainous (1200 m) maquis zone at Urzulei (NU).

Herd of native pigs in the Supramonte, commune of Orgosolo (NU) in one of the rare forests of evergreen oak still extant (on limestone).

Cooperative dairy dealing with both sheep's milk (for making pecorino romano, Bonassai-type cheese and ricotta) and cow's milk (for making provoletto) at Berchidda (SS).

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Direction Départementale de l'Agriculture (DDA) de la Corse, Ajaccio. M. Manioci.
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Herd of native pigs belonging to the brothers Cerati at Guagno (800m).

The Niolo district (Canton of Calacuccia), person interviewed: G. Ravis-Giordani, ethnologist.

Flock of native, transhumant ewes belonging to Pasquin Teca at Bonamanacce in the Niolo district.

Herd of native goats belonging to Jacquet Luciani at Casamaccioli in the Niolo district.

Herd of native cattle belonging to the brothers Geronimi at Bonamanacce in the Niolo district.

Sheep at Casabianda prison (managed by M. Moretti), with 1 000 Corsican ewes already partly crossed with Sardinian rams.

Herd of native pigs belonging to Joseph Orsetti at Burracciola, commune of Quenza.

District of Alta Rocca in the company of J. Prost, driving force behind the intercommunal association for rural rehabilitation in the mountains of Goscione and of Alta Rocca (from Zonza to Serra-di-Scopamene).

Valley of the Tavoro with various cattle crosses

⁽¹⁾NU = province of Nuoro

DISAPPEARING CATTLE BREEDS IN EUROPE AND THE MEDITERRANEAN BASIN

by J.J. Lauvergne

A. Introduction

After studying the literature in Rome during the first month of his engagement the consultant prepared an enquiry by questionnaire which began in May 1974. Besides analysing the answers to the questionnaire, direct contacts were made with those responsible for breeding in various countries. Visits were made in Italy, France, Switzerland, Germany, the Netherlands and Portugal in order to talk to people, see animals and consult unpublished reports.

In the seven months between the beginning of the enquiry and the writing of the report it was not possible to obtain consistent information for every country nor to visit every country for verification. It is therefore an incomplete and partly inexact picture that we are able to give here.

A paragraph is devoted to each country; the reader can then judge the degree of accuracy of the information before studying the summarizing table and the discussion of the main points.

B. Situation country by country

(1) ALBANIA

The two traditional types are the same as in the rest of the Balkans: brachyceros and Grey Steppe. No reply on the current situation has been received.

(2) ALGERIA

The indigenous breed, the Brown Atlas, common throughout the Maghreb, has been repeatedly crossed since the beginning of the colonial period. No one has ever been really interested in it. This situation continues.

(3) AUSTRIA

	1947		1959		1969	
	No.	%	No.	%	No.	%
Gelbvieh	543 159	24.9	460 624	20.0	164 025	6.8
Grauvieh (Tiroler)	42 450	2.0	38 592	1.7	29.888	1.3
Pinzgauer	363 754	16.7	337.696	14.6	254.439	10.5

The Gelbvieh (Austrian Yellow) is declining most rapidly; the breed societies have been dissolved. There is no official intervention to save the three breeds threatened with absorption by the Simmental, the Brown Swiss, and, more recently, the Friesian.

(4) BELGIUM

Two of the five breeds are not indigenous: the Pie noir belge (Belgian Black Pied), which includes the ancient breed of Hervé, is a strain of Friesian; the Pie rouge belge (Belgian Red Pied, formerly called the Campine Red Pied) is a strain of the Red Pied Lowland. The Rouge de Flandre occidentale (West Flemish Red) is related to the Flamande (Flemish) of France. The two indigenous breeds are the Blanc Bleu belge (Belgian Blue White), the new name for the

Central and Upper Belgian, and the Pie rouge de Flandre orientale (East Flemish Red Pied).

Both the breeds of Flanders are threatened. The numbers of first inseminations in recent years were as follows:

	1961		1965		1973	
	No.	%	No.	%	No.	%
Pie rouge de Flandre orientale	39 864	10.0	47 337	9.7	53 355	9.5
Rouge de Flandre occidentale	37 230	9.4	60 146	12.3	51 508	9.2

The Rouge de Flandre occidentale seems to be the most threatened as is the Flamand of France. Probably the Pie rouge de Flandre orientale has been helped to maintain itself by the fact that each breed has its own territory and holds on to it. No other special measure is envisaged for conserving these breeds.

(5) BULGARIA

	1948	1961	1972
	%	%	%
Breeds improved by grading-up to Brown Swiss, Simmental and Danish Red	13.2	61.3	83.0
Iskur (Grey Steppe)	82.1	25.8	6.3
Rhodope	3.7	4.9	2.4

After the war a deliberate policy of replacement was applied. It has halted the almost total disappearance of the two traditional breeds. Now the government is establishing two herds of Iskur cattle in two specialized farms. The conservation of the Rhodope breed (a variety of brachyceros) is assured in the two mountainous regions of Smoljanski and Kardjalúski.

(6) CYPRUS

The local breed strongly resembles the Egyptian Baladi. In 1958 when it was still extensively used for draught, there were about 28 000 head. Since the introduction of mechanization the numbers have fallen to about 14 000 head in 1973. The Friesian is on the increase and there are now about 18 000 head.

(7) CZECHOSLOVAKIA

Towards the end of the nineteenth century the local breeds of Central European type began to be replaced by the Simmental. In 1960 it made up 90 percent of the national herd, the rest being chiefly Pinzgau. The Moravian Red became extinct about 1940. The Lisna Red, almost gone by 1954, then received blood from the Gorbatov Red of the U.S.S.R. The Slovakian Red and the Bohemian Red both expired in 1965. No reply has been received to the questionnaire but it is probable that all the traditional red breeds are now extinct.

(8) DENMARK

The percentages of first inseminations during recent years were as follows:

	1950	1960	1970	1973
Danish Red	79	61	35	26
Danish Jersey	4	11	15	11
Danish Red Pied	3	0.6	1	3

The original Shorthorn was crossed with Meuse-Rhine-Yssel then with Red Pied Lowland from Germany; its official name is now Dansk Rødbroget Kvaæg (Danish Red Pied). The Rødt Dansk Malkekvaæg is losing ground rapidly to the Sortbroget Dansk Malkekvaæg (Danish Black Pied),

a strain of Friesian.

(9) EGYPT

There are no clearly differentiated breeds among the general cattle population called Baladi (= native) which is used chiefly for draught. A policy of crossing it with the Friesian was tried but is not favoured by everyone. In the main the local cattle do not appear to be threatened.

(10) FINLAND

Traditionally there were three distinct types of Finnish cattle: in the west, in the north and in the east. The northern type has practically disappeared; the others are rapidly losing ground to the Ayrshire. Some remnants of these ancient cattle types have been kept and the Finns intend to maintain an experimental herd of 50 - 100 head.

(11) FRANCE

Declining French breeds:

	No. of females (cows + heifers)	
	1963	1972
Armoricaain	305 000	76 000
Aubrac	192 000	102 000
Breton pie noir	385 000	76 000
Flamand	317 000	86 000
Gascon	187 000	59 000
Parthenais	171 000	33 000
Salers	390 000	270 000
Tarentais	146 000	92 000

In recent years the Ferrandais and the Froment du Léon have almost disappeared, as well as the Mézeno.

The expanding Blond d'Aquitaine has been developed from the ancient Garonnais by absorbing other yellow breeds: the Blond des Pyrénées, the Quercy and, more recently, the Villars de Lans.

The Corsican breed maintains itself in the unimproved parts of the island but some crossing has occurred in certain areas. The Abondance is supposed to be part of the Pie rouge de l'Est but a complete fusion has never been made. It is on the road to extinction, like the Bazadais (1 000 birth registrations in 1973).

The shrinking of these local breeds has occurred by the spread of the popular dual-purpose breeds - Normand, Français pie rouge, Français frison pie noir. This development has particularly benefitted the last named and also the Montbéliard - the most milky of the Français pie rouge group. The beef breeds - Charolais, Limousin, Blond d'Aquitaine and Maine Anjou - remain nearly stable.

In the past, perhaps justifiably, the authorities wanted to reduce the number of breeds. This ambition has been all too well achieved in recent years and the result has become a cause for concern. The government continues to subsidize the twenty approved herdbooks, which are grouped into a federation, but help for the small breeds is very feeble. Recently, there have been a few private initiatives as a result of crossing experiments showing the usefulness of keeping nuclei of purebred females of rustic breeds such as the Aubrac and the Salers. For the Aubrac a society has been founded at Laguiolle (Aveyron) including both the breeders of purebred Aubracs and those who cross them with the Charolais. This society sells the crossbred calves and divides the profits in such a way that the purebred breeders are compensated for their lack of earnings. For the Salers, the feeders of Champagne, the breed

society and the insemination centres are forming an organization to check the decline in numbers of the pure breed. Another breed, the Gascon, has had its decline slowed down by being included in a meat testing programme (Mida test). The destiny of the Vosgein has recently been taken in hand by the breeders themselves. The Breton pie noir, the Tarentais, the Parthenais and the Abondance could all be advantageously used for beef crossing and deserve to be saved in the same way.

(12) GERMAN DEMOCRATIC REPUBLIC

No reply received

(13) GERMANY, FEDERAL REPUBLIC OF

In 1970 the threatened breeds formed the following percentages of the total cattle

Gelbvieh	8.0
Angler	1.1
Shorthorn	1.1
Mitteldeutsches Rotvieh	1.0
Pinzgauer	0.7
Vorderwälder	0.7
Hinterwälder	0.1
Murnau-Werdenfelser	0.1

Disappearance stems chiefly from crossing with the Flackvieh (German Simmental) (24 percent of the national herd) in the case of the Pinzgauer, the Hinterwälder and the Vorderwälder. The Angler breed, already crossed with the Red Danish, is more resistant but the Mitteldeutsches Rotvieh is strongly marked with Angler blood. The Murnau-Werdenfelser is mixed with Braunvieh. The fate of the Gelbvieh may be a question of time. It is being used for commercial crossing with the Simmental without sufficient concern for maintaining the pure breed. As everywhere else the Schwarzbunt (Black Pied) (40 percent) is advancing, at the same rate as the Simmental. Ranking after them are the Braunvieh and the Rotbunt (Red Pied Lowland). No Federal effort has been made to save the threatened breeds. However local initiatives are being taken: one to organize a protected area for the Pinzgauer with five to twenty farms, each with fifteen milking cows, near Königssee in Bavaria, the other to establish a relic herd of Murnau-Werdenfelser in the Garmisch-Partenkirchen district.

(14) GREECE

The total cattle population of about 1 000 000 head is made up as follows (percentages):

Breeds	1964	1968	1971
Local	51.1	30.4	22.6
Crosses	41.4	61.5	68.1
Imported	7.5	8.1	9.3

The local population consists of brachyceros animals of small stature which live in the mountain regions and a strain of the Grey Steppe in the plains of Macedonia.

After the war, official policy was to introduce improved breeds at first chiefly the Brown Swiss then the Friesian.

In recent years people have become aware of the usefulness of local breeds for meat production in unimproved areas formerly relegated to sheep. An experimental brachyceros herd is being established in Ioánnina at the Agronomy Station. A large scale utilization programme for local breeds is planned in Thessaly on 70 000 breeding cows. Model herds of 150 cows are planned.

(15) HUNGARY

The Grey Steppe breed used to be dominant. Breeding of the Simmental, introduced in the nineteenth century, was intensified after the war, so much so that by 1972, 90 percent of cattle were of the Simmental type. In recent years the Grey Steppe has disappeared from commercial use. It is conserved in two relic herds of which one is in the outdoor museum at Hortobágy. There are about 300 females and three or four lines of males are kept.

(16) ICELAND

The local Icelandic breed is the only dairy breed in the country. No importation is contemplated. No threat hangs over it. This breed provides an excellent sample of the Scandinavian population of long ago. One still finds great variability in coat colour.

(17) IRELAND

The number of pedigree registered animals of the indigenous Kerry breed in 1950 was 313; in 1974 it was only 90, but there is an unregistered population of about 5 000 head. The government protects this breed by means of bull premiums, help to the breed society and subsidies for shows. A crossing experiment is in progress.

The Dairy Shorthorn, introduced from Britain, is losing ground to the Friesian (1 000 000 head in 1960, 640 000 at the moment) and is being supported by the government in the same ways.

(18) ISRAEL

The traditional Baladi cattle, related to the Syrian and Lebanese populations, are greatly reduced by absorption crossing. About 25 000 remain in Israel and 27 000 in the occupied zones. No measures are planned for their conservation.

(19) ITALY

The estimated numbers of the declining breeds in Italy are as follows:

	Estimated numbers	
	End of 1950s	1973-74
Agerolese	2 750	320
Bianca Val padana (Modenese)	142 000	25 000
Bionda tortonese	41 000	no longer recorded
Burlina	10 500	3 400
Chianina	527 000	210 000
Garfagnina	22 500	almost extinct
Grigia Val d'Adige	40 000	some thousands
Grigia Alpina	300 000	90 000
Marchigiana	715 000	600 000
Maremmana	100 000	75 000
Modicana	180 000	not reported
Mucca Pisana	75 000	almost extinct
Pinzgau (Mölltal)	40 000	20 000
Pontremolese	5 700	1 200
Pugliese	161 000	65 000
Reggiana	110 000	5 900
Rendena	7 200	5 900
Romagnola	590 000	127 000
Sarda	47 000	30 000
Tarina (= Tarentaise)	12 500	1 700
Valdostana pezzata nera	17 000	10 000
Valdostana pezzata rossa	118 000	50 000 ?

In the last fifteen years seven breeds have almost gone: Agerolese, Garfagnina, Bionda tortonese, Mucca pisana, Pontremolese, Siciliana and Tarina. Six others, rapidly dwindling, have reached critical numbers: Bianca Val padana, Burlina, Grigia Val d'Adige, Reggiana, Rendena and Valdostana pezzata nera. Seven others, amongst which some were quite numerous only a short time ago, are threatened in the long term: Grigia alpina, Maremmana, Modicana, Pinzgau, Pugliese, Romagnola, and Valdostana pezzata rossa. Perhaps the Chianina and the Marchigiana must also be included in this group.

The declared policy of replacing local breeds by the Brown Swiss brought it in the sixties to first place with 25 percent of the total population. Now it is having to yield to the Italian Friesian which makes use, not only of European Friesian sires, but of American ones as well. The Simmental, known in Italy as the Pezzata rossa friulana, is also making noticeable progress. The only indigenous breed on the increase is the Piemontese, for the production of meat.

The Associazione Italiana Allevatori, which has recently made the census on which we are relying, is aware of the danger but has no immediate plan of action. Local initiative is paralysed by the lack of means and of a precise plan. The only notable success is in the Autonomous Region of Sardinia where the crossing experiments with local breeds conducted from the beginning of the sixties have drawn attention to the qualities of the Sardo-Modicana and, above all, of the Sardinian, as dams of crossbred calves in difficult Mediterranean environments (see Annexe 1). As a result, the Sardinian breed, in the last few years, has undergone a recovery. Let us add that the qualities for beef crossing of certain other Italian breeds are recognized beyond the Atlantic where there are already nuclei of Chianina, Marchigiana and Romagnola.

(20) LEBANON

The local Baladi cattle, (the same type as in Syria and Israel) formed 90 percent of the population in 1954. Because official policy has been to grade up to the Friesian, in 1974 there were only 10 percent.

(21) LIBYA

The Libyan cattle are close to the Brown Atlas. We know that there have been recent importations of foreign cattle but no reply from this country has reached us.

(22) LUXEMBOURG

There are no indigenous breeds.

(23) MALTA

The native cattle are of the brachyceros type, like so many other Mediterranean breeds, but with very large body size, which is rare in that region. Some specimens are kept on the State Farm.

(24) MOROCCO

Amongst the countries of North Africa there is no doubt that Morocco has suffered least from French colonization as far as crossing is concerned. But now the local population, of Brown Atlas type, is definitely threatened.

The official departments of breeding and of agricultural research are interested in two sub-populations called Oulmès Blond and Moroccan Brown. Experimental herds are being set up.

(25) NETHERLANDS

Two breeds exist as relics - the Aalstreek or Witrik (black and colour-sided), which has a herdbook not subsidized by the government, and the Lakenfelder (Dutch Belted).

The Groningen breed (black or red with white head), although a good milker, is in danger, judging by its reduced numbers - only 1.1 percent of first inseminations in the country.

The two breeds which make up the national herd are the Black Pied with its two herdbooks - FRS for Friesland and NRS for the rest of the country - constituting 64 percent of the population, and the Red Pied, also called the Meuse-Rhine-Yssel (MRY) with 34 percent. These two breeds produce large numbers of breeding animals for export. Some Holstein-Friesians from America, have now been introduced into Friesland.

(26) NORWAY

Over a period of sixty years all the local breeds have been absorbed into the Norwegian Red which has become the sole dairy breed with a national selection programme. Its origins stem largely from the Swedish Red-and-White and from the Ayrshire.

With no other figures available, here are the numbers of dairy cows of the old breeds recorded in 1973:

Telemark	321
Raukolle (Red Polled Østland)	17
Sør og Vestland (South and West Norwegian)	4 417
Sidet Trønder (Black sided Trondheim)	923
Rødt Trønder (Red Trondheim)	1 (sic)
Døle	17

The total number of dairy cows in Norway is about 260 000 of which sixty percent are recorded.

The only conservation measure so far taken has been the freezing of 700 semen doses from the Telemark breed and 1 000 from the Sidet Trønder.

(27) POLAND

The Białogrzbieta (colour-sided) Zuławka (white) and the Kłodzko (white-headed from Silesia) were already considered to be extinct in 1954. Of the ancient breeds only the Polish Red remains (18 percent of the population) and it is in retreat before the Polish Black Pied and the Polish Red Pied. It has had some infusions of Red Danish and Jersey blood but its milk yield remains low. There is a tendency to use it for commercial crossing. A nucleus of about 120 000 head has recently been created in the south of Poland (province of Krakow) in order to maintain the breed in a pure state.

(28) PORTUGAL

In the absence of formal breed societies division into breeds still remains very slight. Statistics are very approximate. In the north and around Lisbon the Turina (25 percent of population), a type of Friesian, is dominant. It is the sole dairy breed. The Minhota

(3 percent in 1965) is retreating before it as well as the Barroša (20 percent). The Arouquesa (7 percent) is crossed with the Gelbvieh.

Inland and in the south the breeds are triple-purpose but often with good meat conformation. In the last ten years experiments have been made to evaluate their qualities, both as purebreds and for crossing, by the Fonte Boa Zootechnical Station, where they are keeping three of the most characteristic types: the Mirandesa (25 percent of the population), the Alentejana (6 percent), and the Mertolenga (6 percent).

(29) ROMANIA

Official policy consists in getting rid of the two traditional Romanian breeds, the Romanian Mountain related to the brachyceros, and the Romanian Steppe related to the Grey Steppe. This objective has now been practically achieved.

(30) SPAIN

The traditional Iberian breeds are triple-purpose. They are not all promoted by well organized breed societies. In the north there is a tendency for them to be absorbed by the Brown Swiss. In the south-west the indigenous Retinta breed is maintaining itself. The following are declining:

Pirenaica: 2 000 registered animals; threatened with absorption by the Brown Swiss
Tudanca: numbers now stabilized
Mantequera leonesa: almost disappeared, absorbed by the Brown Swiss
Berrenda: tending to disappear, absorbed by the Retinta
Zamorana (Sayaguesa): declining, absorbed by the Brown Swiss
Cacereña: almost disappeared

There is some government action to save the Pirenaica, the Tudanca, the Berrenda and the Cacereña by giving subsidies for breeding cows (1 000 to 4 000 pesetas a head) and exercising some control of the farms. Moreover, an experimental herd of the grey variety of the Salmantina has been established near Salamanca. Some examples of Cacereña (a kind of white Retinta) are kept at the insemination centre at Badajoz.

(31) SWEDEN

In 1938 the Swedes tried to blend the two local breeds: the Röd Kullig Lantras: (Swedish Red Polled) and the Svensk Fjällras (Swedish Mountain) without much success. Both breeds are declining (5 percent of national herd in 1961, 2 percent in 1972). No special conservation measures have been taken but the small mountain breed is very hardy in a difficult environment. It contains a factor which is probably pleiotropic for gonadic hypoplasia and white coat colour. This has stimulated some very interesting studies by the team at the Stockholm Veterinary School.

The two important breeds are the Swedish Friesian and the Swedish Red-and-White (SRB).

(32) SWITZERLAND

The traditional Pie noire fribourgeoise has practically disappeared during the last few years due to grading up with the German Black Pied and then with the Canadian Friesian. It is now effectively part of the Friesian family. Some breeders are making an effort to revive it, but probably too late.

The Hérens breed has fallen from 27 000 head in 1956 to 14 500 in 1973. There are signs that both the Federal and Cantonal authorities would like to safeguard it. Several bulls are being tested and experiments have been started to try out its suitability for beef crossing.

The two great dual-purpose breeds which share the country - the Simmental in the western

half and the Braunvieh (Swiss Brown) in the eastern half - are being being remodelled by the introduction of Red Holstein semen for the first and American Brown Swiss for the second. The first bulls born from these inseminations will shortly go on test.

We should add that, since 1964, an albino mutant which appeared in the Swiss Brown has been kept at the Veterinary Faculty of Zurich (Institut d'Hygiène de l'Élevage). More recently another albino mutant, this time from the Simmental, has been introduced into the experimental group which, at the end of 1974, numbered ten females and offspring; semen from several males has already been frozen.

(33) SYRIA

For a long time official policy has been to improve the local Beladi cattle by upgrading to exotic breeds. Since agricultural progress is too slow to permit such a policy to become effective all over Syria, attention is being paid to the local Shami (Damascus) breed for milk production. The first results of a trial are quite encouraging: it is claimed that the Shami would be capable of rivalling the Friesian under the least improved conditions.

Nothing seems to be planned for using the local cattle in meat production programmes.

(34) TUNISIA

As a result of colonial and post-colonial policies the local populations of Brown Atlas are very much mixed with several European breeds. The policy of grading up continues.

(35) TURKEY

In 1970 the situation of the four indigenous breeds was as follows:

Breed	Number	Region
Plevna (Grey Steppe)	1.1 million	Thrace and north-east Anatolia
East Anatolian Red	3.6 million	East Anatolia
Anatolian Black	6.5 million	Central Anatolia
South Anatolian Red	1.2 million	South-east Anatolia

The South Anatolian Red is closely related to the Shami of Syria.

Beginning well before 1970 the grading up process, chiefly with Brown Swiss, accelerated after that date. No measures for improving or saving the local breeds are contemplated.

(36) UNITED KINGDOM

The country which invented the whole idea of pedigree breeds has, from this pioneering, inherited a large number of cattle breeds, many of which have been in a relic state for a long time while others have lost ground more recently.

The disappearance or decline of these breeds has happened because of the advances made by the British Friesian. Some beef breeds are also on the increase.

At a cultural level, preservation of a certain number of relic herds seems to be going well. In order to link up the private initiatives, which have always been numerous, the "Rare Breeds Survival Trust" (RBST) was formed in 1972. It publishes a journal "The Ark" which serves to keep the breeding enthusiasts, often very scattered, in touch with each other. Shows of these rare cattle are organized periodically and are much appreciated. Some members have demonstration farms which exhibit examples of the ancient breeds, in their ordinary surroundings, all the year round. The RBST has recently undertaken the registration of animals of three old breeds which have not, or no longer have, a herd book. These are the Blue Albion, Irish Moyled and Shetland.

With more practical aims, another kind of conservation is already assured by the Milk Marketing Board (Thames Ditton, Surrey) which freezes and stores semen from the threatened breeds.

The following list shows estimated numbers at the beginning of 1974:

Beef Shorthorn	1 500
Belted Galloway	600
Blue Albion	220
British White	200
Dexter	200
Dairy Shorthorn	10 000 (100 000 en 1950)
Devon	2 000
Galloway	1 200
Gloucestershire	50
Highland	2 000
Irish Dun	?
Irish Moyle	?
Kerry	50
Lincoln Red	5 000
Longhorn	200
Northern Dairy Shorthorn	2 500
Red Poll	7 500 (declining rapidly)
Shetland	150
Sussex	3 000
Welsh Black	4 000
White Park	70
Whitebred Shorthorn	500

(37) U.S.S.R.

This country was not included in the enquiry.

(38) YUGOSLAVIA

The Buga^V breed, which still constitutes 50 percent of the herd, is in process of being crossed with improved breeds: Brown Swiss, Danish Red and, more recently, Friesian. The Yugoslav branch of the Grey Steppe has almost disappeared but the Istrian Grey, related to the Italian podolian types, is still holding its own.

C. Table of threatened breeds

With only a relative degree of accuracy we have made three categories: (1) Breeds already in a relic state. (2) Breeds in danger now, that is, rapidly diminishing or stabilized at a reduced number. (3) Breeds in danger in the future.

NATIVE CATTLE BREEDS IN DANGER OF EXTINCTION IN
EUROPE AND IN THE MEDITERRANEAN BASIN

Country	In a relic state	In danger now	In danger in the future	No. of native breeds:	
				in danger	not in danger
Algeria		Brown Atlas		1	0
Austria		Gelbvieh	Grauvieh Pinzgauer	3	0
Belgium			Rouge de Flandre occidentale Pie rouge de Flandre orientale	2	1
Bulgaria	Iskur Rhodope			2	0
Cyprus		Cyprus		1	0
Denmark		Danish Red		1	0
Egypt				0	1
Finland		Finnish		1	0
France	Ferrandais Froment du Léon Mezenc Blond des Pyrénées Villars-de-Lans	Abondance Bazadais Vosgien	Armoricain Aubrac Breton pie noir Corse Flamand Gascon Parthensis Salers Tarentais	17	5
Germany, Federal Republic	Vorderwälder Hinterwälder Murnau-Werdenfelser	Angler Rotvieh	Gelbvieh	6	3
Greece	Greek Shorthorn Greek Steppe			2 2	0 0
Hungary	Hungarian Grey			1	0
Iceland				0	1
Ireland	Kerry			1	0
Israel		Baladi		1	0
Italy	Agerolese Bionda tortonese Garfagnina Mucca pisana Pontremolese Siciliana Tarina	Bianca Val padana Burlina Grigia Val d'Adige Reggiana Rendena Valdostana pezzata nera	Grigia alpina Maremmana Modicana Pinzgau Pugliese Romagnola Valdostana pezzata rossa	20	1

Country	In a relic state	In danger now	In danger in the future	No. of native breeds:	
				in danger	not in danger
Lebanon		Baladi		1	0
Malta	Maltese			1	0
Morocco			Brown Atlas	1	0
Netherlands	Lakenfelder Witrik		Groningen	3	2
Norway	Telemark Raukolle Sør og Vestland Sidet Trønder Rødt Trønder Døle			6	1
Poland		Polish Red		1	0
Portugal		Minhota Arouquesa	Barrosã	3	3
Romania	Romanian Mountain Romanian Steppe			2	0
Spain	Mantequera leonesa Berrenda Cacerena	Pirenaica Zamorana	Tudanca	6	6
Sweden		Svensk Kullig Boskap		1	1
Switzerland	Fribourgeois		Hérens	2	2
Syria		Shami		1	0
Tunisia	Brown Atlas			1	0
Turkey			Plevna East Anatolian Red Anatolian Black South Anatolian Red	4	0
United Kingdom	Belted Galloway Blue Albion British White Dexter Gloucestershire Irish Dun Irish Moyle Longhorn Shetland White Park	Beef Shorthorn Dairy Shorthorn Highland Northern Dairy Shorthorn Red Poll	Ayrshire Devon Galloway Lincoln Red South Devon Sussex Welsh Black	22	5
Yugoslavia	Grey Steppe		^v Busa	2	1

D. Discussion

1. A depressing balance sheet

A quick count of the table shows that in Europe and the Mediterranean basin 115 indigenous breeds are threatened with extinction and only 30 are holding their own. The simple count of breeds, however, provides only an indication of the true situation. According to a country's stage of development many breeds may have been differentiated, as in Norway, or very few, as in Morocco; the loss of several breeds in the former country, or one in the latter, will involve losses of genetic variability of the same order.

With some exceptions, like the Shorthorn, the threatened breeds are those which have not gone beyond their local environment. The process of the disappearance of the traditional dairy breeds is very advanced. Europeans will soon get their milk from only two or three specialized breeds. The recession of the triple-purpose breeds, even though it began later, is also well advanced.

2. Reasons for the disappearance or replacement of breeds

- i. The traditional breeds are not sufficiently productive, especially the dairy breeds
- ii. The dairy breeds, even the good producers, must have large enough numbers to warrant modern testing programmes. This explains, for example, the breed policy of Norway where, in 1960, it was decided to fuse all the breeds into a single dairy breed in order to be able to operate a national selection programme.
- iii. The foundation stock for selection is more and more based on the mixing of genes of different origin. Thus the European Friesian is already strongly influenced by the American Holstein-Friesian.
- iv. Farming structure changes; the small mountain and upland breeders disappear and with them their breeds; example - the Pinzgau.
- v. Cattle are no longer used for draught so the triple-purpose breeds used chiefly for work have no longer any reason to exist. This is especially true in places like Italy and the south of France which had not been converted to horse traction before mechanization.

3. The speeding up of the decline process

This is undeniable, especially in the last ten years.

- i. New reproduction techniques which permit of rapid gene replacement, such as artificial insemination with frozen semen, are hastening the decline. A large part of the territory we have covered now possesses a dense network of inseminators. The A.I. services of the backward areas are rapidly catching up.
- ii. Mechanization is very quickly conquering the places still using draught oxen; for example, the local Cyprus breed has declined rapidly since the introduction of mini-tractors.
- iii. The most drastic governmental decisions are carried out much more effectively than in the past because of the rural exodus, because of agricultural reorganization or because of generally admitted economic necessity. This is true for the east European countries as well as for a western country like Norway.

4. Effect of disappearance of traditional breeds on genetic resources

Before the war the European herd, especially in the temperate Atlantic zone, was divided

into a multitude of breeds of which many were very similar in appearance and performance. Undoubtedly there were unnecessary duplications. So, in the early fifties, the French livestock services advocated several breed fusions and refused to subsidize certain other breeds such as the Vosgien and the Ferrandais which were considered to be too "folkloric". The loss of breeds by fusion should not impoverish the gene pool. A certain number of such fusions have recently been made in France. One of the most successful is that which has given rise to the beef breed called Blond d'Aquitaine, which includes the Garonais, the Quercy, the Blond des Pyrénées and now, the Villars-de-Lans.

However, especially among dairy breeds, a tidal wave is engulfing the local populations and resulting in the disappearance, or irreversible dilution, of their genes. Even more importantly, this process is disrupting the presumptive gene combinations which confer those qualities of hardiness and environmental adaptation (including small size), which are often lacking in improved breeds and which may be useful even in developed countries.

5. Some local breeds deserve to be conserved

As some zones are more intensively farmed, others tend to become abandoned. In order to exploit these zones, in which labour and capital investment have to be minimized, grazing animals must be used. Such abandoned areas may be occupied by sheep, as in some parts of the French Alps. The opposite substitution is also possible. In Sardinia, for instance, the poorest pastures are more and more grazed by cattle while the milking sheep are moved to better pastures. The same phenomenon is to be seen in Greece. In areas where the production of fodder is impossible or too costly, there must be very hardy cows able to resist extreme weather conditions and able to put up with longer or shorter periods when the grass is scarce. These conditions are especially severe in the Mediterranean environment which explains why it is there that the search for hardy females began. Thus, since the beginning of the sixties, experiments have been conducted in Portugal and Sardinia to measure the ability of local cows to produce and wean crossbred calves. Crossbreeding systems in several stages are being studied, especially those using crossbred females in order to exploit their hybrid vigour; a minimum number of the females of the hardy local breed must be kept pure as foundation stock for the production of those crossbreds. In France and in Britain some hill and mountain regions are used for this type of production; the calves born in the uplands are fattened in more favourable areas (Colleau et al., 1972). Vissac (1973) has summarized the situation and shown the importance of maintaining pure stocks of the hardy maternal breeds.

While some indigenous breeds deserve to be kept in this way for local use, others can be kept for use in foreign countries. For milk production, for example, some Mediterranean and wet tropical areas cannot produce, let alone afford to devote to dairy cows, the concentrates required for high performance. In these cases there is really no need to have animals as productive as the modern Holstein-Friesian; dairy cattle such as Brown Swiss, Finzgau, Tarentais or even Breton pie noir will occupy these areas for years to come.

6. Reasons for and ways of keeping certain traditional breeds for cultural purposes

Even if certain breeds are disappearing from commercial exploitation because of low productivity, it would be a pity not to keep some herds as living museum pieces. Experience shows that the public of industrialized countries is eager for such presentations in zoos or in private farms.

Following the example of national reserves for wild animals in untouched natural environments, it is now the fashion to have regional parks, showing models of traditional life based on agriculture and animal husbandry, in which the ancient breeds of domestic animals have a natural place. Even before these public initiatives began a certain number of relic breeds had already been conserved, sometimes for many years, like the White Park and the Highland cattle of Great Britain which are kept as ornamental herds in gentlemen's parks. The Dexter breed in England and the Witrik in the Netherlands have been kept going by private enthusiasts. In recent years there has been a tendency to coordinate these efforts, especially in Great Britain with its Rare Breeds Survival Trust. It would be very desirable,

now that individual efforts need not be frittered away by dispersion, that governments should set about helping societies such as the Witrik in the Netherlands and the Vosgien in France.

Obviously, it would also be desirable that the conservation work of the regional parks be coordinated with the help of ethnologists, sociologists and geneticists for whom these anachronistic herds provide a valuable source of specimens and of data.

7. Justification and methods of conservation for scientific purposes

The relic herds cited above as sources of genetic data can firstly be used as approximate starting points from which to measure the divergence of the improved breeds. Secondly, genetic variants with visible effects, such as Dexter dwarfism, and characters such as colour and horns, can be studied, as well as those with invisible effects, such as blood groups and protein polymorphisms of blood, milk and enzymes.

These herds are not always the most suitable for the study of individual genes and one might envisage herds still more specialized which would more closely resemble lines of laboratory animals with marker genes. By using artificial insemination with frozen semen the need to keep males is already minimized. Moreover it is possible to maintain a herd with genes segregating at several loci provided the behaviour of each is well known. Attempts of this kind made in the past have not often been followed through for very long once the mutant has been superficially studied. In recent years stocks of mutants have been kept over a period of time. For example, in Kansas, a Holstein line which carries the gene for syndactyly and, at the Ecole Vétérinaire of Zurich, a line in which an albinism gene from the Swiss Brown and an albinism gene from the Simmental are both present.

8. Methods of conservation for practical purposes

For cultural and scientific purposes few animals are required; the same is not true for agricultural exploitation. Commercial utilization of a breed requires numbers running into thousands, even if the breed is not involved in a programme of selection for milk production. Potential purchasers must be able to find breeding animals which suit them at the time when they need them; otherwise they will go elsewhere. In order to maintain the hardy stocks necessary for beef crossing, so important for the future, the people who breed the purebred females must be sufficiently rewarded. This means that they must receive a fair share of the profits which are made when the crossbred animals are sold for meat. We have already described such a price mechanism at work in France in the district of Aubrac. The intention, if not the exact details, of this arrangement deserve to be more widely applied.

In addition, governments must act in two main directions:

- i. By giving fairly generous help for a limited period to interesting breeds which are severely threatened. In France this would apply, for example, to the Breton pie noir.
- ii. By organizing trials of native breeds to test their value as purebreds and in crossing, in order to find out which are worth keeping.

But the comparison which we would most strongly recommend is a general, international one. It would include, on the one hand, the small brachyceros type of Mediterranean cattle in Sardinia, Corsica, North Africa (Brown Atlas), Yugoslavia (Busa), Bulgaria and Greece and, on the other, the large, narrow type, often grey in colour, known as Grey Steppe, which appears to be related to the Podolian breeds of Italy (Apulian, Marche etc.) and which exists in Hungary, Bulgaria, Yugoslavia, Greece and Turkey only in a relic state.

In addition, certain Alpine stocks should be tested in order to compare their performance as beef crossing animals in temperate mountain zones.

9. The relationships among European and circum-Mediterranean breeds

This subject is of the greatest interest to ethnologists who are trying to relate human

migrations to those of cattle, using their knowledge of the one to clarify that of the other.

It is equally interesting for the modern zootechnician, when breeds have to be combined, when he has to choose which ones to keep or which to use in crossbreeding in such a way that there will be maximum benefit from hybrid vigour.

The old writers on European breeds have built up classifications on the bases of historical events (like invasions within the historical period), and on visible resemblance of size, conformation and colour. Thus we have the Channel and North Sea breeds, the Iberian breeds, the Podolian breeds and the brachyceros breeds. Some of these classifications are both interesting and justifiable. The only trouble is that they are often regarded as gospel truth even when exact confirmation is lacking.

Kidd (1967) suggested that European breeds should be analysed by using programmes designed for the study of relationships between human groups which employ the data of allele frequency at loci with multiple alleles. Kidd and Pirchner (1971) gave the first results for Austrian breeds. More recently another paper on this subject has appeared (Kidd et al., 1974).

The building up of a phylogenetic tree is still open to criticism on the grounds that in the writing of the computer programme the research worker must make numerous choices and that the final result merely confirms what we already know, or what we think we know. Besides which, there is a risk of complicating the task if the plan were extended to countries where allele determinations are not made in the same way, especially in the case of blood groups.

On the other hand, if we are content to measure genetic distance between breeds, which is already very useful in establishing relationships and planning certain crosses, it would appear that existing statistical methods may be satisfactory.

10. Gaps in our knowledge and information

In order not to overburden the text, the difficulties of gathering up-to-date information have not been mentioned. For example, in the first place, it is almost impossible to gauge the breed situation in a country without having been there. Statistics, when there are any, appear only when they are already out-of-date, often by as much as five years. The useful data are often scattered between, for example, artificial insemination centres and official departments dealing with agricultural returns. A census by breeds is often non-existent, or unreliable, because many breeds are poorly differentiated from the general population, as in south-west Spain, or because, as in Sardinia, classification is uncertain due to the long history of crossbreeding. It would be desirable that the work we have done be repeated country by country on a more accurate demographic basis; that is to say, by analysing the distribution by age, especially of the females, as well as parameters such as generation interval, percentage of males and females used in purebreeding and for crossing, the number of females per male in the breeds with natural service and the size of the herds. An interesting attempt along these lines has been made by Bougler in France. We hope that a more detailed paper from this worker will soon appear as it would constitute a pilot article.

There are crossing experiments going on at this moment some of which involve declining breeds. It would be useful to have a list of these and an account of their chief features, even before having results, in order to avoid repetitive research and to excite that practical interest in the hardy breeds which is far from being generally felt.

Finally, at a genetic level, we would like to see breeds better characterized than merely by the breed standard - as much by their genes with invisible effects as by those whose effects are visible - particularly genes causing abnormalities. The analysis of frequency of the alleles of blood groups and of polymorphisms could lead to the measurement of genetic distances which would be extremely useful in planning crosses.

E. List of people contacted in the course of the enquiry

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F. Printed sources

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PRELIMINARY SURVEY OF ENDANGERED BREEDS THROUGHOUT THE WORLD

by

I.L. MASON

Since Annex 2 covers European cattle this annex is concerned with other species and with cattle outside Europe. The arrangement is species by species, except that the U.S.S.R. and Eastern Asia are considered separately at the end.

A. Cattle breeds outside Europe

1. Local dairy breeds

The spread of the improved dairy breeds of western Europe is affecting not only the local breeds in eastern and southern Europe (see Annex 1) but also the local dairy breeds in Africa, Asia and South America. Though they are of low productivity compared with the improved European types they have the advantage of adaptation to the local (usually tropical) environment and can be extremely useful in a systematic crossbreeding programme (e.g. crisscrossing with European dairy breed). Some are pure zebu (humped), some are zebus with humpless blood (zeboids) and some are pure humpless. Examples are as follows:

Zebus under long term threat - Sahiwal, Red Sindhi, Tharparkar and Gir (India and Pakistan);
Kenana and Red Butana (Sudan)

Breeds in immediate danger:

Zeboid - Hatton (Ceylon) and Taylor (India)

Humpless - Dairy Criollo (S. America) (See also Group 6)
Mauritius Creole

2. West African humpless cattle

Kuri - See Annex 4

N'Dama This breed is of interest because of its resistance to trypanosomiasis. It is at present plentiful but its advantage will disappear if trypanosomiasis is controlled.

West African Dwarf Shorthorn This breed is also trypanotolerant and lives in the forests and coasts of the Guinean zone from Gambia to Cameroun. Local names include: Gambia Dwarf, Manjaca (Guinea-Bissau), Race des Lagunes (Ivory Coast, Togo and Dahomey), Somba (Atakora Highlands - Togo and Dahomey), Muturu (Nigeria), Logone (Chad), Bakosi (Cameroun). Because they are little exploited economically and because they are smaller and less trypanotolerant than the N'dama their numbers are declining rapidly.

Other small local types similar to the Dwarf Shorthorn but with varying amounts of N'Dama or zebu blood are the Baoulé (Ivory Coast), Ghana Shorthorn, Borgu (Dahomey and Nigeria), Biu (Nigeria) and Namji (Cameroun)

3. Sahelian zebus

These are not under pressure from other breeds but because they are living in the Sahel it is animals of these breeds which have suffered from the drought. They include the following: Maure (Mauritania), Tuareg (Mali), Azaouak (Mali and Niger).

4. Sanga breeds of eastern and southern Africa

The long-horned small-humped Sanga breeds of East Africa have for centuries been under pressure from the more recently arrived shorthorned zebu. This process is accelerating as the breeding aim turns from beauty of appearance (gigantic horns) to economic utility (growth rate, milk yield, disease resistance.) New types have already developed which are probably more zebu than Sanga but their present status is not clear e.g. Arado (Ethiopia), Alur (north-east Zaïre), Tuni-Giddu (Kenya-Somalia). The one remaining Sanga breed of Ethiopia - the Danakil of Dancalia - is facing the added hazard of drought.

In southern Africa the local Sanga types do not have the zebu to contend with but several are declining by the spread of the Africander and by crossing with European breeds. The Basuto breed of Lesotho is now much diluted. The Bavenda of Transvaal is almost extinct. The Nguni of Swaziland is facing an official crossbreeding policy. In this connection it is interesting to note that the Tswana of Botswana has, in preliminary tests (Botswana, 1974), shown itself superior to the Africander, an "improved" Sanga from South Africa. Furthermore the Sanga breeds show hybrid vigour when crossed with the American Brahman on the one hand or with European beef breeds on the other.

5. Zebus of South-east Asia

These include the local cattle of Burma, Thailand, Cambodia, Laos, Vietnam, Malaysia, southern China, the Philippines and Indonesia. They are extremely poorly described. In many places because of their small size and low milk yield they are not even considered suitable foundation stock for crossing with European dairy breeds; for this purpose imported Indian zebus are preferred. Descriptions, censuses, and evaluation (especially in systematic crossbreeding) are urgently needed.

6. Criollo breeds of Latin America

The descendants of the European cattle introduced four and a half centuries ago by the Spanish and Portuguese colonists have been in America long enough to have developed clear adaptation to their new environment. But they were not selected for productivity so that in the temperate areas they have now been displaced by improved European breeds. In the tropical areas crosses with the zebu, particularly with the American Brahman, have shown themselves superior in adaptation and beef production. This has been interpreted as an absolute superiority of the zebu over the Criollo and is leading to a policy of displacement. In fact it may be due to hybrid vigour and therefore be an argument for maintaining a nucleus of pure Criollo as a foundation for a crossbreeding policy in order to exploit this heterosis.

7. Dwarf breeds

Dwarf breeds in Africa, in addition to the West African Shorthorn, include the humpless breed of Socotra island, the Nuba Mountain (Sudan), the Chagga zebu of Tanzania and the Govuvu of Rhodesia. All are nearly extinct.

The Nuba Mountain cattle are particularly interesting because, although now humped by crossing with the surrounding zebu, they are said formerly to have constituted an isolated group of humpless trypanotolerant cattle in a tsetse area.

Small or dwarf breeds in Asia include the Indian Hill zebu of the Himalayas, the Sinhala zebu of Sri Lanka and the humpless Tibetan cattle. It does not appear that these breeds can yet be described as declining but their small size will lead to replacement as soon as more productive animals can be kept in their environments. However, before they are replaced the extent to which their small size represents an environmental adaptation should be investigated.

8. Relic herdbook breeds

Breeds such as the Dutch Belted (U.S.A.) and the Canadian dairy breed of Quebec can probably

rely, as in western Europe, on the attention of hobby farmers and fanciers for their retention. The same applies to the Texas Longhorn (U.S.A.) which has the same origin as the Criollo types. Although of no economic importance it now has an active breed society and there are many herds in private hands or national parks.

B. Sheep breeds

1. Europe

With the intensification of agriculture sheep husbandry is becoming polarized between the hardy breeds on marginal lands and the very intensive husbandry in small household flocks or even indoors. Nowhere is this process more obvious than in the British Isles where most of the sheep now belong to the mountain and hill breeds. Indeed no less than 24 breeds now come under the umbrella of the Rare Breeds Survival Trust. This number includes hardy, very local, breeds such as the Cladore, Herdwick, Lleyn, Manx Loghtan, Mayo Mountain, Norfolk Horn, North Ronaldshay (Orkney), Portland, Rhin, Cardy, Whitefaced Dartmoor and Whitefaced Woodland; ornamental park breeds such as the Black Welsh Mountain, Jacob and St. Kilda; and lowland breeds formerly of considerable economic importance such as the Cotswold, Leicester, Lincoln, Oxford Down, Shropshire, Southdown, Wensleydale, and Wiltshire Horn. Most of this last group are still represented overseas.

In France, Laurans (1974) writes "Of forty one breeds of sheep only seven go to make up half the national flock while twenty others constitute only seven percent. Some of these are in great peril (Aure-Campan, Berrichon de l'Indre, Castillonais, Lourdais, Précoce Mérino, Thônes-Marthod), the others are on the road to extinction or have already vanished save for a few specimens." This last group includes the following: Ardes, Avranchin, Bizet, Boulonnais, Brigaque, Corbières, Landais, Monts d'Arrée, Noire du Velay, Quessant, Rava, Rouge du Roussillon, Trunière, Tête Rouge du Maine, Tête Noire.

"The Natural Regional Park of Armerica has undertaken to establish a flock of Quessant sheep."

In Scandinavia sheep numbers are falling and only Norway and Iceland have large populations. However, some local breeds are being maintained on account of special characteristics. The Finnish Landrace was declining rapidly in numbers but now is widely sought after overseas because of its high prolificacy. The Gotland sheep of Sweden is maintained for its grey fur. The Icelandic sheep is being maintained pure after some unfortunate effects of crossing and disease introduction.

In Central Europe sheep numbers are low but they include a number of interesting local breeds. In Germany, in addition to the improved breeds derived from Merino or British breed crosses, the Heidschnucke remains to eat the heather on Lüneburg Heath, and in Bavaria several disappearing local types are included in the general term German Mountain. The East Friesian may soon be considered rare because in spite of its wide distribution and high milk yield there are only a few individuals in each flock. Other local breeds are the Leine of southern Hanover and the Rhön of Central Germany. Of the five Swiss breeds three are derived from crossing with imported breeds; the other two are now rare. The Brune noire du Pays represents the union of four local breeds in the west of the country. The fifth is the very local Valais Nez Noir. In Austria the Tyrol Mountain is interesting on account of its high fertility; there is also a Carinthian breed. Two Zackel types exist in Czechoslovakia in small numbers, the Sumavska and the Valasska.

In Eastern Europe sheep are more numerous and numbers are stable. In Poland the local breeds - Wrzosówka (Heath), Pomorska (Pomeranian) Świniarka, Cakiel (Zackel) - are being or have been displaced by or crossed with English Longwool, Merino or East Friesian breeds. The screw-horned Hortobágy Racka (Zackel) of Hungary is preserved in the Hortobágy Open Air Museum. Local breeds (mostly of Tsigai or Zackel type) remain in Romania and Bulgaria but they are being extensively crossed with Merinos. Bulgaria was particularly rich in breeds, having no less than 14 named varieties. The government is now subsidizing special farms where

these breeds can be maintained pure with a view to exploiting them in a stratified crossbreeding scheme.

Southern Europe was surveyed in Mason's (1967) book on Mediterranean sheep breeds. The situation of rare breeds there is currently under study by Dr. Brooke.

2. Africa

The breed situation in Africa has been surveyed by Mason (1951) (West Africa), Mason and Maule (1960) (Eastern and Southern Africa), Mason (1967) (North Africa) and Epstein (1971) (all Africa). The chief pressure from imported breeds comes in the south and east. Epstein (1974) sums up the situation as follows: "The fat-tailed Namaqua breed of South and South West Africa would have become extinct 30 years ago owing to the encroachment of the Karakul on their breeding area, had the last remaining flock not been preserved by Government action. Many of the local types of hairy, thin-tailed Bantu sheep in eastern and southern Africa are being replaced by the fat-rumped Somali extending its range from the north and the Blackhead Persian from the south".

3. Asia

In the countries of the Near East sheep are frequently the most important species of livestock. Nevertheless there is no recent systematic account of their sheep breeds except for countries of the eastern Mediterranean which were covered by Mason (1967). Because of the nature of the environment there does not seem to be any immediate danger from imported breeds. Because of market demand there is no sign that other species will supplant sheep. But the relative importance of different sheep breeds is little explored. In such countries as Iran and Pakistan with many different environments and many local breeds there is much work needing to be done in census, description and economic evaluation of different breeds.

In tropical Asia sheep are of much less importance. This also means that we know too little about them. There is mention, for instance, of a very fertile breed in Java but there are no hard facts available about it.

4. America

In USA and Canada nearly all the sheep are of fairly recent European origin. (One exception is the Navajo, which has the same origin as the Criollo). The situation is not one of disappearing breeds but of the formation of many new breeds by crossing and selecting.

In Latin America the original types from the Iberian peninsula have formed the various local Criollo breeds which are inadequately described and evaluated. In addition, hair sheep from West Africa have formed distinct "woolless" or "ox-haired" breeds in south-east Mexico, Cuba, Barbados, Bahamas and north-east Brazil. Some of these, particularly the Barbados Black-belly, are reported to be very prolific.

C. Goats

1. Europe

Goats are declining in numbers almost everywhere in Europe and now number more than half a million only in Albania, France, Greece, Italy, Portugal, Romania and Spain. Laurans (1974) sums up the situation in France as follows: "For goats most of the ancient local populations have been eliminated, or are in process of being eliminated, by the advance of the Alpine, Saanen and Poitevin breeds". If "Poitevin" is replaced by "Toggenburg" the same would apply to most other countries, at least in northern and central Europe. Laurans also writes: "... the Natural Regional Park of the Camargue is interested in saving the Rove breed of goat formerly widely used by the transhumant goatherds in the Alps".

In England four breeds are on the list of the Rare Breeds Survival Trust, namely Angora,

Bagot (Schwarzhals), Golden Guernsey and Old English.

In addition to the three international breeds mentioned above in Switzerland there are also small numbers of four other local breeds, the Appenzell, Chamoisée des Grisons, Valaisanne à col noir, and Verzasca.

In the Mediterranean countries there are several interesting local dairy breeds notably the breeds of Granada, Murcia and Malaga in Spain and the Maltese from Malta.

2. Asia, Africa and South America

In spite of their immense importance in developing countries goats have been little studied or described. Devendra & Burns (1970) give some breed descriptions chiefly from Africa, India and China. These apply to the commoner rather than to the rarer breeds. French (1970) also gives a brief outline of named breeds. But in addition to these there must be many populations of unnamed local goats making an important contribution to the diet of the subsistence farmer.

D. Pigs

1. Europe In Europe nearly all the native breeds have been eliminated by the Large White (Yorkshire) and the (Danish) Landrace or their derivatives. Since commercial pigs are kept intensively, hardy breeds adapted to the local environment are now redundant. Furthermore, the very fat carcasses produced by such once famous breeds as the Mangalitsa no longer correspond to market demand.

On the other hand, one new Belgian breed, the Piétrain, almost unknown 20 years ago, has recently been exported to many countries to exploit its characteristic of an extremely meaty carcass possibly due to a single gene.

In a few areas (Spain, Portugal, Corsica) pigs are still maintained extensively on pasture and chestnut and oak-mast and for this the local breeds are used. However, in southern Spain and Portugal the recent epidemic of African swine fever has much reduced populations.

In Britain, the Rare Breeds Survival Trust includes in its family the following breeds: Berkshire, British Lop, Gloucester Old Spot, Large Black, Lincolnshire Curly Coat, Middle White, Oxford Sandy and Black, Tamworth, Ulster White. For France, Laurans (1974) writes: "The Old French breeds have been progressively almost completely replaced chiefly by the Large White, but also by the Landrace and the Piétrain."

2. Africa

Epstein (1974) writes: "In Africa north of the Sahara small, primitive, black pigs were prevalent until the introduction of improved European breeds. In Algeria, they have been completely superseded by the latter, but in Tunisia and Morocco, small remnants of the original type still remain".

In West Africa some "native" pigs occur which are descendants of early importations, probably from Portugal. Zaïre and Angola have large populations of such pigs.

In Southern Africa there is a Bantu pig which appears to be descended from Chinese and European imports.

3. Latin America

De Alba (1972) describes some native breeds in Mexico, Central America, Venezuela and Brazil. These breeds are adapted to the "survival peasant economy" and will be replaced when it takes the "gigantic step" of moving onto a more productive level.

E. Livestock breeds in U.S.S.R.

In European Russia the same displacement of local cattle breeds has taken place as in the rest of Europe. In many cases new breeds have been formed on the basis of a cross between local and improved breeds. Now these breeds are under pressure from the purebred Friesian, Simmental, Charolais, Hereford, and other breeds which are being imported. Even in Soviet Asia few of the local breeds remain but recent information is difficult to come by.

The same process is occurring with sheep, the imported breeds being chiefly the Merino and the British lowland meat breeds. However there still remains a large number of local breeds whose utility needs to be evaluated both in purebreeding and crossbreeding, both inside and outside the U.S.S.R. The Romanov breed of Yaroslavl has already attracted attention because of its high fertility and has been exported. The breeds of Soviet Asia are much less well known. The Caucasian Fat-tailed group includes about 20 local breeds. There is also a group of about eight fat-rumped breeds in Central Asia including the Hissar which is said to be the biggest sheep in the world. The Siberian breeds, both local and derived, must have useful adaptations to harsh climates.

F. Livestock breeds of China and Eastern Asia

Chinese breeds have recently been described by Epstein (1969). Crossbreeding with imported breeds does not appear to have advanced so far that any local breeds are in danger from this cause. However, there are some breeds of interest whose numbers are small. For instance, the Han sheep of Shantung and the Hu (or Wusih) sheep of Shanghai are quite exceptional in their prolificacy - over two lambs at a birth and three lambings in two years. Because they are kept on a household scale, the population is not high.

Chinese pigs are also famous for their prolificacy. Epstein (1974) sums up the present breed situation as follows: "In China there were over a hundred breeds and varieties of pigs. Since 1949 only about forty of these are considered to be of economic value; the rest were condemned to extinction, although among those there were some with exceptionally high fecundity and a large number of functional teats of the sows. In 1963 there were only a few aged females of some of these breeds still alive (Epstein, 1969); at the present time none of these will have survived".

On goats the same author writes: "In Manchuria and Inner Mongolia the local goats have become practically extinct, save for a few females still sporadically seen in the Gobi; their breeding area has been taken over by the Cashmere goat. In southern China the local, black, short-legged goats have become exceedingly rare due to grading to Jamnapari stock imported from India".

In Eastern Asia, the "Research Group on the Native Farm Animals in Japan and Eastern Asia" which later changed its name to "Society for Researches on Native Livestock", has produced the following six reports:

1. Almost all the native breeds have been extinguished in central Japan but they remain in the smaller islands, e.g. native ponies and goats in Tokara island.
2. Ryukyu native horse, goat and pig, Mishima cattle and Hokkaido native horses are described.
3. Taiwan native cattle, pigs, goats and fowls are described and some blood group results are given.
4. Korean native horse (Cheju), cattle, goats and fowls are described. Coat colour and blood variants were investigated and relationships are discussed.
5. The report includes a variety of investigations on: Ryukyu fowl; Ogasawara (Bonin) Islands fowl and goat; Taiwan buffalo, goat and fowl; Tokara fowl, cattle and goat.

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REPORT OF THE MISSION TO THE KURI CATTLE OF LAKE CHAD

by I.L. MASON

The humpless Kuri breed of Lake Chad is unique in its habitat and morphology. Its inflated spongy horns are unknown in any other breed. Its habitat is, for cattle, a very special one, namely the islands and shores of Lake Chad. To this environment it is remarkably adapted and animals are able to subsist on the coarse forage of the shores and to swim from island to island to reach new pasture. The Kuri is a moderate milker and an excellent beef animal. Nevertheless a curious combination of climatic vagaries and economic circumstances is endangering the numbers and particularly the purity of the breed. The rise of the water level of the lake in 1960 reduced the grazing area. Because two zebu can be obtained for one Kuri, bartering with the neighbouring zebu breeds is leading to a dilution of the herds with zebu blood. More recently the Sahelian drought has led to pressure on the grazing area of the Kuri by zebu herds coming from drought-stricken areas.

In order to preserve and improve the breed and to encourage its extension from its present habitat in Niger and Chad to the other two riparian states, namely Cameroun and Nigeria, Dr. Renard of the Lake Chad Basin Commission (L.C.B.C.) prepared a "Projet pour la sauvegarde de la race bovine Kouri et l'extension de son élevage à l'ensemble du périmètre du lac Tchad" (CBLT/O4.104. April 1973). This project proposes the formation of a selection centre and three multiplication centres. Each will have 200 breeding females and about 500 animals in all. Bulls would be progeny tested at the selection centre and the best would be used in this centre and in the multiplication centres. The best of the surplus bulls from the selection centre and the best of the bulls from the other centres would be distributed locally. Full records would be kept and appropriate genetic studies undertaken. The total budgeted cost was US\$ 2.22 million of which 1.225 million would have to come from external aid.

Later in 1973 the Government of Chad recosted the LCBC Project as a national project with a selection centre and a single multiplication centre, both in Chad. The total cost came to 312 million F.CFA of which 266 million F.CFA (=US\$ 1 million) would have to come from external aid.

In order to assist the Lake Chad Basin Commission in finalizing the preparation of their project and to assess to what extent it might be of interest to UNEP for financing, a consultant visited Chad for 10 days during May 1974 and reported as follows.

The questions under consideration fall into the following groups:

- A.
 - 1) Is the Kuri breed disappearing?
 - 2) Is it declining in numbers?
 - 3) Is it becoming diluted with zebu blood?
 - 4) Is the characteristic horn form becoming less frequent?
- B.
 - 1) What is the economic value of the pure breed, especially for meat production?
 - 2) How does the performance of the pure breed compare with that of its crossbred with zebu (Arab or Bororo)?
 - 3) What is the correlation between horn form and the economic characters of growth rate, milk yield, fertility and longevity?
- C.
 - 1) According to the answers to these questions, what action should be taken and by whom?

The present status of the breed

In answering the questions in group A one immediately runs into a further question; what are the characteristics of the pure Kuri? One should not be too formalistic in this matter. The Kuri is not a closed breed with a herd-book and a breed standard. One must not therefore demand that every animal should be white with black points and have the characteristic buoy-shaped, inflated, or very thick horns. Even in European selected breeds off-colours occur (e.g. red pied in the Friesian) and horned animals turn up in polled breeds. We must accept that, while the coat is usually white, coloured or spotted or pied animals are not uncommon. Breeders confirm that white parents can give coloured offspring which would be expected in a breed in which the white colour is due to a dominant gene.

There is no evidence that the Kuri was formerly uniform in colour and horn type and that it has become more variable by introduction of zebu blood. There is an illustration taken from Adolf Friedrich, Duke of Mecklenburg, and included as Fig. 219 in Epstein's 'The origin of the domestic animals of Africa' (1971). This dates from the early 20th century and shows 20 Buduma cattle. Ten are white, one self-coloured and nine have coloured markings. In the few herds and markets which the consultant visited, between 10 and 20% of animals were coloured or pied.

As for horns, Epstein's illustration shows no inflated or extremely large and wide horns. Most are of the open crescent or lyre shape still very characteristic of the breed.

In general there is little evidence of the use of crossbred zebu bulls in Kuri herds and none of the use of pure zebus. On the other hand there does seem to be a demand for Kuri bulls in zebu herds. Indeed the increasing number of crossbreds would appear to be due to the spread of Kuri blood into zebu herds rather than vice versa.

The buoy-shaped horn is certainly rare - the consultant saw only one example - and the inflated horn is not common (perhaps 5%). But we do not know that the proportions were any higher in the past. There are many descriptions, illustrations and museum specimens of these remarkable appendages, but travellers, writers, photographers, artists and museums naturally tend to emphasize the spectacular and unusual. (Lépisier is convinced they are decreasing).

Very tentative conclusions are that the Kuri breed is not in immediate danger of disappearing, that it is impossible to make any statement about its numbers and their possible change, and that the bizarre horn forms are uncommon and are no longer being selected for: body size and growth rate appear now to be more important.

The economic value of the breed

There is no doubt that the Kuri breed has a great potential as a meat producer. It is clearly well adapted to its natural environment and the breeding herd appears to flourish on natural pasture. At the same time the males (particularly the uncastrated males) appear to respond well to feedlot fattening. Their docility is truly amazing. The results obtained at Matafo in 1973 are very encouraging. However, the stagnation among the present batch is disappointing and the explanation in terms of biting insects (mosquitoes) may have to be rigorously proved and an antidote discovered, especially in view of the statement of Quéval et al.* "The young Kuri bulls are said to be relatively immune to external parasites....." and of Renard (1973) "The Kuris scarcely seem to notice the attacks of biting insects which swarm during the greater part of the year (Tabanidae, Muscidae, Culicidae)"

The crossbreds are said to grow even better than the purebreds and it will be interesting to see the results of the LCBC trial at Koundoul using crossbreds and the same ration (Pennisetum purpureum + cotton seed) as at Matafo. However, the trials will not be directly comparable since location, weather and management may introduce differences.

* Quéval et al. 1971. Rev. Elev. Méd. vét. Pays. Trop., 24: 667

The crossbreds are also said to be better for milk production, particularly on account of earlier sexual maturity.

On the relationship of horn form and performance we have only the suggestion that animals with inflated horns have a poorer longevity and that cows with no horns or floating horns are better milkers. This opens up fascinating fields for speculation and research. For instance, when and why were these strange horns selected in the first place?

Action which should be taken

It is clear that more information is needed on the above points but without doubt this can only be obtained from an experimental herd or herds where breeding can be controlled. At the same time a selection programme can be instituted in this herd which will thus become a source of improved bulls for use in the breeders' herds. Thus the purity of the breed will be maintained for the sake of its own productivity and as a source of animals for crossbreeding. Dr. Renard's project to achieve these ends is discussed below.

The breed should also be studied in its natural habitat in the herds of the breeders. This would involve: a) A census of numbers; it might be possible to use the technique of aerial photography for this purpose. b) A detailed description of a sample of 5-10% of the herds well distributed in different parts of the lake. In these, each animal would be described in terms of age, sex, coat colour, pattern, pigmentation of skin, conformation (especially trace of hump), chignon, horn size and shape.

c) Information in regard to season of calving, fertility of cows (calving interval), mortality of calves, criteria for choice of bulls, origin of bulls (home-bred or bought in), opinions on horn form and its inheritance, opinions on coat colour and its inheritance.

This would involve an investigator working in the field for at least 6 months. He would need to know the language or have an efficient interpreter. He might be helped initially by an experienced field anthropologist.

It is understood that FAC is financing such an investigation which was due to start at the end of 1974. However it would be highly desirable that the formation of a nucleus herd should not await the results of the census. Indeed, as Dr. Renard points out, the investigator making the census could profitably assist in choosing the cows and bulls for the nucleus herd.

The LCBC project

This is an extremely comprehensive and well thought out plan which will enable the breed to be preserved, studied, improved and extended. It has the great merit that the animals in the nucleus herd(s) will be maintained on natural pasture and therefore their adaptation will be retained while they are selected for improved performance. One or two modifications in the breeding programme are suggested as follows:

a) In choosing the foundation animals too much emphasis should not be placed on obtaining only animals of "pure Kuri type". Certainly the largest animals with the best beef conformation should be chosen and any with the least trace of hump should be rigidly excluded. Coat colour should be restricted as far as possible to white, grey and isabella - but it may be necessary to accept some coloured animals in order to include a rare horn shape. The V-shaped chignon and pigmented mucosa (not necessarily black) would be desirable but not indispensable. All horn types within the Kuri range should be included e.g. buoy-shaped, inflated, open crescent, lyre-shaped, thick base, even hornless. With this range it should be possible to establish any relationship between horn type on the one hand and milk production, growth rate, fertility and longevity on the other. It should also be possible to learn something of the inheritance of horn type.

b) Centre and stations Instead of a selection centre and three multiplication stations it would be better to think in terms of two selection centres, one in Chad and one in Niger. Multiplication centres could be added later if necessary. This will avoid the danger that the

breed might in future be based on a single herd. It is unlikely that this would in fact happen but it is important also not to give the impression that it would be desirable. Also there may be different types in the two countries.

c) Number and use of males Bulls should be selected on the basis of their own conformation and growth rate; a progeny test should not be attempted. It is not necessary for growth rate and, with the numbers envisaged (i.e. only 7 daughters per bull), it will be very inaccurate for milk yield. To obtain a wide selection of bulls at the start and to guard against subsequent inbreeding twice as many bulls should be used per annum as envisaged in the plan i.e. 10 instead of 5 for the herd of 200 females. This would mean 1 bull per 20 females, each bull being used for only one year. The bulls will be bred out of the best cows and will be chosen as the fastest growers.

This quick turnover should give a more rapid rate of genetic improvement than waiting for the result of the progeny test. Nevertheless the cows should be kept in single-bull herds in order to know the paternity of calves born. (Detection of heat is presumably so difficult that it would not be practicable to run all cows together and use hand service on those in heat).

At equilibrium there will thus be 10 herds each with a bull. After one year 9 bulls will be sold and the best one kept as control as in the plan. The 8 best young bulls will be taken into service and the tenth herd will be headed by a bull bought in from the field. (Each year one outstanding bull will be thus bought in). Thus instead of there being 13 adult bulls on the centre at any one time of which 5 are in use and 8 are awaiting progeny test, there will be 10 - all in use. Buying in one bull each year will guard against the concentration of the breed on a single herd and will eventually be a measure, by comparison of his progeny, of the genetic improvement being achieved in the herd.

d) Selection criteria Section III of the Appendix is very satisfactory. It is most important that the major emphasis be placed on growth rate in both sexes and on milk yield (estimated from growth rate of suckled calves) in females. As in the choice of the original stock, off-colours may be discarded (for aesthetic reasons) and certainly any trace of hump should be selected against. But preconceptions regarding the "correct" horn shape of the true Kuri should be avoided.

e) Data to record The suggestions made in Section IV of the Appendix are extremely exhaustive. If all the measurements are taken at the frequency suggested a great deal of work is involved and vast numbers of figures for analysis will accumulate. The observations might well be reduced by half or more. Tentative suggestions are: monthly weighing up to one year of age, then 3 monthly weighing up to 2 years, 6 monthly up to 3 years and annual weighing thereafter. The body measurements would be made at 6 months, 12 months and then annually.

f) Herd development and collection Section V of the Appendix would now read as follows:

Year 1	-	formation of 3 herds each with 17 cows and 1 bull
" 2	"	" 5 " " " 20 " 1 bull
" 3	"	" 7 " " " 20 " 1 bull
" 4	"	" 10 " " " 20 " 1 bull
" 5	-	heifers born in year 2 distributed among the herds to replace cull cows. Use 8 best bulls born in year 2. Keep best bull from year 4 as control. Sell 9 bulls used in year 4. Buy in one bull.
" 6	-	Distribute 20 heifers born in year 3 among 10 herds and cull 20 cows. Use 8 best bulls born in year 3. Keep best bull used in year 5 and sell 9. Buy in 1 bull.
" 7	-	Distribute 28 heifers born in year 4 and cull 28 cows. Used 8 best bulls born in year 4. Keep best of bulls used in year 6 and sell 9. Buy in one bull.
" 8	-	same thing
" 9	-	" "

The place of UNEP

Until the report of the FAC census is known it is impossible to affirm the exact status of the breed. It is a breed of great scientific and economic interest about which our knowledge is all too little. The economic exploitation and improvement of the breed is not the primary concern of UNEP but it is to be hoped that it will be vigorously pursued by LCBC and by the national governments concerned with the aid of UNDP.

On the status of the breed in respect of numbers and purity we urgently need more information and, hopefully, that will soon be forthcoming.

However, UNEP might be interested in one aspect of the breed which has received much publicity - namely its quite extraordinary horn shape. This characteristic puts it into the category of a natural curiosity - or more specifically a unique human production. The most bizarre horn forms are rare and, as selection turns more and more towards economic characteristics, they will become rarer.

It is therefore recommended that UNEP support the formation of a small herd of this special variety of Kuri. It could start with 50 females and 5 bulls chosen for their inflated, buoy-shaped or extremely thick horns without regard to colour. This herd would give information on the genetics of horn form and its correlation with productivity. It would also produce pure-bred Kuris for those interested primarily in appearance.

The herd should be formed as a matter of urgency while suitable specimens are still available. This means that it should be located in a place where already there are facilities. This would suggest one of the following three sites. At Koundoul (25 km south of N'Djamena) LCBC has a small farm growing Pennisetum purpureum under irrigation. A matter of 3 ha should be sufficient to feed the 55 animals which would be kept in yards. Similar conditions would be available at Bol on the SODELAC station. The latter location would have the advantage of being within the natural habitat of the breed but it is not easily accessible from N'Djamena. A third possible site would be on the southern edge of the Lake at Karal. This is the headquarters of the Assalé sector of the Assalé-Serbewel Project of FAO/LCBC and only 130 km from N'Djamena.

As soon as possible this first herd should be followed by one in Niger in the region of Nguigmi which will shortly be connected to Nigeria by a metalled road. These herds would eventually become part of the LCBC project and be transferred to their centres when these are functioning. The animals could then be kept on pasture in their natural environments instead of being in yards.

If it were suitably located such a herd could easily become a tourist attraction - nowhere else in the world can such animals be seen. If it could be isolated and maintained disease free it might be possible to export animals to zoological gardens in Europe many of which keep exotic domestic breeds as well as wild animals.

These herds would, at least until the larger project got going, be under the control of a zootechnician who would collect the animals, organize the breeding programme and maintain the records. He could also cooperate in the field study of the Kuri breed.

Furthermore he would be well placed to study other breeds in West Africa whose status is uncertain (e.g. Dwarf Shorthorn and its many varieties, Namji cattle, forest ponies, Macina sheep). This would link his work with the cataloguing of rare and disappearing breeds of livestock which is being undertaken for Europe, the Mediterranean basin and the Near East. West Africa would be the next step.

Costing of UNEP project over 4 years 250 F CFA = 1\$ US

<u>Personnel</u> (over 4 years)	<u>External aid</u>	<u>LCBC</u>
	US \$	US \$
1 project director - expatriate animal breeder (30 000 \$ x 4)	120 000	
1 codirector - counterpart (15 000 \$ x 4)....		60 000
2 livestock officers (2 500 \$ x 2 x 4)		20 000
1 mechanic (3 000 \$ x 4)		12 000
1 driver (1 200 \$ x 4)		4 800
4 cattlemen (400 \$ x 4 x 4)		6 400
10 labourers (350 \$ x 4 x 10)		14 000
TOTAL PERSONNEL	120 000	117 200
<u>Investments</u>		
Purchase of foundation stock (50 females, 5 males) (55 x 80 \$)		4 400
Transport of animals (55 x 20\$)		1 100
Buildings: Project director's house with office, water, electricity and furniture	60 000	
Housing for livestock officers and mechanic (3 x 4 000\$)		12 000
Housing for lower grades		5 000
Fencing	20 000	
Pump (200 m ³ /h)	6 000	
Drinking troughs	1 200	
Cattle shelter	2 000	
Equipment: 1 station wagon (Land Rover)	10 000	
1 tractor (40 HP with trailer and plough)	10 000	
1 inflatable boat and engine	6 000	
Husbandry and veterinary items	6 000	
Various medicaments	4 000	
TOTAL INVESTMENTS	125 200	22 500
<u>Maintenance</u> (over 4 years)		
Maintaining furniture and equipment	2 500	2 500
Vehicles, boat and engines	15 000	15 000
Pump, electric installations	10 000	10 000
TOTAL RUNNING COST	27 500	27 500
Total Personnel + Investments + Maintenance	272 700	167 200
Miscellaneous and contingencies	27 300	16 800
TOTAL PROJECT	300 000	184 000

This is the cost of establishing and maintaining a single herd. Obviously, for two herds, the figures must be doubled.

List of people and places visited

Lake Chad Basin Commission (LCBC)

Dr. Renard (Animal Husbandry Expert)
Dr. N'Gaba
M. Toupou M'Fouapou

FAO and UNDP

M. Bonnevie (UNDP Resident Representative)
M. Boccar Ly (SAA/FAO Country Representative)
Dr. Crouail (Project RAF/71/268 FAO/UNDP)
Dr. Lépissier (Project CHD/72/007 FAO/UNDP)

Veterinary research laboratory at Farcha

Dr. Provost (Director)
Dr. Quéval
Dr. Tacher

Direction de l'Élevage, Ministère de l'Agriculture, Gouvernement du Tchad

Dr. Touadé (Director)
Dr. Mamadou (at the slaughter house)

Visits to:

Cattle markets at Massakory and Gredaya
Matafo experimental station (SODELAC)
Koundoul feed lot (LCBC)
Several herds on islands in the lake

VARIOUS OTHER CONTACTS MADE WITHIN THE SCOPE OF THE PROJECT

by J.J. Lauvergne

A. Archaeozoological Conference, Groningen, 22-26 April 1974

This conference was organized by the scientists of the Institute of Biological Archaeology of Groningen, especially by Dr. Clason. The business of the hundred participants was to try to reconstruct the first stages in the utilization of animals by man - hunting, fishing and domestication. Because the main sources of information are the remains of animals found in the neighbourhood of ancient dwelling places, the accent is placed on excavation techniques and on the analysis of bones. The concerns of the archaeo-zoologists thus join those of the husbandmen who want to discover the origins of their own techniques. Great importance is placed on the conservation of relic herds which represent a stage in domestication. During the conference a visit was organized to the excavations of a neolithic village at Swifterbant in the N.E.polder of the Ysselmeer, and to a farm near Ruine in the province of Drenthe where a flock of the ancient breed of Heath sheep grazes the heather - the Drentse heideschaap.

B. International Union for the Conservation of Nature and Natural Resources (IUCN), 1110 Morges, Switzerland

Person contacted: C.W. Holloway, ecologist; visit 11 July 1974.

Founded in 1948 IUCN is an independent international organization which works through six commissions of which one is devoted to threatened wild species and comprises twenty groups of experts, one for each species, mostly animals and, in particular, the wild Bovidae: the tamarao (Bubalus mindorensis) of the Philippines, the kou-prey (Bibos sauveli) of Cambodia, the markhor (Capra falconeri) of Afghanistan, the urial (Ovis vignei) and the Marco Polo sheep of Central Asia, and the ibex and mouflon of Europe. Up till now there have been practically no contacts between the specialists on wild species and those who study the domestic breeds deriving from them. In regions where the wild and the domestic forms still coexist there could be very fruitful collaboration between specialists. Most importantly, the laboratories working on the genetics of domestic animals, on chromosome studies and on biochemistry have a present potential much greater than that of laboratories attached to the various museums of natural history.

IUCN is also publishing a Red Data Book of species, starting with mammals, which are in danger.

C. UNESCO - Division of Ecological Sciences, Place de Fontenay, 75007 Paris

Persons contacted: Drs. Celecia and U.C. Gilbert; visit 23 July 1974

The International Biological Programme (IBP) of UNESCO was completed in 1974 but, from 1970 its work has been taken over by another programme called Man and Biosphere (MAB), whose secretariat is provided by UNESCO. MAB collaborates with a number of international organizations and is supported financially by UNEP. Thirteen projects have been carried on by the council of MAB of which one, no. 8, concerns us particularly: Conservation of natural areas and of the genetic material they contain. The present tendency is towards setting up reserves (Report No. 22 of MAB - Task force on criteria and guidelines for the choice and establishment of biosphere reserves). Zones which one would like to see protected in this way would certainly include the varied and harmonious agricultural landscapes created by hundreds of years of human occupation. Of equal interest would be areas degraded by ancient human activity, such as mining, deforestation, overgrazing, in order to study the possibilities of bringing

them back into good condition.

These two aspects - conservation and reclamation - require the use of domestic animals of traditional type. The expert panel on Project 8 submitted its report (No 12) in September 1973. It is now planned to form working groups. Experts conversant with the present UNEP/FAO project should undoubtedly participate in these.

D. Laboratories for animal genetics

In the time allowed for the consultancy and bearing in mind the importance of concentrating on the main subject of the project, visits to laboratories could be made only occasionally. The purpose of these visits was to explore the possibilities of departments of karyology, serology, genetic polymorphism, certain metabolisms and population genetics forming an international network for the purpose of making coordinated studies on the fundamental genetics of domestic animals and their wild relatives.

FRANCE

Département de génétique animale, INRA, 78350 Jouy-en-Josas

- Laboratoire de génétique biochimique - F. Grosclaude
- Laboratoire de génétique factorielle (Unité de caryologie) - P. Popescu

Unité de génétique humaine, Institut national d'études démographiques, 27 rue du Commandeur, 75675 Paris Cedex 14 - A. Jacquard, J.M. Lalouel

ITALY

Istituto chimica organica e biologica, Università di Napoli, Via Mezzocanone 16, Naples - G. Prota (metabolism of melanins)

Laboratorio di ricerche sull'adattamento all'ambiente degli animali in produzione zootecnica del Consiglio Nazionale delle Ricerche, Portici - T.M. Bettini, D. Iannelli and P. Masina (blood groups and milk protein polymorphisms)

Istituto di Zooteconia generale, Facoltà di Agraria, Via Celoria 2, Università di Milano, Milan - G. Curto, G. Succi, M. Rognoni (blood groups, karyology unit imminent)

SWITZERLAND

Laboratoire de sérologie, Chaire de Zootechnie, Ecole Vétérinaire, Bremgartenstrasse 110a, Berne - W. Weber

E. First World Congress on Genetics applied to Livestock Production, Madrid, 7 - 11 October 1974

This congress, the first of its kind, was organized by a team directed by Professor de Cuenca with the scientific cooperation of the International Veterinary Association for Animal Production, the European Association for Animal Production, the World Veterinary Association and the World Association for Animal Production.

More than 600 people attended the congress. All the genetic disciplines which concern domestic animals were discussed as well as the fundamental bases (cytogenetics, polymorphism, genes with visible effects, genetic models with laboratory animals). Sessions were devoted to each livestock species and to special aspects like disease resistance. The subject of the conservation of breeds in process of disappearing was discussed at a round table organized by the FAO Animal Breeding Officer. This meeting was the occasion for making many contacts and for emphasizing the fact that much basic genetic and zootechnical information about domestic species is lacking.