DENMARK'S Country Report on Farm Animal Genetic Resources

Ministry of Food, Agriculture and Fisheries
Danish Institute of Agricultural Sciences

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Foreword

The FAO Committee for Genetic Resources decided in 1999 to make a total assessment of the animal genetic resources of the world. The object is to produce one "State of the World Report on Animal Genetic Resources", based on national reports – the so-called Country Reports. Generally, these shall describe the national conditions concerning the utilization and the conservation of the domestic animal genetic resources.

In May 2001 the Ministry of Food asked the Danish Institute of Agricultural Sciences to preside the work to produce Denmark's Country Report. The Mandate stipulates to have the country report made by an ad hoc work group with the participation of representatives from the Committee for the Management of Farm Animal Genetic Resources, the Ministry of Food, The Agricultural Industry, Conservation Associations, the Ministry of Culture and the Ministry of Environment. Danish Institute of Agricultural Science asked the above ministries, organizations and associations to appoint members for the said work group.

The Department of the Ministry of Food took part in the work group until August 2002, initially represented by Mr. Tom Damgaard Kristensen, Head of Section, from spring 2002 until August 2002 represented by Ms. Henriette Oldager, Head of Section. The Ministry of Culture was represented by Mr. Peter Baunshøj, Museum Director of the Danish Agricultural Museum, The Ministry of Environment by Mr. Hans Erik Svart, Biologist of the Forestry and Wildlife Administration, and Agricultural Industry by Mr. Erik Ørnbjerg Johansen, National Consultant. The Conservation Associations Danish Livestock Breeders and Association for Old Breeds were represented by Mr. Jens Skov and Mr. Leo Kortegaard, and the Genetic Resources Committee by Mr. Frank Vigh-Larsen, Senior Scientist and Mr. Torkild Liboriusen, Senior Scientist. Mr. Frank Vigh-Larsen was chairman as well as secretary until 1 July 2002, when he resigned for a planned leave. Mr. Poul Sørensen, Professor of Danish Institute of Agricultural Sciences, took over the job as chairman for the Committee, and Mr. Torkild Liboriusen took over the job as secretary.

The work group has been gathered for 4 meetings. As instructed by FAO the data material has been collected and analysed to serve as background material for the preparation of the report. This material has been gathered in an Appendix to this Report.

The Committee of Genetic Resources has had the opportunity to comment on the draft to the report as well as on the appendix. The work group would hereby thank for all comments and proposed amendments.

Foulum d. 03.04.2003

Poul Sørensen, Chairman
Summary

Denmark is situated in Northern Europe, is a member of EU, and is the most southern of the Nordic countries. The coastal climate gives relatively mild winters, and the highest point of the country is 173 m above sea level. Denmark has 5,333 million inhabitants with a high living standard.

About 61% of the area are brought under cultivation. The number of agricultural farms has been heavily reduced during the latest 30 years by farm uniting and discontinuation. In 1999 there were 57,831 registered farms. At the same time a heavy specialization of each farm has taken place. Part-time farming has usual, and only 41% of the owners are fully occupied with farming. The size of the animal husbandry is big in relation to the size of the country and the number of inhabitants. The export value of the animal husbandry production constitutes about 10% of the total Danish export income.

The major productions as to commercial significance are: pork, milk, beef, veal, broilers, fur and eggs. The production has been concentrated on big units, and is intensive with high inputs and outputs. The breeds applied have high productivity under intensive production conditions.

Horses, beef cattle, sheep, goats, rabbits and hobby breeds of poultry are especially kept by part-time, leisure-time and hobby farmers using many different breeds. Breeders of old Danish domestic animals are mainly found among these categories of animal husbandry.

Horses, beef cattle, pigs, sheep, goats, fur, rabbits, turkeys, geese, ducks and hens are represented by various breeds or breeding lines. The old Danish breeds include 3 horse breeds, 4 cattle breeds, 1 sheep breed, 1 goat breed, 2 pig breeds, 1 rabbit breed, 1 goose breed, 1 duck breed and 1 hen breed. During the 1970's the interest for conserving old national breeds was awaken in Denmark. The old breeds were strongly threatened because of crossing with other breeds, or because the previous field of utilization disappeared. In 2002 the condition of conservation is still critical for almost all old Danish breeds, but the decrease in number of purebred animals and breeders have stopped, and a small increase in the size of population might be expected during the years to come.
Since 1986 the Danish Government has had a national strategy to conserve genetic farm animal resources. The Ministry of Food, Agriculture and Fisheries has the superior responsibility. To carry out this national strategy the Ministry has appointed the Committee for the Management of Farm Animal Genetic Resources (Genetic Resources Committee).

Among other things the Genetic Resources Committee has registered breeders and breeding animals of the old national domestic animals and established semen banks for horses, cattle, pigs and sheep. During the latest 5 years the Genetic Resources Committee has had an annual budget of DKK 1.5 million. About half of this amount has been paid to breeders as animal subsidy.

The Government approved museums with livestock of farm animals as well as private conservation and visit centres are making a very big effort to intensify the conservation work, both by taking part in the breeding work with old breeds, and by spreading the knowledge about this topic. Private persons own the vast majority of the stocks of old breeds, and their commitment in the conservation work has been – and will continue to be – of a fundamental significance to in situ conservation of old breeds. Furthermore, breeders and users of old farm animal breeds have established breed societies, breeders associations and interest groups all taking part in the debate on the conservation of farm animal genetic resources.

The farm animals used in the intensive animal husbandry in Denmark have been developed from the old national breeds by crossing with breeding material from other breeds, or they have been produced from imported breeding material. As to dairy cattle and pigs insemination is widely used in both breeding herds and production herds. The intensive use of only a few bull sires in dairy cattle AI-breeding programmes has led to inbreeding. However carriers of letal-genes have been identified due to a systematic pedigree recording and relevant countermeasures have been implemented.

The consumption of animal food in the developed part of the world is not expected to increase in the years to come. There are, however, expectations that there will be a growing demand for special products, and that the consumers will show more interest in production methods. Genetic diversity may contribute to a varied offer of animal raw material to support the special products and thus contribute to a susstaniable animal production. The old breeds may have some qualities to be utilized in the commercial production.

In future, it is expected that regular grazing will give recreational value to more marginal geographical areas in Denmark. The use of old Danish breeds of horses, cattle, sheep and goats for grazing of meadows and moors might add a culture-historical dimension to the nature conservation, and the old breeds might be suitable for that purpose.
Direct economic aid as animal subsidy to the breeders is necessary for maintaining living populations of old breeds due to the expensive costs by keeping each animal. Storage of genetic material as germ cells should be used as a supplement to the conservation of living populations of the endangered old breeds. The commercial breeding programmes should also conserve semen banks for all species where cryo conservation is possible. It is recommended to involve the breeders and their organizations in the conservation plans. Finally, further information and research is necessary to determine the characteristics and qualities of the old breeds in relation to the modern breeds.

Internationally Denmark participates in the implementation of the FAO strategy for the conservation and utilization of the farm animal genetic resources. At the regional level Denmark cooperates with Nordic Gene Bank for Livestock (NGH) on solving the common problems in relation to the Nordic countries. Danish development projects for enhancing livestock production in less developed countries do consider the potentials of locally adapted breeds.
1. Description of the State of Agricultural Biodiversity in the Agricultural Sector

This chapter starts with a short introduction to Denmark, the Danish population, the country's animal husbandry and the economic major animal production systems. Subsequently will be given a presentation of the country's farm animal genetic resources distinguishing between 1) the old Danish farm animal breeds and 2) other livestock breeds. Furthermore a presentation of the major actors in the work to conserve and utilize both the old Danish farm animal breeds as well as other breeds with an assessment of their achievements until today. Finally, the most important and most critical areas as to conservation and utilization of the genetic resources of both the old endangered breeds and other breeds of livestock are identified.

1.1 Denmark, the Danes and their Agriculture and Animal Husbandry

Denmark is situated in Northern Europe, centered around 56°N and 10°E. The total area is 43,100 km². The biggest province is the peninsular Jutland bordering Germany in the south. The remaining part of the country is made up by islands, of which Sealand and Funen are the biggest. Copenhagen is the capital (see appendix 1, map of Denmark).

The coastal climate gives relatively mild winters and chilly summers. The coldest month is January with an average temperature of -0.9°C. The hottest month is August with an average temperature of 15.7°C. During the period 1961-1990 there were on average 84.0 days per year with a temperature under zero. The annual amount of precipitation is on average 712 mm, varying from about 550 to 850 mm per year within the country. The potential evaporation is about 450 mm per year. The highest point of the country is 173 m above sea level, and almost all areas are suitable for cultivation.

The number of inhabitants is 5,333 million. In spite of the low birth rate there is a slow increase of the population because of a net immigration. The gross national product (GNP) is DKK 228,000 (about US$ 32,500 per capita (year 2000). The infrastructure is well developed. Since 1972 Denmark has been a member of the EU. As to language and culture Denmark is closely connected to the other Nordic countries.

About 20% of the population live in the Copenhagen area, and 48% live in the country or in small towns with less than 10,000 inhabitants. Small towns, villages and farms are spread in the countryside dominated by cultivated fields.
1.1.1 Danish Agriculture

About 61% of the area are under cultivation, and the major cash crops are grain (wheat and barley primarily used for forage to domestic farm animal production), sugar beets, rape, grass seeds and peas. The major forage crops are grass and green maize for ensilage. The forest area is about 11.3%. Fresh meadows, coastal regions, moors and commons total up to about 250,000 ha, equivalent to 5.9% of the total area of the country. About half of these areas is used for pasturing.

In 1999 there were 57,831 registered farms, 34,700 of these having livestock. In 1970 there were 148,512 farms. This change of the Danish agricultural structure towards bigger and fewer farms has been going on since the 1950s with the result of many disused farms with more or less old-fashioned buildings and production plants. With the continuous uniting of farms many of the present farms may be closed down in 10 years. The average age of the farmers is 51, and 10% of all farms are managed by persons over 70. In almost all farms (95%) the manager and his family have the right to use the farm, also being their home. The manager works full-time (at least 37 hours a week) in 41% of the farms. 31% of the farms have hired help. In 33% of the farms the spouse is assisting in the daily work. Part-time farming has become very usual, and in 29% of the farms the manager works less than 9 hours a week on the farm.

The animal production in Denmark is great in relation to the size and population of the country. The gross income from livestock was in 1999 US$ 4,433 million ex farm, and the export of animal food reached a total of US$ 4,807 million, equivalent to 10% of the Danish export. The primary agricultural production employs about 2.7% of the Danish labour force. Further 1.2% is employed in the animal food industry (slaughterhouses and dairies). The socio-economic significance of the animal husbandry is still substantial although it has declined considerably.

1.1.2 Production Systems

The major products of commercial significance are: Pork, milk, beef, veal, broilers, fur and eggs.
1.1.2.1 Intensive Commercial Animal Husbandry

The vast majority of the country's production of milk, pork, broilers, eggs and fur is produced in high input production systems. The average size of the dairy herds has doubled in the latest 10 years. The pig production has furthermore experienced a substantial expansion.

1.1.2.2 Part-time, Leisure-time and Hobby Breeders

Beef cattle, horses, sheep, goats, rabbits, ducks, geese, turkeys, ostriches and deer are mainly kept by part-time, leisure-time and hobby breeders. There are a number of enterprises with industrialised production (especially beef cattle, turkeys and ducks) but most herds are small with medium or low input of investments.

Part-time, leisure-time and hobby breeders keep many different breeds. They therefore constitute a target group in relation to conservation and utilization of farm animal genetic resources. The keeping of livestock constitutes an important recreational value to many people. Furthermore, grazing cattle, horses, sheep and goats have an effect on environment and scenery, which is highly appreciated by many people, and this aspect of animal husbandry is essential when assessing its significance to the Danish society.

1.1.3 Species, Breeds and Breeding Programmes

There is a representation of (at least) 24 cattle, 29 horse, 17 sheep, 4 goat, 6 pig and almost 180 poultry breeds in Denmark. Among these, however, only 5 cattle, 3 horse, 2 sheep, 1 goat, 2 pig, 1 rabbit, 1 poultry, 1 goose and 1 duck breed have been recognized as national Danish breeds (for further details confer with DAD-IS).

1.1.3.1 Dairy cattle

The major dairy breeds are the Danish Black and White Cattle (SDM-Danish Holstein), Danish Red Cattle (RDM), Danish Jersey (DJ) and Danish Red Holstein (DRH). From 1990 the dairy cattle population has decreased from 753,114 to 635,519 (year 2000). During the same period the number of dairy herds have decreased from 21,935 to 10,327, and the number of cows per herd has almost doubled. The mean herd size is now 61.5 cows (2001).

Milk recording is practised in almost all herds, and a linear conformation scoring system is applied on daughter groups of all AI-bulls. Fertility data are also available from the AI-program. Resistance to mastitis is calculated from somatic cell count of individual cows and
from registration of individual treatments of mastitis. All data are collected in the Cattle Database, which forms a basis for the calculation of individual breeding values. Furthermore, various users' programmes have been developed to extract information from the Cattle Database for e.g. management, feeding instructions, breeding planning at herd level. About 90% of the female animals in the dairy cattle livestock are being inseminated. Approximately 60 RDM-, 400 SDM-, 80 DJ- and 10 DRH-bulls are tested annually in the national AI-breeding programme. The AI-breeding programme is operated by Danish Cattle Breeding, cooperative owned by the users of the AI-programme, i.e. mainly dairy farmers. The selection of AI-bulls is based on an index (Total Merit Index) including: Yield, quality of udders and limbs, fertility, calving ease, calving mortality, resistance to mastitis and resistance to "other" diseases.

The Danish breeding goals for dairy breeds have many resemblances to the universal demands to dairy breeds all over the world when used in intensive production systems. However, by the weighting of the characteristics included in the TME-index each breed society tries to adapt its breed as much as possible to the expected future production conditions for Danish dairy cattle livestock. Through Denmark's membership of INTERBULL the Danish dairy cattle breeds are part of a global network thus making it possible to compare breeding bulls from various countries. By the selection of foreign bull sires attempts have been made to find bulls meeting the demands of the Danish breeding goals in the best possible way. In 2001 the Nordic cattle breeder’s organizations started to cooperate on e.g. testing of young bulls across national borders.

1.1.3.2 Beef cattle

Limousine, Simmental, Charolais, Aberdeen Angus and Hereford are the most widespread beef breeds. Out of a total of 11,576 herds with suckler cows in year 2000 a number of 2,779 equivalent to about 25% had joined the nationwide programme of registration of calving difficulties, birth weight, and calves' weight after 200 and 365 days. These data form - together with the reports from the slaughterhouses of each animal's slaughter weight and slaughter quality – a basis for the calculation of each animal's breeding value. Furthermore, there is a central performance test station to select potential breeding bulls of beef breeds. Here about 200 potential young bulls are tested every year for growth rate, feed utilization and fleshiness. The commercial beef production based on suckler herds is mainly based on cross-breeding. Concentration on fewer breeds might result in higher rates of genetic gain, but the easy access
to several breeds puts the producers in the best possible position to utilize the diversity of the breeds by cross-breeding.

1.1.3.3 Pigs

The Danish pig population is big and has experienced a substantial increase during the latest 10-20 years. In 2000 there were 1,083,192 sows in 7699 herds. The pig producers have often specialized in either a production of piglets or a production of slaughter pigs having bought the piglets. In 2000 there were 10,987 herds of slaughter pigs, and they totally produced about 21 million pigs to be slaughtered and processed in Denmark. Furthermore, about 1.5 million piglets were exported for fattening in other EU-countries (primarily Germany).

The production of pigs is mainly based on cross-bred animals, and the genetic material comes from the breeds: Danish Landrace, Yorkshire, Duroc and Hampshire. The breeding goals for each breed are different but include both production characteristics as well as functional traits. The National Committee for Pig Production is responsible for the nationwide breeding programme including the use of insemination of fresh boar semen (the KS-programme). The breeding activitiees is concentrated on about 50 breeding centres practicing pure-breeding with Landrace, Yorkshire, Duroc and / or Hampshire. The breeding centres report continuously their reproduction and production data for each breeding animal to a central database. Male piglets with high pedigree indicies are tested on growth rate and fleshiness (scanning) at the Danish Slaughterhouses Performance Test Station. The highest ranking performance tested boars are selected for the KS-programme, and the breeding centres are the first in line to use the semen from new boars. Between 100 and 200 boars of each breed are used annually in the breeding centres. The utility period for KS-boars is 5 - 8 months, but after 1-2 months the boars are mainly used in commercial crossbreeding.

The British breeding company, PIC (Pig Improvement Company) has established breeding and production herds in Denmark, and is responsible for about 10% of supplies of the breeding animals and boar semen.

1.1.3.4 Sheep

Although the production of lambs and wool is rather modest there are 17 different breed societies for sheep in Denmark. Most of the breeds are internationally known and imported to Denmark during the latest 30-50 years. The breeders associations for the breeds Oxforddown, Shropshire, Leicester, Texel and Dorset have breeding plans to improve the growth rate and
carcass quality. Many of those breeders are reporting reproduction and production data for each animal to the central Goat and Sheep Registration (GEFA). These data form – together with reports from the slaughterhouses about weight and quality of the carcass – the basis for calculation of individual breeding values. A central performance test station for potential breeding rams has been abandoned for economic reasons.

1.1.3.5 Horses

The major breeding association is Danish Warmblood aiming at producing saddle horses suitable for both spring and dressage riding. Among other things each horse is subject to a breeding value assessment based on individual achievements, assessment of progeny and the progeny's achievements. The population of Danish Warmblood is a synthetic breed with genetic contributions from various European saddle horse breeds and thoroughbred horses. During the latest decades the insemination with fresh semen has been widespread within Danish Warmblood. Danish Trotting Horse breeding is substantial and especially based on the selection of breeding animals after achievements in trotting races, and on insemination of imported semen. The social significance of horse breeding is especially attached to the recreational values of horses. Having about 70,000 members the Danish Equestrian Federation is one of the major Danish sports associations.

1.1.3.6 Fur

Denmark has large mink and fox industries. Danish mink producers maintain about 2 million breeding animals that produce approximately 11 million pelts per year. By comparison, the fox producers maintain 11,000 breeding animals that produce approximately 46 pelts per year.

The Danish Association of Fur Farmers currently has 2500 members and runs its own research and experiments, and publish hit lists for producers of the various colour varieties. The scores on these lists are indexies calculated from the size and quality of the pelts delivered from each farm to the central pelt auktions. The hit lists are used when breeders and producers buy new breeding material (mainly males). Import of genetic material is not often seen. The Danish Association of Fur Farmers also maintains small populations of various colour mutants not used in the current production as a gene bank.
1.1.3.7 Goats

The herd of goats in Denmark is mainly a leisure-time interest. There are 5 different goat breeds in the country, 3 of them have been imported to Denmark within the latest 25 years. Many breeders have joined the Goat and Sheep Registration and there are efforts to estimate individual breeding values.

1.1.3.8 Poultry

The intensive production systems only use animals produced from parent stock imported as day-old chickens from multinational breeding companies. These parent animals are always two-breed crosses produced on the basis of breeding stocks placed geographically in consideration of transport, veterinary rules and regional climatic conditions. One of these international breeding companies has breeding stocks of egg layers, and another has breeding stocks for the production of broilers placed in Denmark. However, the Danish producers have no influence at all on the breeding policy of these companies.

A small private breeding center in Northern Jutland – The Hellevad hatchery – runs an independent breeding programme with White Leghorn and New Hampshire with an annual production of about 50,000 day-old chickens. They are mainly sold to small producers and have been found suitable for the egg production on freerange. At the Danish Institute of Agricultural Sciences a current research and development project is aiming at breeding egg layers especially suitable for the egg production outside cages.

There is a huge interest for poultry breeding as a leisure-time work, and the Danish Association for Poultry-Breeding has registered about 140 different poultry breeds, 21 duck breeds, 12 goose breeds and 8 turkey breeds. Socio-economically these hobby breeds are of no significance, but they represent a big genetic diversity. Furthermore, because this hobby poultry breeding is of a considerable dimension, it has a substantial recreational significance.

1.2 Assessment of the State of Conservation of Farm Animal Genetic Diversity

The interest for conserving the farm animal genetic resources was raised in the early 1970s. Several of the old farm animal breeds were almost extinct, and the motivation was especially the culture historical aspect to conserve the living populations of old national breeds. Denmark has ratified the Convention on Biological Diversity from 1992 (the Rio-convention),
and has thereby an obligation to protect and make efforts to conserve the country's biological diversity, including the farm animal genetic resources.

1.2.1 The Actors

The superior national responsibility for the management of farm animal genetic resources has been placed in the Ministry of Food, Agriculture and Fisheries (The Ministry of Food). In 1985 the existing ministry of agriculture set up the Danish Committee for the Management of Farm Animal Genetic Resources (i.e. the Genetic Resources Committee). The work of this committee was to "assist in the conservation of the genetic resources of Danish farm livestock with a view to securing biological diversity, our cultural and historical inheritance, and the traditional landscape". The Genetic Resources Committee has since then undertaken the public interest in relation to the conservation and utilization of Denmark's Farm Animal Resources. In the period 1996-2002 the Genetic Resources Committee has annually spent about DKK 1.5 million to cover its activities. About half of this amount has been paid to breeders of old Danish farm animal breeds.

1.2.1.1 The old breeds

Besides the Genetic Resources Committee there are other actors working in the conservation of living populations of the old farm animal breeds. They are as follows:

- Accredited museums with livestock of old breeds.
- Breeders associations for each breed.
- Interest groups for breeders etc.
- Conservation and visit centres for old Danish farm animal breeds.

The Ministry of Food supports four privately owned conservation and visit centers for old Danish farm animal breeds by up to DKK 2 million annually.

1.2.1.2 Other breeds

Breeders associations for each breed are responsible for operating breeding programmes for all other breeds than those that have been declared as endangered old Danish breeds.
1.2.2 Activity

In 1996 Genetic Resources Committee developed a "Strategy for Conserving the Farm Animal Genetic Resources" (1997-2001). The strategy incorporated the 4 following main areas of input:

1. Development of breeding plans for the old breeds.
2. Improvement of existing gene bank.
3. Coordination and information
4. Research and development

1.2.2.1 The old breeds

The conservation of living populations. The Genetic Resources Committee has made a big effort to stop the decrease in number of animals of old national breeds. The effort has been concentrated on the registration of the populations of: Jutland Horse, Frederiksborg Horse, Knabstrupper Horse, Jutland Cattle, Danish Red Cattle anno 1970 (RDM-1970), Black and White Cattle anno 1965 (SDM-1965), Black Pied Pig, Danish Landrace Pig anno 1970 (DL-1970) and Danish Landrace Sheep and on encouraging the breeders to join the national conservation plans. The granting of animal subsidies has been used as an incitement to make the breeders register their animals. In situ conservation has a major priority but until today the production systems and other environmental factors have not been taken into consideration when deciding to grant animal subsidy or not. There are so few breeders of each breed that all breeders have been included in the conservation work, if possible. Almost all breeding animals have now been registered, and the plans to conserve all the threatened breeds have been successful. However, the populations of the old danish breeds are still critically small.

Gene banks. Semen from some of the best breeding bulls of the breeds RDM, SDM and Jersey was collected and stored in the mid-1970s. About 500 semen doses from each of some 50 bulls were stored. These semen banks have been supplemented in the 1980s and 1990s with semen from among others the bulls, which the Genetic Resources Committee first recognized as Jutland Cattle. Since 1996 semen is continuously being collected from selected bulls from old breeds. The selection of bulls to enter the semen bank is made with a view to secure the widest possible genetic basis within the existing populations. During the latest years semen stores have been established after a few stallions, boars and bucks of old Danish breeds. Furthermore, there is a small storage of cattle and pig embryos of some of the old breeds.
Coordination and information. Museums, breeders associations and interest groups have made a big effort to spread information about old farm animal breeds through exhibitions, historic cattle shows and the publishing of member magazines. Furthermore, the Genetic Resources Committee has published a pamphlet about the conservation work and the old breeds, published a newsletter and arranged yearly meetings for breeders of old breeds.

1.2.2.2 Other breeds

The breeds used in the intensive animal husbandry are internationally competitive, and their continuous existence is dependent on maintaining their competitiveness. There are breeding programmes for all the economically essential breeds. The calculation of the breeding values is based on recognized statistical methods and techniques, e.g. Animal Model, MOET-breeding plans (Multiple Ovulation Embryo Transfer) and DNA technology for e.g. breeding control and control of genetic diseases.

Danish Cattle Breeding has a store of at least 500 semen doses from all the bulls being recognized for the use in the national AI-breeding programme. The semen is being stored for at least 10 years after removing the bulls from the breeding programme. Furthermore, the Genetic Resources Committee stores 20 doses from each of these bulls in a permanent gene bank.

1.3 Assessment of Utilization of Animal Farm Genetic Resources

Denmark has developed and utilizes its farm animal genetic resources for an essential production of animal products. Research in animal farm breeding and genetics is at a high international level. There exist outstanding central and regional advisory centres and educational systems offering instructions on animal husbandry and farm animal breeding at all levels. Furthermore, there is a well-developed network between Research, Advisory and Education.

1.3.1 Old breeds

Almost all old Danish animal breeds are threatened because they are unsuitable for the dominating production systems in the Danish animal husbandry. They are mainly kept by part-time and hobby farmers, public institutions, conservation centres and museums with animal husbandry with no direct interest in registration and recording of data on reproduction and production of their animals. Information of the breeders are hence of the utmost significance if
the conservation of old breeds shall continue to be based mainly on people's interest and voluntary work.

The old Danish cattle breeds are originally all dairy-type breeds, but their economic competitiveness in relation to the modern dairy breeds has been reduced with every year. Almost all cattle of the Jutland Cattle are therefore used as suckler cows although the breed has a past as a dairy breed. As to RDM-1970 the number of cows utilized for the dairy production has also suffered a big decline during the latest years. Almost only leisure-time and hobby farmers keep old pig breeds, and the herds are generally small – typically of 2-5 sows and a single boar. Sheep farming in Denmark is generally a hobby, and in particular the breeding of old sheep breeds, where most flocks are less than 10 ewes. The old poultry breeds have – in relation to the many exotic breeds – only little appeal to the many hobby breeders being interested in poultry breeding. Probably this might be changed by better information about the old poultry breeds and by an easier access to suitable breeding material.

1.3.2 Other breeds

The breeds utilized in the intensive production systems are all products of a goal-oriented and professionally managed breeding work. The competition among the breeding companies is very strong, and the breeding goals have been focused on demands to be expected in the immediate future. Within the cattle breeding there is a widespread trade of bull semen over the frontiers. This internationalisation of breeding has been promoted additionally by the establishment of the organization INTERBULL publishing breeding values for breeding bulls from many different countries. Some few AI-bulls have been widely used as bull sires both nationally and internationally with inbreeding as a result. In a well-organized breeding programme the harmful consequences of in-breeding will quickly be revealed, and relevant countermeasures can be taken. Part-time, leisure-time and hobby breeders are often interested in trying something new. This interest is reflected in the presence of a many exotic breeds. The general production characteristics often play a minor role in relation to characteristics and qualities that are particular to a given breed. Many of the national populations are however too small for an efficient breeding programme.
1.4 Identification of the Major and Most Critical Fields in Conservation and Utilization of Farm Animal Genetic Resources.

1.4.1 Old breeds

The most critical conditions for the conservation of old national farm animal breeds in Denmark are as follows:

- The old breeds are not economically competitive in intensive production systems.
- Animal food produced on the basis of old farm animal breeds cannot be sold at a higher price than similar food from industrialized animal husbandry.
- Disappearance of the environment where the old breeds have been developed.
- Many farmers of old breeds omit registration of pedigree and do not participate in recording schemes for individual production, reproduction and health of their animals.
- Inadequate examination of the possibilities for utilizing the special characteristics with some of the old breeds.
- Poor experience and low success rates concerning the cryopreservation of semen and embryos from the breeds: horse, pigs, sheep, goats and poultry.

1.4.2 Other breeds

- Use of reproduction technology increases risk of inbreeding
- Local breeds adapted to local/regional production conditions are replaced by universal breeds
2. Analysis of the Changed Demands for National Policies, Programmes and Strategies related to the Farm Animal Production and the Farm Animal Genetic Resources

This chapter will analyse the possibilities for conserving and developing the farm animal genetic resources in the years to come. The national strategy until now will be analysed, the disadvantages will be pointed out and the possibilities for making them good will be discussed.

2.1 Previous Policies, Programmes and Strategies

2.1.1 The old breeds

The Genetic Resources Committee has given high priority to in situ conservation and has made a big effort to register the herds of old Danish horse, cattle, pig and sheep breeds. The granting of animal subsidy has been used as an incitement to increase the populations and recruit new breeders. It has been a success, but the populations are still critically small.

The previous strategy has given very high priority to information, and the Danish public has a widespread understanding that the endangered old national breeds must be conserved as living populations.

2.1.2 Other breeds

Because of Denmark's considerable export of animal products the major part of the animal production is competing in the global market. Until now this market has not been paying an extra price for the "soft" product values such as animal welfare and ecology. However, there are signs in e.g. the British market - one of the biggest markets for Danish bacon - that animal welfare has turned out to be an essential topic for the consumers when shopping. This trend has resulted in contracts between British supermarket chains and Federation of Danish Slaughter Houses. The contracts stipulate the standards of production for e.g. age of weaning and floor area per piglet.

The commercial dairy cattle breeding is working towards a widely composed set of breeding goals. All AI-breeding bulls have been assessed for both their general breeding value and
utilization of their breeding value in ecological dairy production. When assessing the general breeding value the weighting of yield has been reduced in relation to the functional and health related characteristics. It is expected in future to attach less significance to yield and relatively more significance to functional and health related characteristics.

2.2 Analysis of Future Demands and Development Trends

The Danish home market for animal products is not expected to change considerably in the nearest future. The capability to compete in the export markets will therefore be essential for future production of farm animal products.

The consumers in the developed countries will become more concerned about food security (no bacterial contamination, zoonotic risk nor medicine residuals). These consumers will also give considerable attendance to the methods of production. The animals must be healthy, and the methods of production must be ethically acceptable to customers with high purchasing power if animal production shall remain sustainable in Denmark.

A clarification of legal rights for specific genes is necessary, no matter if such genes are only present in old breeds, modern breeds or in a gene modified /cloned farm animals.

2.2.1 The old breeds

In general the social interest in conserving old farm animal breeds can be connected to their potential value in relation:

- Cultural and historic considerations
- Ecological reasons / conservation of nature
- Possibilities for meeting future demands
- Possibilities for adapting animal husbandry to future production conditions
- Possibilities for better utilization of existing socio-economic conditions
- Possibilities for a better research in production, animal health and food quality.

The Danes' interest in history and old farm animal breeds is considerable, and the interest to watch and learn about the old farm animal breeds is expected to continue. Conservation plans for old breeds must therefore make it possible for the Danish population to watch living animals of the old breeds –and as far as possible - in their natural environment. These objectives might be fulfilled by relatively few animals of each breed, especially if the cryopreservation of genetic material would be a part of the conservation plan.
The future consumers will probably more than until now demand "adventures" in connection with their consumption. Could "the story" be made a part of the concept for goods produced on the basis of animal of old breeds it might be possible to establish an economically sound production on a small scale. The marketing of special products based on old farm animal breeds might give an income to the breeders of old breeds.

Lines of hens utilized in intensive egg production have lost their brooding instinct. The Danish Landrace Hen and many of the fancy breeds have kept this instinct, and it has been used by hobby breeders preferring the natural brooding of chickens. Resistance to infectious diseases and parasites has often been mentioned as a special quality of old landrace breeds. It is however uncertain whether the old breeds' qualities in these respects will be in demand in future animal husbandry.

Marginal grass land must be grazed frequently to conserve its recreational value. The old breeds of horses, cattle, sheep and goats make small demands on nutrition, and this might be an advantage in connection with preservation of rural amenities. The use of old national breeds would add a cultural dimension to landscape preservation.

2.2.2 Other breeds
Breeding schemes with increased focus on the animals' functional qualities and health are necessary to keep the breeds internationally competitive. Application of gene technology will be an enhance selection methods, as it makes it possible to identify genotypes with genes with known effects.

2.3 Discussion on Alternative Strategies for Conservation, Utilization and Development of Farm Animal Genetic Resources

2.3.1 The old breeds
Lacking consensus on breeding goals and breeding methods has been – and is still – a problem. The populations of many of the old breeds are still critically small in spite of the public support given. A public effort will be necessary to recruit and instruct new breeders, coordinate the breeding and supervise the application of males in the breeding programme in order to avoid high rates of inbreeding in these small populations.
The development within the reproduction technology has improved the possibilities of cryopreserving genetic material. Semen banks should be established for both old and modern breeds, and the banks should be supplemented with data on the donors and their genotypes for a number of specific traits. The long-term conservation of old farm animal breeds might be favoured greatly by the initiatives taken to add values to the breeds, e.g. by utilization of them in preservation of protected areas. Marketing of products from old farm animal breeds might support higher prices than ordinary animal products. Restrictions on the production systems favouring in situ conservation could also be a dimension in development of niche products.

2.3.2 Other breeds

The changing social demands (as to economy, product quality and production systems) put pressure on the breeding associations responsible for the breeding programmes applied in the commercial animal husbandry. The functional qualities of dairy cattle (i.e. mastitis resistance, fertility and longevity) can only be improved genetically in an AI-breeding scheme with testing of large progeny groups. The Nordic countries have an exceptional system of recording of other characters than just milk yield in almost all herds. This has been utilized to develop a specific Nordic profile in dairy cattle breeding with relative high weight on resistance to mastites and other functional traits. Semen from some exceptional dairy bulls have been used world wide in the past 20–30 years. One of the consequences has been increased levels of inbreeding with occurrence of abortions and malformed calves because of homozygosity for recessive lethal genes. The DNA-technology has however provided the breeding managers with a strong tool to discover and exterminate lethal genes. In future inbreeding should therefore not be a problem in numerically large populations.

2.4 Draft for Future National Policies, Strategies and Conservation Plan for the Conservation, Utilization and Development of Farm Animal Genetic Resources

2.4.1 The old breeds

Subsidies rewarding breeders to produce pure-bred animals is efficient in supporting conservation plans for threatened old breeds of horses, cattle pigs, sheep and goat. Subsidies should
however be granted on the condition that the breeder participate in a national breeding pro-
gramme with conservation of the breed as the main objective.
Cryo conservation of genetic material should be given higher priority than previously. Be-
sides semen and embryos it might also include conservation of somatic cells. Cryo conserva-
tion can however not replace maintenance of living populations of old breeds with a substan-
tial cultural and histrical importance.
On a long-term basis niche products and niche markets based on old breeds should be devel-
oped, and old Danish farm animal breeds should be assessed for the utilization under exten-
sive production conditions deviating from the conventional conditions in Danish animal hus-
bandry.

2.4.2 Other breeds

Should the Danish breeds be ousted by international breeds the possibilities will be reduced
for adjusting farm animal genotypes to special national production conditions or marketing
conditions. Conditions for animal production in Denmark is expected to change conciderably
over the next decade. Besides the traditional demands for high efficiency and economic com-
petition, solutions must be found that can meet increased requirements from national and in-
ternational consumers and the Danish society regarding food security, animal welfare and
environmental protection. The national policy should support the Danish breeders associa-
tions in their attempts to breed animals that are suitable for future conditions for animal pro-
duction in Denmark.

2.4.3 Elements for Future Strategy

Based on experience from the work with genetic resources during the latest 15–20 years, the
expectations to the future, and an assessment of the tools available for the conservation and
utilization of genetic resources a new national strategy might include the following elements:
• Animal subsidies for breeders of threatened old farm animal breeds
• Cryo-consevation of genetic material (semen, oocytes, embryos and cell cultures)
• Support to breed organizations and breeding centres of old farm animal breeds
• Co-operation with museums with animal husbandry
• Co-operation with interest groups for the conservation of old farm animal breeds
• Grazing of natural grass-grown areas with old Danish breeds
• Research and experiments aiming at the conservation of genetic resources.
• Contacts to breeders societies and breeders association for not currently threatened breeds.
3. National Capacities and Assessment of Future Demands for the Capacity Development

3.1 Assessment of National Capacities

Denmark's national and international responsibilities for the conservation of farm animal genetic resources are undertaken by the Ministry of Food, Agriculture and Fisheries (the Ministry of Food). The Conservation work under the auspices of the Government is undertaken by the Committee for the Management of Farm Animal Genetic Resources (Genetic Resources Committee). From 1997 the Genetic Resources Committee has worked out from the guidelines stipulated in the "Strategy for Conservation of Farm Animal Genetic Resources" of 1996.

3.1.1 Previous Activities

In May 2000 the Ministry of Food asked The Danish Agricultural and Veterinary Council (SJVF) to conduct an evaluation on the Danish efforts to conserve farm animal genetic resources. The evaluation was carried out by a committee of 3 (IEC) with a Danish president, Mr. Jan Mousing, General Manager, and as international experts Mr. Lawrence Alderson, England, General Manager of 'Rare Breed International', and Mr. Koor Oldenbroek, Division Manager, Holland. The IEC report was published in May 2002. The conclusions have been collected in a "SWOT-analysis" as follows:

**Advantages**

Denmark has joined the Convention on Biological Diversity and started up a public programme recognized by the Government.

High degree of commitment among the many breeders and their organizations.

Adequate economic resources per animal for the time being (compared with the prevalent international standards).

The international activities of Genetic Resources Committee.

An efficient surveillance programme.
Conservation programme for pig RDM70 and horses.
Involvement of goats and bees.

**Disadvantages**

Long lasting bad relationship between the Genetic Resources Committee and major private breeders.
Lack of priority, specific goals and restrictions concerning species and breeds.
The introduction of reconstruction and back-crossing programmes in general.
Research activity and utilization of development and research results (inadequate).
Lack of strategy in connection with the construction and utilization of the gene bank.
Economic resources are not appropriately used with regard to conservation programmes.
Essential imbalance in the composition of the members of the Genetic Resources Committee (no representatives of breeders or breeders organizations.)

**Possibilities**

High degree of commitment among a considerable number of breeders.
Development of utility value and new markets for the products from threatened farm animals.
Public attendance and interest.
Higher degree of involvement of all interested parties in the decision and management process.

**Threats**

High risk of losing valuable genetic material – within a very short time limit.
Lack of public aid and resources if the major interested parties continue to disagree.
Strained relations between Genetic Resources Committee and Grass-Roots organizations.
New health regulations concerning animal husbandry.

The Ministry of Food Agriculture and Fisheries is considering a new strategy to be implemented during 2003.

**3.1.2 Education**

The Royal Veterinary and Agricultural University and the Danish Institute of Agricultural Sciences undertake jointly the higher education and research concerning genetic resources.
The two partners have established the Animal Breeding Centre Denmark (ABCD), to cover national requirements for both education (MSc and Phd) and research in Population Genetics and Breeding.

3.1.3 Organizations and breeding programmes

The Danish producers of animal products are organized in breeders and producers co-operatives. These coops have facilities for testing and utilization of breeding stock (e.g. test of progeny, semen collection and distribution, embryo-transfer and research facilities) and have tight bonds to the advisory centres and research institutions. The coops concerning cattle breeding and production, processing and marketing (dairy products and beef) are united in one single organisation "Danish Cattle" undertaking the producers' interest from the primary production to product development as well as marketing. The Federation of "Danish Slaughter Houses" undertakes the interest of the pig producers and is an umbrella organization for the co-operatives undertaking the breeding work, slaughtering, processing and marketing of pork.

Denmark's participation in international activities related to the conservation of farm animal resources is described in Chapter 5.

3.2 Assessment of Demands of Capacity Development

Denmark should be well qualified to develop and utilize the farm animal genetic resources to form a good basis for a future animal husbandry with a sound economy and of a big social significance.

The animal husbandry is generally well organized, and the breeding programs utilize all modern technological facilities. However, there is limited experience in cryopreservation of embryos of farm animal species with the exception of cattle.

The decision-makers are well educated, and the Danish research of farm animal breeding is highly qualified. However, there is a demand for a better elucidation of genetic speciality and the possible special qualities of old Danish breeds.

There is a considerable interest in conserving old national breeds. However, there is a demand for a better co-ordination of the efforts from both public and private actors.
4. Identification of National Priorities for the Conservation and Utilization of Farm Animal Genetic Resources

4.1 National Interdisciplinary Priorities

Information about the values of the animal husbandry and the farm animal breeds is very essential in order to increase the public consciousness of the value of the farm animal genetic resources. The target group is the political-administrative system, the educational system, the agriculture organizations and the society in general. The old Danish farm animal breeds are given a substantial historical significance and value, and they form potential genetic resources, which might be utilized commercially in future animal husbandry. Research and development might contribute substantially to the better utilization of the genetic resources than until now. The commercial breeds must continuously be changed to maintain their competitiveness.

4.2 National Priorities on Farm Animal Species, Breeds, Regions and Rural Districts

The Ministry of Food, Agriculture and Fisheries has taken the initiative to create a new strategy for the national effort to conserve and utilize Denmark's farm animal genetic resources. Having concluded this work the Ministry will inform FAO on the Danish priorities of the public efforts in this field.
5. Formulation of Recommendations for an Increased International Co-operation within Farm Animal Biodiversity

The FAO "Global Strategy for the Conservation and Utilization of Farm Animal Genetic Resources" forms an excellent framework for the activities. The development of the strategy under the "Nation-based Technical Work Group" (ITWG-AnGR) under the Committee for Genetic Resources for Food and Agriculture (CGRFA) ensures the meeting of the countries' wishes and demands. A general priority of this area will be a topic of major significance for future sustainable management of farm animal genetic resources. Therefore all development programmes involved in the development and improvement of agriculture based production systems should include a farm animal genetic component. Another major element in the global strategy is the possibility of transfer of technology, know-how and other expertise related to multilateral conservation and utilization of farm animal genetic resources. Denmark participates actively in the development of the global strategy through ITWG-AnGR and the SoW-process.

In 1984 Denmark, Finland, Iceland, Norway and Sweden established the Nordic Gene Bank for Livestock (NGH) under the auspices of the Nordic Council and Ministers, which is a government institution for the Nordic co-operation, established in 1971. Through the latest decade the NGH has experienced an increasing attention, and the latest two strategies (1998-2000 and 2001-2003) have carried through substantial budgetary increases. During the first years NGH urged to establish activities related to farm animal genetic resources in the Nordic countries, and the activities were mainly directed towards old farm animal breeds. The latest two strategies have increased the focus on the problems related to the active populations in the Nordic countries. The present strategy is working in 4 main fields:

- Increase information on the conservation of farm animal genetic resources (value of conservation and sound development, as well as the organizing of the breeding programmes in this connection).
- Promote pro-active network between breeders organizations and government institutions.
- Promote research and development in the area
- Improve the political-financial basis for a sound utilization of farm animal genetic resources in the Nordic countries.
The present strategy for NGH can be found in full context on the NGH website: www.nordgen.org. NGH works closely together with the three Baltic countries and Poland on the conservation and utilization of these countries' farm animal genetic resources. Denmark also participates in the EU Committee Genetic Resources working on the conservation and sustainable utilization of both animal and plant genetic resources within the EU countries (previously EU regulation 1467/94, presently under examination (COM 2001/617)). Through DANIDA Denmark grants international development aid to a large number of developing projects for the agricultural sector in 15 - 20 of the poorest countries in the world. The conservation and utilization of local and regional farm animal genetic resources in the recipient countries have been included in many of the present DANIDA-projects.

5.1 Recommendations

- Regional co-operation should be promoted and should mainly focus on information, research and implementation of breeding programmes for both old and modern breeds.
- A common conservation programme should be established across the borders for genetically identical populations.
- Local and regional genetic resources in recipient countries' animal husbandry should have higher priorities in all international and bilateral development programmes for the development of animal husbandry.
Appendix 1. Map of Denmark
Appendix 2. Mandate of the Work Group

Ministry of Food, Agriculture and Fisheries

National Report on Farm Animal Resources

MANDATE

During the latest meeting in the FAO Committee for Genetic Resources in April 1999 it was decided to prepare a global report on the state of the farm animal genetic resources, a so-called "State of the World Report on Animal Genetic Resources".

The objectives of the global report would be to have a survey of the world farm animal genetic resources, of the knowledge and of the resources available for the utilization, development and conservation of genetic variation and diversity to secure future supply of animal based food, clothing, tractive capacities, cultural based values etc. A corresponding report has been worked out about the plant genetic resources in 1998.

The global report will be a further development of the present global work on conserving the farm animal resources, anchored in the FAO "Global Strategy for the Management of Farm Animal Genetic Resources". Additionally, the global report together with the already recognized global strategy will be an important follow-up to the global action programme Agenda 21 accepted during the UN conference in Rio de Janeiro in 1992.

The report must be made up by the national part reports. The FAO Intergovernmental technical work group for farm animal genetic resources has stipulated a number of guidelines for time schedule and contents of the national reports. The Danish national report must follow these guidelines and in general describe the National conditions concerning the utilization and conservation of the farm animal genetic resources. Both the active populations supplying animal based foods, and the old breeds primarily kept for cultural/historic reasons. The report must be short and precise, almost 25-30 pages plus appendix.
As the report covers both political and business related questions, FAO would recommend establishing special ad hoc working groups responsible for the preparation of the national reports.

The farm animal genetic resources are under the auspices of the Ministry of Food and are managed by the Committee of Management of Danish Farm Animal Genetic Resources. The daily secretary activities are undertaken at the Danish Institute of Agricultural Sciences.

The preparation of the national report should therefore be undertaken by a small ad hoc work group with participation of members of the Committee for Management of Danish Farm Animal Genetic Resources (2 persons)*, The Ministry of Food (1 person)**, The Agricultural Industry (1 person), Conservation associations (1 person), Ministry of Culture (1 person) and the Ministry of Environment (1 person). The Danish Institute of Agricultural Sciences undertakes the secretarial functions and is responsible for establishing the Committee. The Danish Institute of Agricultural Sciences undertakes the Presidency.

The Committee for Management Conservation of Danish Farm Animal Genetic Resources must be kept informed of the work in the ad hoc working groups and must accept the national report before sending it to FAO. The work group may if necessary involve the Committee for Management of Danish Farm Animal Genetic Resources in the preparation work of the report.

The work group must finish the draft by 1 May 2002, and shall then submit the matter to a large numbers of interested parties.

The national report shall subsequently be sent to FAO not later than 31 August 2002. FAO will then prepare a global report to be treated and recognized during the ordinary meeting in the Committee for Genetic Resources in 2005.

* The conservation associations have participated in the work group with 2 representatives.

** As the Ministry of Food in the summer 2002 decided to establish a committee for the preparation of a suggestion for a new strategy for the conservation of farm animal genetic resources the department of the Ministry of Food left this work group.