Country Report
on
THE STATE OF ANIMAL GENETIC RESOURCES
(Sri Lanka)
submitted
to
THE FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

Compiled by
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July 2002
PREFACE

By 2020 the world is expected to consume 120 million tons and 240 million tons more meat and milk respectively than it did in 1993. To meet this expected increase in demand more reliance is being placed on high producing few breeds and intensification of animal husbandry. Most farm animal breeding is taking place in the developed countries using animals that require great care and large amount of food. Valuable local genetic resources in the least developed and developing world are still idling.

Many countries have indigenous animals species and breeds that could potentially contribute far more to food and agriculture production than they are currently contributing and meet much wider human needs. The FAO and its inter governmental Commission on Genetic Resources for Food and Agriculture (CGRFA) which has 161 members and is the major international forum for developing policies on genetic resources for food and agriculture, has requested the preparation, through a country-driven process, of the first Report on the state of the World’s Animal Genetic Resources for Food and Agriculture. This report will provide a foundation for setting country, regional and global priorities and assistance in maintaining and enhancing the contribution of animal genetic resources (AnGR) to food and agriculture.

The ultimate objective of this exercise is to improve national capacities and international co-operation to develop and use of efficient livestock production systems. This will be achieved through the development and wise use of locally adapted AnGR, whilst taking into consideration the constraints and opportunities created by growing demands on the livestock sector and by changing climate, disease status and technologies. These locally adapted animals could be used to improve the food security by increasing their productivity through breeding programs. Continuous introduction of exotic germplasm in breed improvement programs without giving due consideration for the conservation of the valuable indigenous breeds has resulted in dilution of the local populations. As a result, these low productive but genetically valuable local breeds are now threatened.

This report has been prepared according to the guidelines provided by the FAO and has addressed the Avian and Mammalian species that are of interest to food and agriculture in Sri Lanka. Existing data from various sources have been used in the preparation of the report and wherever possible the trends that have occurred have also been analyzed using the past records. Due to the civil disturbances in the North and Eastern parts of the country collation and analysis of data and information have been difficult and certain information were not available. It is believed that this report would provide sufficient information on the state of AnGR, the trends of these resources and their current contribution to food and agriculture and rural development.
In this report the authors have strived to assess the country’s capacity to manage the AnGR and to prioritize national capacities for the sustainable conservation and utilization of AnGR. Further this report has also compiled essential baseline data and information on the state of animal genetic diversity highlighting the gaps and problems.

Existing policies and changes needed to meet the current demand have also been given due consideration. I hope this document will fulfill the requirements of the FAO.

Finally I take this opportunity to thank Dr. A.D.N. Chandrasiri, the Chairman and all the members of the National Consultative Committee (NCC) for spending their valuable time and energy in the preparation of this report within a very short time frame using extremely limited resources without any additional funding.

Dr. S.S. Balachandran
Director General
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MESSAGE OF THE HON. MINISTER OF AGRICULTURE, LIVESTOCK AND SAMURDHI, SRI LANKA

It is with great pleasure that I convey my greetings and best wishes to the National Consultative Committee (NCC) on the occasion of the publication of the country report on the State of the Animal Genetic Resources in Sri Lanka.

The goal of this document is to provide policy makers, stakeholders and international organizations with the information and guidance for developing and strengthening legal and institutional framework in order that preservation and sustainable use of farm animal genetic resources would take place in accordance with the Convention on Biological Diversity. This report provides structural framework in the present situation of the farm animal genetic resources. It gives an understanding of the current status, sustainable use, and threats envisaged, gaps and problems and impact of the introduction of exotic breeds on indigenous breeds. This document not only provides an assessment of the present situation of country’s farm animal genetic resources, it also provides the present national capacities and international cooperation to achieve the sustainable intensification of livestock development.

Sri Lanka has many indigenous and locally adapted animal species and breeds that could potentially contribute far more to food and agriculture production than they do at present. Although these animals are low productive they are well adapted to the local environment and possess good characteristics. Among livestock farmers in Sri Lanka majority belongs to the rural sector. Highland farming is greatly integrated with livestock and this diversification will improve the present food security and rural development.

Farm animal genetic resources if developed successfully to ensure productivity and quality has the capacity to alleviate rural poverty, which is one of the main objectives of this ministry. I have no doubt that this document will fulfill the requirement of the FAO.

This document is the result of an intensely participatory process involving many discussions and consultations with the relevant agencies and stakeholders. I am happy with the effort that was made in compiling this document and my ministry wishes to thank the Chairman, Technical Secretary and the National Coordinator of the NCC and all those contributed in preparing this document using extremely limited resources and within the given time frame.

S.B. Dissanayake
Hon. Minister of Agriculture, Livestock and Samurdhi
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ACKNOWLEDGEMENTS

This report is intended to provide information on the present status of the farm animal genetic resources in Sri Lanka. On behalf of the National Consultative Committee I wish to thank every one who helped me to make this document a reality. Particularly I would like to thank Mr. Gamini Gamage (Director/ Biodiversity, Ministry of Environment and Natural Resource Management), Dr. Mrs. Pradeepa Silva (Senior Lecturer, Department of Animal Sc., Faculty of Agriculture, University of Peradeniya), Dr. Missaka P.B. Wijayagunawardana (Senior Lecturer, Department of Animal Sc., Faculty of Agriculture, University of Peradeniya). Mr. S.H.G. Wickramaratne (Livestock Officer, Veterinary Research Institute) Mr. D.V.S. de S. Gamage (Research Officer, Veterinary Research Institute), and Mr. A.S. Premasundara (Assistant Director/ Dairy Development, Department of Animal Production and Health) for providing information, writing relevant chapters and giving valuable suggestions. Special thanks are due to Mr. A.S. Premasundara for designing the cover page. My sincere thanks are due to Dr. B.D.R. Wijewardene and Dr. Mrs. Pradeepa Silva for editing the manuscript. I also wish to thank Dr. R. Wickramasinghe, Director/ Veterinary Research) for allowing the use of the computer facilities at the Veterinary Research Institute. Special thanks are due to Dr. Mrs. Hemali Kotalawala for providing the maps on distribution of the livestock breeds of Sri Lanka. I thank the Ministry of Environment and Natural Resource Management for sponsoring the workshops. Last but not least I wish to thank Ms. Sandamali Dissanayake for her excellent typing. Without her assistance I would not have completed this tremendous task in time. Finally I wish to thank the Technical Secretary, National Coordinator and all the members of the National Consultative Committee and all the participants of the workshops for their encouragement and moral support extended towards me.

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EXECUTIVE SUMMARY

The Sri Lankan society is predominantly agrarian. Sri Lankan economy is characterized by an increasing GDP (value added) in livestock sector at current producers prices (Rs. 6,612 million in 1995 and Rs. 12,862 million in 1999) and the changing nature of food habits. As a result the demand for animal products has increased.

Of the 40 species of mammals and avian species of farm animals found in the world, four mammalian species namely neat cattle & buffalo, goat & sheep, pigs and avian species of chicken are widely reared in Sri Lanka. Minor domesticated species are duck, geese, quail, turkey, horse and ass (donkey) found in small numbers scattered in isolated locations. According to the climatic factors, resource distributions and management patterns the system of rearing these animals varies widely.

Ministry of Agriculture and Livestock (MAL), The Central Department of Animal Production and Health (DAPH), Provincial Departments of Animal Production and Health, The National Livestock Development Board (NLDB), Mahaweli Authority of Sri Lanka (MASL), Milk Industries of Lanka Company Limited (MILCO), Feed Manufacturers and few private organizations are the main organization involved in Livestock Sector. Ministry of Higher Education through the respective faculties of the universities offers academic degrees for development of higher-level expertise for the livestock industry. Sri Lanka is far from achieving food security. Especially the low-income groups below the poverty line may be deprived of consumption of animal products due to poverty. The local production of some food commodities is seasonally affected by environmental factors such as drought and floods. Majority of essential food items are still being imported from various parts of the world. There is a wide range of animal products for subsistence use in both domestic and commercial markets. They are food items, draught, ornamental and aesthetic enjoyment. Some animal products are also used as biomedical materials in indigenous and ayurvedic treatment. Some livestock species have significant influence in cultural, religious, recreational and native rituals.

In most parts of the country farmers keep more than one animal species. Under extensive system of management mostly local species or locally adapted species, which require minimum inputs, are used. Use of exotic genetic resources on indigenous breeds have reduced the genetic diversity and even has threatened the existence of certain indigenous and locally adapted livestock breeds. The risk factors involved in different livestock production systems are discussed in detail.

Phenotypic and physiological characterization of some breeds, their conservation and management patterns have been studied under the FAO/UNEP funded collaborative project in 1984. It however, is not comprehensive and does not include all the information. There is a great need for a systematic genetic characterization program of all the breeds in order to find out the genetic relationship of the local and locally adapted breeds.

Non-availability of base line survey data on the distribution of valuable farm animal genetic resources is the main gap, which reduce the ability to plan and implement a program on the
use of the animal genetic resources. There are few major factors preventing collection of information. They are; lack of priority to the related areas, lack of funds and infrastructure facilities, lack of manpower, and lack of recognition of the importance of the indigenous livestock breeds.

There are few wild relatives of domestic species in the country. None of these wild relatives are actively being used in breeding programs for domestic use.

There are several acts, legislations and policy decisions to facilitate utilization of animal genetic resources and management of environment in Sri Lanka. Sri Lanka has implemented major trade policy reform measures to create an internationally competitive environment for the Sri Lankan agricultural and manufacturing products during last two decades. The Sri Lanka Resource Centre for Indigenous Knowledge (SLARCIK) has initiated preparation of a National Policy for conservation and sustainable use of indigenous knowledge.

As animal breeding is a devolved function, the provincial governments have to play a major role in providing technical assistance, extension services and training for the staff as well as for the farmers. The research capacity is available in the central Department of Animal Production and Health and the relevant departments of the Universities. There is no specific institution with specific facilities for preservation of germplasm of animal origin. Facilities for conserving the genetic material of wild species of animals and local breeds of livestock are considered inadequate. There are no policies or legal instruments to support and promote sharing of benefits that are derived from the use of AnGR.

Following priorities for capacity building are suggested.

I. Establishment of in-country AnGR center
II. Establishment of Regional Genetic Conservation Centers (RGCCs)
III. Data base on present states, conservation and management of AnGR
IV. Human Resource Development on conservation and sustainable use of AnGR
V. Regular livestock census
VI. Email and internet linkages between the RGCCs and individual organizations involved in conservation activities
VII. Establishment of modern GIS system to facilitate location of important AnGR in the country
VIII. Establishment of liaison units to coordinate between local genetic centers, RGCCs and the global focal points.

Imported cheaper animal products may hinder the growth of the local industry. Thus the need for AnGR will not be high as in the past. Policies on importation of subsidized milk and milk products have very badly affected the development and sustainable use of the local AnGR. Genetic improvement alone will create other problems such as shortages of feed, health problems and marketing of the products of genetically improved breeds. Therefore the aspects of non-genetic development such as feeding, healthcare, marketing and general management have to be given equal consideration and genetic improvement should go hand in hand with the non-genetic development.
Other than Artificial Insemination in cattle, buffaloes, goats and pigs, there is no action plan in place for improved use of AnGR. The breeding strategies and follow up work have to be further improved. There are no opportunities to use locally adapted AnGR for diversification of animal production, to improve product quality and develop new livestock products etc. There are many opportunities to improve the use and development of AnGR by further recognizing the roles of women, men and children in the rural community.

The primary constraints to the improved use of AnGR is the lack of a national policy for the livestock sector. There are problems at the level of implementation of the existing acts, legislations and policies. Some of the existing laws have to be amended to suit the present situation. Lack of knowledge and training on conservation and sustainable use of AnGR and lack of incentive scheme for conservation programs is also a constraint.

At present there is no network established for sharing resources, data, information and knowledge on the AnGR. For this purpose SAARC (South Asian Association for Regional Cooperation), the biggest international organization in the region could be used to enhance the regional co-operation in the management of AnGR. Each country should establish an AnGR center to deal with the AnGR in the respective countries. These local AnGR centers should liaise with the regional level AnGR centers, which have close links with the world AnGR centers or the global focal points.

Sri Lanka has not yet passed any laws to specifically deal with the issue of Genetically Modified Organisms (GMOs). However, some provisions in the existing laws could be successfully used to control, check and even ban the introduction of certain GMOs.

There is an act relating to intellectual property rights, which has incorporated internationally recognized principles and concepts of Intellectual Property in the light of the local conditions and requirements.

As far as research capacity is concerned, lack of training facilities for the research staff and non-availability of funds for research are the major deficiencies. Therefore, priority should be given to providing training opportunities for both researchers and middle level technical staff. In additions to research funds, there should be a flexible financial management system to facilitate the procurement and employment of research staff.

The state sector should take the leadership on the conservation of the AnGR. For any conservation programme joint efforts of the government, private sector, non-governmental organizations, stakeholders and the individuals who are interested in conservation of AnGR are essential. The degree of involvement will depend on the type of the breeds to be conserved.

For enhancing capacity to develop and implement a conservation programme, priorities have to be laid down. Following can be the areas, which should be considered by the authorities.

2. Acquire financial resources - again, the main responsibility lies on the Ministry of Agriculture and Livestock. Private sector can also get involved in providing the financial resources for a conservation program.

3. Human resource development/ training - DAPH, NLDB, MASL and Universities can get involved in a joint programme

4. Research - DAPH and Universities could provide research facilities.

5. Infra structural and storage facilities - Government and private sectors jointly can get involved in a programme to improve the infra structure facilities for a successful conservation program.
CHAPTER 1
SRI LANKA AND THE AGRICULTURAL SECTOR

1.1 Physical Characteristics
1.1.1 Geography
The Democratic Socialist Republic of Sri Lanka, consisting of a main island and several
small offshore islands, is situated close to the South-Eastern corner of the Indian sub
continent. The country lies in the Indian Ocean between 79°39' and 81°53' East Longitudes
and 5°54' and 9°52' North Latitude. It covers a total extent of 65,610 km², consisting of
62,705 km² of land area and 2,905 km² of inland waters. The island has a maximum length of
435 km and a maximum width of 225 km.

Considering the topography of the country, three distinct peneplains are discernible. The
lowest of these, the flat lowland peneplain covers 75 percent of the land consisting of the
Northern half of the island, a broad strip along east coast and a relatively narrow strip along
the Southern and Western coasts. This first peneplain is referred to as the “Low country” with
the altitude rising from sea level to an average of 75 m above mean sea level (msl). Towards
the South-Western parts of the island, the land rises steeply on all sides and the second
peneplain of “Mid country” is identifiable from 100 m to 1,000 m msl. Further inland the
land rises very steeply to form the South Central mountain massif with plateaus. This
constitutes the third peneplain or “Up country” (1,000 m - 2,500 m msl).

1.1.2 Climate
Climate features of the country are basically determined by the geographical location of the
country in the equatorial belt and its position in the inter-tropical convergence zone. The
chief determinants of the climate in Sri Lanka are rainfall and temperature. The location has
assured Sri Lanka a tropical climate and a regular monsoon dominated rainfall. The mean
temperature is 27.5°C over low lands. The oceanic influence helps to reduce temperature in
the lowlands by sea breeze. The temperature decreases at a steady rate of 6.5°C for each 1000
meters rise and in the mountain region the mean monthly temperatures varies from 13°C to
16°C with the night temperature occasionally dropping to around zero. Diurnal variation of
temperature is well marked and the range increases with altitude as well as with distance
from sea. There is only a small variation in mean monthly temperatures experienced
throughout the year in most parts of the country. The relative humidity varies generally from
about 70 percent during the day to about 90 to 95 percent at night. In the dry areas these
values are lower by 5 percent. The rainfall is of three types - monsoonal, conventional and
depressional. The two monsoonal periods, the South-West (May - September) and the North
East (December - February) are responsible for major portion of the annual precipitation.
Local topography plays a major role in determining the rainfall distribution over the island.
The South-West monsoon provides rain mostly to South-Western quarter and the central high
lands. The North-East monsoon along with inter-monsoonal depressional activity in
October/November is stronger and produces rain through out the island. The other inter-
monsoon period in March/April produces less rainfall. Based on the mean annual rainfall and
its distribution, the country is classified in to three major climatic zones: Dry Zone (1,250
mm - 1,525 mm), Intermediate zone (1,525 mm - 2,280 mm) and Wet Zone (2,280 mm -
5,100 mm). The Dry Zone experiences a prolonged dry period from May to September with
drought conditions prevailing from June to August. The presence of strong dry winds
accentuates the harsh conditions during this period. Additionally the two areas in the North-
West and South-East of the island receiving a mean annual rainfall of 890 mm - 1,250 mm and having a more prolonged and intense drought are classed as the arid zone.

1.1.3 History and Culture
The recorded history of Sri Lanka goes back to the advent of Indo-Aryans from India in 543 BC. Sri Lanka has high endemism per unit area and is listed as one of the 18 Biodiversity hot spots in the world. This diversity is mainly found in the forests and aquatic environments and spread across the agricultural land and home gardens. Sri Lanka has a long historical heritage in biodiversity conservation. During the region of the King Devanampiyatissa in the 3rd century B.C. when Buddhism was first introduced Sri Lanka had one of the world’s first Wildlife Sanctuaries. In 12th century A.D. the King Keerthi Nissankamalla prohibited the killing of animals within a radius of 35 km of his kingdom of Anuradhapura. “Udawatta Kale” reserves in Kandy and Singharaja were also areas reserved by ancient rulers of the country. According to the “Mahavamsa”, the great chronicle of Sri Lankan history, the protection of forests and animals was esteemed highly by the both rulers and subjects. This respect for all forms of life is fostered by Buddhism, which spurns animal slaughter. As far back as the third century BC, wildlife ‘sanctuaries’ for the protection of fauna and flora existed in this country, while the concept of ‘urban nature reserves’ was promulgated in the twelfth century AD.

Until the 16th century AD, the country had an independent, monarchical system of governance. From 1505, the maritime areas were dominated successively by the Portuguese, Dutch and British. In 1815 the British assumed control of the entire island after they annexed the Kandyan kingdom. Sri Lanka regained political independence in 1948 and became a Republic in 1972. During the time of monarchial rule the concepts that we now recognize as biodiversity conservation were ingrained in the cultural and religious beliefs of the people of Sri Lanka. With the onset of the colonial era, there was a dramatic change in the cultural and socio-political climate in the country. During this period of foreign rule there was large-scale destruction of the forests, particularly for the establishment of plantations. These activities marked the beginning of environmental problems and large scale-biodiversity erosion in the country. After gaining independence, clearing land for development schemes in the Dry Zone commenced and continued to gain momentum, causing a further loss of indigenous biodiversity. Despite these adverse trends, the concepts, which underlie conservation of biodiversity, continue to influence the lives of rural people, particularly those of the older generation.

1.1.4 Floristic Regions and Agro-ecological Zones
Taking the topography and the climate into consideration the country has been divided into seven bio-climatic zones to describe the distribution of natural vegetation. These are the Wet Zone Up Country (WU), Wet Zone Mid Country (WM), Wet Zone Low Country (WL), Intermediate Zone Up Country (IU), Intermediate Zone Mid Country (IM), Intermediate Zone Low Country (IL) and Dry Zone Low Country (DL). Each of above zone contains several agro-ecological regions and those are shown in Figure I. Distinguishing characteristics of the agro-ecological regions are shown in Table 1.

1.1.5 Demography
The population of Sri Lanka, according to mid year census in 2000 is estimated at 19.36 million. The density of population has increased from 299 in 1998 to 304 persons per sq. km in 1999. The country has a high literacy rate of 91.8 percent. The basic demographic indicators are shown in Table 2.
Population growth, which was at 1.1% in 1990, has declined to 0.9% in 1992 and again increased to 1.7%, in 2000 the highest growth rate recorded during past decade. The main reasons of the decline in growth rate has been identified on increased literacy rate, rise in age of marriage among women and increased contraceptive use due to a successful family planning programme. However, the overall population increase is expected to create a considerable pressure in the country’s environment, natural resources and employment opportunities.

1.1.6 Population Trends
In certain principal cities, the population has declined during 1981 to 1990. Colombo city has shown a population increase of only 25,000 over this period. The urban population density is high in the Wet Zone areas.

Despite the high overall population density, 75% of the population is living in rural areas, with only one forth of the population living in urban areas. The overall rate of urban growth has been low.

1.2 Main Farming Systems, Crops and Livestock
The Sri Lankan society is predominantly agrarian. Although the country is moving towards industrialization, the agricultural sector still continues to be an important sector in the economy of the country and contributes substantially to foreign exchange earnings and to GDP. Sri Lankan economy is characterized by an increasing GDP per capita (US$ 804 in 1998) and the changing nature of food habits. As a result the demand for animal products has been increased. Farming is the oldest of economic activities and has been the main livelihood of the population. However in the past two decades since the farm subsidies and especially other support services have been gradually withdrawn, the agricultural employment and its share in Sri Lanka’s output have decreased. Hence during past few decades contribution of agriculture to total GDP has been reduced from 28% (1975) to 18% (1998). This implies that the country’s national policy is moving towards industrialization at the expense of food production. However, contribution of livestock to the agricultural GDP has increased from 5.6% (1975) to 7.0% (1998), Livestock includes all animal species that are of economic, scientific and cultural interest to mankind for agriculture. Economically active population in agriculture and related activities is estimated to be 51 percent. Agriculture contributes 23 percent of the countries’ current export earnings, even though it has declined through the years with the shift in national policy towards industrialization. Out of the 40 species of mammals and avian species of farm animals found in the world, only four mammalian species comprised of neat cattle (1,557,000), buffalo (698,000), goat (495,000), sheep (11,000), pigs (71,000) and avian species of chicken (10,622,000) are widely used in Sri Lanka. These species are used extensively throughout the country. Minor domesticated species comprises of ducks (9,900), geese, turkeys, horses and ass (donkey) are found in small numbers scattered in isolated locations.

1.2.1 Livestock Production Systems
Cattle and buffalo farming systems:
Cattle and buffalo represent a major proportion of livestock population of the country. According to the climatic factors and resource distributions, the system of rearing of this category of animals varies widely. The predominant cattle and buffalo production systems are listed below.

1. Plantation crop based cattle farming system (Estate system)
2. Kandyan home garden system in the Mid country (Mid country small holder system)
3. Coconut based cattle farming system (Coconut triangle system)
4. Dry Zone extensive system
5. Off-farm income based peri-urban dairy farming system
6. Small holder buffalo system
7. Vegetable based intensive “Jaffna peninsula system”
8. Irrigated Rice Based System

Characteristics of the main milk production systems practiced in Sri Lanka are shown in Table 3.

Goat farming systems:
According to the resource basis in different areas of the country, there are three main farming systems of goats.
1. Rain fed highland crop based goat farming (Extensive)
2. Crop based goat farming (Semi intensive)
3. Intensive goat farming in estate sector

Pig farming systems:
Swine production contributes only 3% share of the animal product output value and represents 4% or 5500 MT per year of the total meat production Pig farming is not an island wide industry. Pig rearing areas have been concentrated around the Western Coastal area of the island (pig belt) where three main system of rearing exist.
1. Intensive large scale pig production system
2. Semi-intensive small scale pig farming system
3. Scavenging backyard pig rearing system

Poultry farming systems:
The contribution of livestock to the agricultural GDP has increased mainly due to the growth in this sector. It should be noted that the commercial poultry sector depends mostly on imported inputs, which accounts to about 85% of the cost of production. Poultry sector is the most developed and well-organized animal industry in the country. According to the scale of operation and resources, there are four distinct rearing systems.
1. Intensive large scale operations
2. Semi-intensive medium scale operations
3. Small scale scavenging village chicken system
4. Buy back (contract) rearing system

1.2.2 Plantation Crops
The major plantation crops are tea (*Camelia thea*), rubber (*Hevea braziliensis*) and coconut (*Cocos nucifera*). Spices such as cinnamon (*Cinnamomum verum*), cardamoms (*Elleteria cardamomum*), black pepper (*Pipper nigrum*), cloves (*Syzygium arromaticum*), and nutmeg (*Myristica fragrans*) are grown in minor plantations. These crops constitute the export agricultural crops. Food crops such as paddy, vegetables, legumes and fruits forms the domestic agricultural crops. The Wet Zone of Sri Lanka is the most intensively cultivated zone with 67 percent of the area under permanent agriculture. Presently Sri Lanka is exporting limited quantities of vegetables and fruits to the West Asian markets and generates a significant income (Approximately Rs. 1,046 million in 1998). The status of production of main crops cultivated in Sri Lanka is shown in Table 4. During the period from 1996-1999,
The rubber production has dropped by 14.1% while coconut production was almost stable. Tea and paddy production has shown steady increase during 1996 to 1998.

### 1.2.3 Land Use and Current Trends

The total land area of Sri Lanka after leaving the area occupied by inland waters is approximately 6.2 million hectares. The land/man ratio is thus only 0.32 ha/person. According to the Third Land Commission Report, after allowances are made for forest cover, steep and barren lands, urban and rural dwellings etc., about 2.5 million hectares (nearly 40 percent of the total land area) is available for further settlements and agricultural production. The per capita cropland is so small as 0.12 ha. Bulk of this land is rain fed and is in the Dry Zone. Systematic land use planning is thus vital in the management of natural resource base for agricultural development. Competition for land is severe among the sectors using it. The major land use sectors are agriculture, forestry, wildlife and animal husbandry. Land use and current trends in Sri Lanka is shown in Table 5. The arable land agriculture and land under permanent crops remained stable during 1980 to 1997, while agricultural area (cropped land) has been declined.

The land use statistics obtained from Sri Lanka/Swiss Remote Sensing Project indicate that of the total land area, 25 percent is under permanent agriculture, while 20 percent is classified as sparsely used croplands, 12 percent occupied by homesteads, 16 percent under grasslands, scrublands, marshes etc. and nearly 27 percent under forests. At the beginning of the last century Sri Lanka 70% of the land area were natural forests. Around 82% of the land area of Sri Lanka is under some form of state control. The laws relating to the land use and agriculture involve wide-ranging policy issues on economic, sociological and political environment in the country. Land Development Ordinance, which relates to the development and alienation of state land, provides a set of regulations. Appointment of a Land Commissioner, the issue of permits and grants, succession to alienated lands, rights of the recipients are listed in this Ordinance. This ordinance does not promote environment protection. This statute can be amended section 56 of the Tea Council Act; Section 4 of the Tea Small Holdings Development Law; section 6 of the Sri Lanka Tea Boar Law; section 10 of the Tea and Rubber Estates (Control of Fragmentation) Act; section 3 of the Rubber Research Ordinance section 10 of the Sate Agricultural Corporation Act; section 4 of the Mahaweli Authority of Sri Lanka Act; section 3-26 of the Coconut Development Act.

Alternatively the objectives of these institutions may be amended including protection of the soil and land with special reference to environmental issues as their functions. Soil Conservation Act deals with the question of soil erosion. One drawback of this Act is that it addresses only the question of soil erosion and does not consider other aspects of soil degradation. State Lands Ordinance that deals with the power of the State to sell, lease, grant or otherwise dispose of State land reflects the policies of the Government in the alienation of State Land. Under this Act, the President has the right to Vast State lands. This could cause extensive environmental damage, as environmental assessment is not done in alienation for projects.

Laws relating to agriculture and land use may be amended in the light of the 13th Amendment to the Constitution. A comprehensive land use statute may be established amalgamating State lands Ordinance, Land Development Ordinance, Land grants (Special Provisions) Act, State Lands (Recovery of Possession) Act, Lands Resumption Ordinance, State Landmarks Ordinance, State Land (Claims) Ordinance, Land Acquisition Act, Land Reform Law and

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Land Settlement Ordinance. Citizen’s suits with respect of land use decision may be given legal recognition.

In Sri Lanka livestock farming is carried out mainly on small farms, and secondly on estates. The total livestock holdings are 1,807,697. The small holding sector comprises an area of 3.5 million acres. Here the majority of peasants own a plot of land, with an average size of 1.95 acres. About 3% of livestock farmers are landless. They mainly depend on pieces of barren land owned by the government, which is called “crown land”. The tenants, those who do not own any land, constitute about 11% of the agricultural operators.

As for the estate sector, covering 1.3 million acres (an estate has by definition 20 acres of land or more), 69% is nationalized land operated by the government or parastatal organizations and 31% belongs either to individuals or private companies. It is on these estates that the landless estate labourers live.

Farm structure and distribution of the whole island is shown in Table 6. The average farm size in the Dry Zone and Wet Zone are 1.2 and 0.75 ha. respectively. About 42% of the smallholdings in Sri Lanka are less than 1 acre, while 78% are smaller than 3 acres.

1.2.4 Organization of Livestock Sector

Ministry of Agriculture and Livestock (MAL) is responsible for policy planning and implementation, resource mobilization and monitoring of progress. Ministry’s approach is always top-down and stakeholder consultation is present to a reasonable extent. The Central Department of Animal Production and Health (DAPH) provides technical support for policy implementation, veterinary research, production of vaccines, animal health and disease control, animal breeding, human resources development and training, monitoring and evaluation, and dissemination of information. DAPH is also functioning as a statutory body and carry out disease surveillance, quarantine and implementation of laws and regulations. Some of the DAPH functions have been devolved to the provincial governments. The nature of intervention of the provincial department of APH is policy and program implementation through field veterinary units, animal health and breeding, extension and training and implementation of special projects determined at the central level. The National Livestock Development Board (NLDB) which is coming under the MAL is a commercially oriented organization and it’s main function is maintenance of nucleus herds of livestock and supply of improved breeding material to the needy farmers. Breed improvement programs rarely use selected bulls from the NLDB farms. Furthermore the herd records of these farms have never analyzed in the recent past to select the next generation breeders. Nevertheless the breed improvement programs mainly use imported semen from high yielding animals. NLDB is also carrying out-processing of livestock products in a small- scale. Ministry of Higher Education through the respective Faculties of the Universities offers Academic Degrees for development of higher-level expertise for the livestock industry. Livestock related research and dissemination of information through the respective faculties of the Universities is another function. The DAPH, Department of Agriculture, Ministry of Education and a private organization conduct two-year diploma programs related to agriculture and animal husbandry. The main function of Milk Industries of Lanka Company Limited (MILCO) is procurement and processing of milk and value added milk products. MILCO provides institutional support for dairy farmer organizations. Promotion of livestock farming among settler communities is the main function of the Mahaweli livestock enterprise of the Mahaweli Authority of Sri Lanka (MASL). Various cooperative societies scattered all over the island provide management and technical know-how to the member societies, promote
procurement of milk and value added milk products and provides welfare schemes for members. There are few private organizations, which are involved in large-scale procurement and processing of milk, packaging and marketing of milk products. These organizations also provide welfare schemes for the dairy farmers. (Some private sector organizations involved in production and marketing of poultry meat and eggs, hatcheries, contract operations, manufacture and marketing of animal feed etc.).

Poultry industry is mostly controlled by the private sector and the state involvement in flock improvement and production is very minimal. Majority of the small and medium scale poultry farmers are organized into regional and national level producer societies. The national level organization is called All Island Poultry Association. The large-scale private farms belonging to multi national companies or large-scale national enterprises act as individual organizations.

The involvement of government is more prominent in the dairy sector. More than 90% of the smallholder dairy farmers are either members of a dairy co-operative or a farmer society. There are few medium scale dairy farmers who function individually. Almost all large-scale dairy enterprises belong to the state sector. Processing and marketing of livestock products are mainly in the hands of national and multi national companies. Few medium-scale local processing plants are also in operation at the moment. Changes in livestock population in Sri Lanka during 1990 – 2000 are shown in Table 7. Except poultry, the population of all other livestock breeds has decreased during the last decade. The poultry population has increased by 20.7% during the same period.

1.2.5 Main Animal Products
The livestock sector consists mainly of the dairy and poultry sub-sectors. In the dairy sector, the annual cow and buffalo milk collection is 260 and 82 million liters respectively. At present, country’s milk production is sufficient to meet only 20-25% of the local requirement. In the past 10 yrs, the percentages of imports were between 71-83%. At no stage country’s imports were below 55%. The annual quantity imported was 54,000 metric tons spending Rs.7118 million. In 2000 the local production was only 43%. The trend indicates that the imports will overtake even the total production. Imports of milk and milk products during 1990 – 2000 are shown in Table 8.

The national egg production in 2000 was 922 million. The major problem faced by the egg producers is the high cost of feed as almost all the raw materials are imported. Poultry meat is a common source of animal protein in the diet as there are no cultural taboos as for pig products and cattle and buffalo meat products in the country. The annual chicken meat production is 57,000 million kg (Dept. of Census and Statistics, 1999). Sri Lanka has become self-sufficient in poultry meat. Trends in milk and egg production during 1990 –2000 are shown in Table 9. Cow milk production has increased by 22% during the last 10 yrs while the improvement in buffalo milk production was only 8.6%. Egg production, which showed a gradual increase, has shown a sharp increase in year 2000. However, the overall increase in egg production was only 12.9% during past 10 years. Number of animals slaughtered during 1990 – 2000 is shown in Table 10. Number of sheep, goats and pigs slaughtered during last decade has increased slightly. Although the slaughter of cattle has increased by 39% the supply of meat and meat products could not meet the demand. Therefore, the import of meat and meat products has increased annually. Import of meat and meat products during 1990 – 2000 are shown in Table 11.
1.3 Food Security
Sri Lanka is far from achieving food security. Especially the low-income groups below the poverty line may be deprived of animal products due to poverty. The local production of some food commodities is seasonally affected by environmental factors such as drought, floods etc. Majority of essential food items are being still imported from various parts of the world.

1.3.1 Food Availability
Food policy under the largely non-interference open market economy operates under the influence of demand and supply. Over the years subsidies on food commodities were gradually eliminated and interference on trade was minimized. General tariff mechanisms are adopted in regulating imports and on honoring international trade and tariff agreements.

Under the general policy the government dismantled the guaranteed price scheme operated for paddy and other food crops and neutralized the direct participation and market interventions of the State. Subsidies granted to food were largely reduced or eliminated. The wheat flour subsidy, which amounted to about Rs. 6 billion in 1996 were almost removed in 1997 by adjusting the market prices of wheat flour.

The food availability in the market improved gradually and the total availability of calories increased from a level of 2,213 calories in 1991 to 2,266 calories in 1995. A large proportion of the consumption expenditure was for food, with rice alone accounting for 25 percent of the total. The per capita availability of Animal Products is shown in Table 12.

In spite of population increase, the per-capita availability of Chicken has increased. This is mainly due to rapid expansion of the broiler industry. This rate of expansion was not observed in the egg industry. Per-capita availability of all other animal products has decreased during 1995 to 1999.

1.3.2 The Socio-Economic Indicators
Despite commendable achievements in social indicators such as high rates of life expectancy and literacy and a low rate of infant mortality, Sri Lanka is currently confronted with extremely serious political and economic problems resulting from unemployment and high incidence of poverty.

Though the per capita income has grown, the distribution of it is increasingly skewed; the share of the national income for the bottom 40% of the population declined from 19.3% in 1973 to 14.1% in 1986/87 and remained at 14.8% in 1990/91.

Recent estimates of poverty indicate that the proportion of households in consumption poverty declined from 27.3% in 1985/86 to 22.4% in 1990/91, which is a decline in absolute poverty by about 18% in less than five years. The depth of poverty, which was 6.5% in 1985/86 has declined to 4.8% in 1990/91. During this period the poverty in rural households decreased from 31.7% to 24.4%. In the estate sector, the decrease was marginal from 14.3% to 12.6%. However, in the urban sector, there was an increase from 16.4% to 18.3%. Low-income households in the urban sector seem not to have benefited from overall growth experienced during the past five years.

Reference food poverty line derived at daily nutritional threshold of 2,500 calories and 53 gms by protein per adult (age 20 –39 yrs) was Rs. 202.49 per month in 1985/86. In 1990/91

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this was increased to Rs. 421.90 per month. The higher poverty line (about 20%) was Rs. 565.44. Status of poverty all island and by sector is shown in Table 13.

The incidence of poverty decreased by 23% in the rural sector and by 12% in the estate sector; but increased by 11% in the urban sector between 1985/86 and 1990/91. The level and distribution of per-capita consumption expenditures by province is shown in Table 14.

The highest per capita consumption was recorded in the Western Province, followed by the North-Western Province. The Western Province is the commercial and industrial hub of the country. The North-Western Province, which shares a border with the Western Province, has enjoyed the spillover of economic activity from the leading province. In addition, the North-Western Province has one of the best agricultural climates and soils in the country, along with the finest coconut lands. Hence, the finding that these are the two most affluent regions of the country, in terms of consumption per capita, is consistent with a prior knowledge of economic conditions. The Central Province has the lowest per capita expenditure, followed by the Uva Province. The Central Province contains the district with the lowest per capita expenditure level, Matale, which accounts for its ranking at the bottom of the provincial expenditure distribution; The Uva Province, which is mainly an inland area lying far away from the economic hub in the Western Province, and containing no major rivers or irrigation schemes, has generally been a neglected area of the country. This is likely to account for the lowest ranking of the Uva Province.

1.3.3 Nutritional Status
Studies in Sri Lanka and elsewhere have shown a strong correction between malnutrition and poverty. Also, invariably a large proportion of malnourished children are found to be from poor households. A nutrition survey conducted during 1980-82 found 36% of all pre-school children to be suffering from chronic malnutrition, resulting in stunted growth and 12% of the children were found to be suffering from acute malnutrition or wasting.

Along with the noticeable social changes, the nutritional status of children appears to have improved over the last three decades. For instance, stunting (Height for Age) among children of ages 6 – 60 months have appeared to decline from 36.5% in 1980-82 to 23.8% in 1993. Similarly, the wasting (weight for height) declined from 18.4 in 1988/89 to 15.5 in 1993.

The policies of the government of Sri Lanka have always reflected a high degree of concern for the general well-being of the population and efforts have been made consistently, directly or indirectly to help the poor and the under privileged. The food subsidy policy formed one of the major elements of Sri Lanka’s welfare-oriented strategy, the effects of which were reflected in a fairly adequate calorie intake, a relatively low degree of malnutrition, a decline in death rate and a progressive increase in the average life-expectancy, since independence.

Over the years, though the overall food supply situation in the country improved, the household food security problems amongst poor segments of the society remain to be a major problem. The poor are characterized by small and marginal farmers, landless labourers, unemployed and under employed. Food insecurity is also found to be a problem amongst lower paid workers engaged in agriculture and other production and service sectors of the economy. During the recent past Sri Lanka has experienced change in food habits due to migrant workers to middle east.
The open market mechanism appears to affect the farmers in the short run. The ‘market crisis’ through cheaper imports of food items affected the big onion farmers, the potato farmers and the chilies farmers. Some of the producers were wiped out and others struggle for survival. The expected outcome of crisis in the short run is the reduction of the work opportunities for the unskilled. This possibility will further aggravate the household food insecurity amongst the poor households.

Average monthly income per household and per person is Rs. 6,476/= and Rs. 1,442/= respectively and the percentage of income received by poorest 40% of households to total income is 15.2%.

1.4 Role of Livestock

There is a wide range of animal resources for subsistence use in both domestic and commercial markets. They include food items, draught, ornamental, aesthetic enjoyment etc. Some animal products are also used as biomedical materials in indigenous and auralvedic treatment. They are ghee, curd, whey, dung and urine of some livestock species. Some livestock and livestock products have captured local as well as export markets.

In the past due to the “chena cultivation” or shift cultivation method practiced by the rural farmers livestock did not have much impact. Except few scavenging village chicken they did not have any other types of livestock. But now the situation has changed and livestock is an essential component of agricultural activities. Like in other South Asian countries Sri Lanka now dominates mixed crop-livestock farming systems. Animals are an integral component in these systems and perform a variety of roles either supplying products for household, for sale or providing inputs for crop production. They also act as living savings that can be converted quickly into cash when there is cash urgency. The species of animals are cattle, buffalo, goat, pig and poultry. The common feature is the rearing one or few species of them together with the crops. The increasing trend for mixed farming promotes livestock rearing in Sri Lanka. In this context, animals have multi-purpose role in the smallholder systems. Although their contribution of the livestock sector to the total GDP is (1%) low, they are extremely important for the existence of smallholders. These livestock are a good source of family nutrition as they provide milk, egg and meat for children, pregnant women and nursing mothers. Large ruminants are used to provide draught power, milk and meat and manure for croplands. In the past a small proportion of the rural farmers had Buffalo and cattle, basically for draught purposes. In certain pockets, milk production was primary and secondary output was meat. Goat herds were kept by a small proportion of farmers for meat in pocketed areas. Village chicken was available in large numbers.

Lowering the utilization of inorganic fertilizer during the past 5 years has resulted in the need for farmyard manure or organic fertilizer. Therefore the number of farmers who rear large ruminants is gradually increasing. Especially the upcountry vegetable farmers, who do not have land and other resources to rear cattle, purchase cow dung from the cattle farmers in other areas for their vegetable cultivations. As exotic or newly imported breeds of livestock do not thrive well under the smallholder management system, locally adapted or indigenous animal genetic resources seem to play an important role in their farm units.
CHAPTER 2

THE STATE OF PRODUCTION SYSTEMS

2.1 Primary Animal Production Systems

Sri Lanka is considered as an agricultural country for many centuries. According to the structure of Agri-based production systems there are two main sub sectors.

   I. Domestic or non-plantation agriculture.
   II. Plantation agriculture.

Livestock can be defined as an integral component in the sustainable crop-livestock farming systems in the country. It remains as a sub component under the crop-dominated agriculture. Daırying is the most prominent and commonly integrated sector in different farming systems. Government has given high priority to uplift the dairy industry since past but the resultant achievements are not up to the expected level. The feeding practices vary depending on the agro-ecology and the particular farming system. Lack of good quality feed year round is one of the major constraints for profitable smallholder dairy production. The daırying in Sri Lanka primarily depends on pasture and fodder found on-farm, roadside grass or from common property lands with limited areas of cultivated pasture and fodder. Pasture subsidy schemes operated by the government from time to time, has not made any significant contribution to alleviate the problem of the dairy farmers in the country.

Majority of them depend upon grazing as their main source of animal feed. Grazing occurs mainly on paddy land (bunds and harvest aftermath), tank beds, public lands and under coconut. Animals are usually tethered during grazing, except in the Dry Zone where free grazing is practiced. In the higher production potential zones, stall-feeding, often combined with some grazing is common. In the Wet Zone, peri-urban dairy systems use higher quantity of concentrates per lactating cow than elsewhere in the Wet Zone.

In the Dry Zone, which is the predominant rice growing area, larger quantity of rice bran is fed to both dry and lactating cows. Approximate price of coconut poonac and the dairy mix is equal and the price of rice bran is half of it. In some areas cut fodder is used for night feeding for dairy cows when grazing is restricted due to cropping.

Labour forces employed and unemployed is shown in Table 15. Unemployment rate, which was at 15.9% in 1990, has declined to 9.2% in 1998. During the 4th quarter of 2001 the unemployment rate was 8.3%. There is a steady reduction in the population employed in the public sector and a growth in employment in the private sector. There has been a perceptible drop in the labour force with ‘no’ or ‘only primary’ education. The segment with G.C.E. (AL) or tertiary educational qualification has grown. Much of the unemployed population (41.4%) is concentrated among the young adults of 20 – 24 yrs. Labour force participation rate which was 50.2% in 1999 has dropped to 48.9% in the 4th quarter of 2000. Persons employed in agriculture sector have dropped from 35.0% in 1999 to 33.4% in the 4th quarter of 2001.

Depending on the wide range of agro-ecological and socio-economic conditions, a number of livestock production systems are found in Sri Lanka. However, very limited studies have
been undertaken on the farming systems. Our agriculture being crop dominated, information on livestock is extremely limited. Major farming systems which livestock as a component can be listed as follows.

2.1.1 Cattle and Buffalo Farming Systems
Within the livestock sub-sector more prominence is given to broad-scale dairy development. More than 50% of the value of livestock production originates from dairying and another 30% is contributed by beef production, which to a large extent is regarded as a by-product of the dairy industry. In addition, about 95% of the cattle are kept by small holders with a farm size of less than 4 acres and/or by landless estate labourers. It was estimated that about 400,000 - 500,000 farmer families are involved in dairying, which represents almost 15% of the population, if 5-6 persons per farm family were taken as a norm.

2.1.1.1 Plantation Crop Based Cattle Farming System
This system is common in the Uplands, Mid and Low Country Wet Zone. There are two systems of production can be found under plantation crops.

(a) Tea estate system in the Uplands and Mid Country
The Up Country (Hill country) estate workers keep dairy cattle mainly of improved European breeds under stall-fed condition. They have no own lands. For forage requirement, they have to depend mainly on the natural grasses grown on the roadside, ravines and uncultivated lands. Very few farmers have small plot of improved fodder. In addition to grass the cattle are fed with concentrate feeds. It is a common practiced to sell the surplus animals to maintain the herd size about 4-6. Average daily milk production per cow is around 8-10 l. or 2500 l. per cow per lactation. Manure is also a good source of income. Dung is sold as a fertilizer for vegetable cultivation. The potential for further development is limited.

(b) Vegetable based or off – farm based cattle farming systems in the Hill Country Wet Zone.
In the village-based system, farmer owns a piece of land and the farming is mainly crop-livestock mixed farming. They are engaged in commercial oriented intensive vegetable cultivation. Dairy cattle are kept mainly to get manure and the milk is often a secondary. They also get an additional income by selling the surplus animals.

2.1.1.2 Kandyan Forest Garden System in the Mid-Country
This is very complicated but sustainable system with limited potential for further development. The land size is less than one acre. Taller trees such as forest trees (Champaka tree- *Michelia champaka*, Wanasapu – *Michalia nilagica*), plantation crops such as coconut (*Cocus nucifera*), arecanut (*Areca catechu*), kithul/ fishtail palm (*Caryota urens*), jak (*Artocarpus heterophyllus*), fruit crops such as durian (*Durio zibethinus*), butter fruit (*Persea americana*), mangosteen (*Garcinia mangostana*), spices such as cloves (*Syzygium aromaticum*), coffee (*Caffea arabica*), nutmeg (*Myristica fragrans*), pepper (*Piper nigrum*), are common in these lands. From recent times cut flowers also have become a major component. Dairy cattle and goat are kept under semi intensive system. Very often the animals are tethered. Forages are collected off-farm and fed with concentrate feeds. In
addition, the tree fodder grown on the live fence around the garden is also fed to the animals. Generally, the herd size is limited to two cows in production and their offspring. Small-scale rice production in the low-lying areas using buffaloes is also a common feature in this system.

2.1.1.3 Coconut Based Cattle Farming System
The cattle and buffalo rearing in the coconut triangle (Puttlum, Kalutara & Kurunegala districts) and wet lowlands form an integral part of the farming systems. In addition to milk and meat these animals help in controlling weeds and provide manure for the plantation. The bulls and buffaloes are commonly used in land preparation work processing the harvest and for haulage. The dairy buffaloes are also kept and milk is converted to curd, which is a delicacy. Animals are allowed to graze in the coconut land and fallow paddy fields. The land holding size is comparatively large (5-10 acres). Generally landowner resides away from the coconut garden and hired people manage the plantation.

2.1.1.4 Rain Fed Rice Based Cattle Farming System in the Low Country Dry and Intermediate Zones. (Dry Zone Extensive System)
The Northern and Southern Dry Zones possess a considerable variety of settings ranging from sub humid forest, dry scrub to large irrigated rice-growing areas. These zones are characterized by use of indigenous breeds. They graze for most of the year on paddy lands, bunds, tank beds, villus and scrub jungles. The Villus are the flood plains of the main water streams (the Mahaweli and Kala Oya) in the Dry Zone. The extent of villu land is estimated as 20 – 30,000 acres. Villus are not available for grazing in the rainy season from October to February, as they are intermittently inundated by water over flowing from the river. During this period animals are moved to highlands where they graze “Savana type” parklands consisting of low quality and early maturing pastures. Small extent of this area has been planted with Brachiaria brizantha. During other period of the year (February to September) luxuriant growth of grass provides a good resource based for extensively managed cattle and wild life. The pasture species found in the Villus are Brachiaria mutica, Digitaria longiflora, Cynodon dactylon and Paspalidium sp. Sedges varieties such as Frimbystylis, Cyperus and Typha are also common in the Villus.

During cropping seasons, the animals are moved some distance to scrub jungles. There is almost no use of concentrates and only a little use of crop residues. Buffaloes in some herds are fed with rice straw. The herd size is comparatively large and varies from 30 to 200 head of cattle mainly of Lankan and some Indian crosses. Use of natural tree fodders such as katuandara (Accacia leucophloea), kohomba (Azadirachta indica), weera (Drypetes sepiaria), keliya/ kohu-kirilla (Grewia microcos), boru damaniya (Grewia polygama), damaniya/ damina (Grewia tiliaefolia) are common in these areas. These herds utilize feed resource of wildlife. Therefore, spread of diseases especially epidemic diseases to and from livestock is inevitable and is frequently reported. Since the recent past, more and more lands and villus, which were used as natural grazing lands are being increasingly used for other purposes such as development projects, wildlife sanctuaries etc. Therefore, limitation of natural grazing lands has become a serious problem.
In this system, animals are kept as a live saving and they are sold at any moment when there is a need of money. Milk is sold mainly to local market. According to a recent study, the average daily milk production of an extensively managed Lankan cow is $2.3 \pm 1.3$ l. and the lactation length is around 180 days with a calving interval of approximately 1 year. High calf mortality is a common feature. The buffaloes are used for draught purposes in the Northern Dry Zone while dairy buffaloes are reared in the Southern Dry Zone for curd production.

Many of the extensively managed herds are very large (150-300 heads). Semi intensively managed herds are generally smallholder (2 – 3 cattle farm). Intensively managed herds are consisted of large, medium and small-scale farmers. State owned intensively managed large-scale farms are the biggest commercial units. However, medium and large-scale intensively managed private farms are becoming popular from recent past.

Intensively managed herds depend on many external inputs such as veterinary care, concentrates feeds, labour, market facilities, AI facilities etc. Therefore, the farmers tend to give up their operations when they face unfavorable situations. Therefore, the maximum utilizations of the genetic resources are limited according to the level of inputs. For example, when the cost of concentrate feeds increases the level of feeding will be reduced and the production level goes down. Similarly, availability of AI service, which is very much influenced by the infrastructure facilities, affects the breeding strategy of the herds. Many years attempts to upgrade an animal can be destroyed by single mating of an un-descript bull.

2.1.1.5 Off-Farm Income Based Peri-Urban Dairy Farming System
In this system, high producing crossbred dairy cows and buffaloes are kept indoor and fed with limited amount of purchased forages (mainly natural forages & tree fodder) and high amount of concentrates (Coconut poonac and rice bran). Usually these animals are high yielders and milk is sold to the informal market that gives a high price compared to the formal market.

2.1.1.6 Smallholder Buffalo System
Two thirds of national buffalo herd live in the Dry Zone and Dry Intermediate Zone and they are managed extensively. These animals graze on natural forages available in the reservoir (tank) beds, shrubs, jungles, fallow paddy fields, abandoned and uncultivated agricultural lands, roadside grass and other unutilized lands. Usually they graze during daytime. But in certain areas, especially in some districts in the Eastern province the animals graze both during the day and night.

Semi intensive system where animals are tethered during the day is more popular in the coconut growing areas, Mid Country and Low Country Wet Zone. Most of these animals are crossbreds of various genetic compositions. The feed is supplemented with banana stems, jak fruits, and other agricultural by products. In the Low Country Wet Zone, buffaloes are also fed with forages grown in the large tracts of marshy and water logged wetlands.

2.1.1.7 Vegetable Based Intensive “Jaffna Peninsula System”
Intensive crop farming through out the year using ground well water is the common feature. Organic manure coming from livestock is mainly used for own croplands. Different kinds of
cropping systems are practiced. Vegetables, onion and chilies, tobacco, and fruit crops are common in all the cropping systems. Crop-livestock integration is clearly seen. Animals are intensively managed and the predominant breeds are high yielding European crosses.

2.1.1.8 Irrigated Rice Based System
Irrigated rice based system is similar to rain-fed system in many aspects. But there are few distinct features. The herd size is fairly small and the buffaloes are less common. ‘Local X Zebu’ crosses are used for land preparation purposes. The lands are fully occupied in most of the time of the year. The crop residues are available in plenty but are occasionally used for livestock feeding. Each farm family has about two acres of lowland for rice cultivation and about half an acre homestead in the upland. When water supply is limited the farmers go for various other combinations of crops. Rice–pulse crop, and rice–vegetable crop systems are some of the common sub systems.

2.1.2 Goat and Sheep Farming Systems
2.1.2.1 Rain–Fed Highland Crop Based Goat Farming in the Low Country and Intermediate Zones
Goats are reared mainly under extensive system. Breeds are mostly indigenous and cross of Indian breeds. The herd size varies from 10 - 150. The animals are fed with forages in the scrub jungles. Milking is practiced rarely and the main purpose of rearing is for meat.

2.1.2.2 Coconut Based Goat Farming in the Low Country Wet and Intermediate Zones
Goats are reared as small herds of 4-12 under semi-intensive management. Animals are allowed for free grazing during daytime. A shed is provided to rest during night and bad weather. Investment on goat is very low. Some animals are milked while the majority are sold for meat.

2.1.2.3 Intensive Goat Rearing in the Tea Estate Sector
Goats are kept indoors and fed with concentrates and tree fodder. These goats are reared for meat and milk. Improved breed such as Saanan and crosses are used under this system.

2.1.2.4 Crop Based Semi Intensive Sheep Rearing
Sheep rearing is not very common in Sri Lanka. Few herds are reared under coconut and sold for meat. There is no demand for sheep wool. Sheep is also used to control weed in the plantations. Various types and degrees of crosses are available. Herd size varies from 40 – 400. In the Jaffna peninsula the sheep are used for meat and to obtain fertilizer for vegetable crops the predominant type is the famous local breed, which is known as Jaffna Sheep.

2.1.3 Pig Farming Systems
There is a great potential for pig production in Sri Lanka, yet the swine industry is growing at a slow rate. The pig population is mainly concentrated in the traditional “pig belt” extending from Puttlum to Kalutara districts along the Western Coastal line. According to the statistics, the total pig population is around 76,300 and the number had been almost static during last decade. Approximately 26,300 pigs are slaughtered every year. The present per-capita availability of pork is only 3 g/person/day. According to a recent study, swill and rice bran were the most common feeds used in swine feeding in general. Lack of suitable breeding
materials at an affordable price has been identified as the major constraint. The most popular breeds reared in all the pig growing areas are Landrace and Large white. Lack of reliable market is a limiting factor for expansion. Depending on the farmers’ main income source there are three pig-farming systems in existence.

2.1.3.1 Crop Based Pig-Farming System
The main income source of the farmer is crops. Pigs are reared semi intensively. This is a small-scale operation with some improvement to the scavenging system. Very little inputs are required for housing, health care and feed. Pigs are allowed to move around in a limited area or some times animals are tethered. Mainly crossbred animals are reared under this system. Fatteners are fed with kitchen refuses, garbage and swill collected locally. The breeding materials are obtained from a breeder farm. Herd size is approximately 10. Some farmers depend on the middlemen in marketing animals for slaughter while few farmers slaughter their animals and sell wet-pork. Environmental pollution is the biggest disadvantage of this system.

2.1.3.2 Livestock Based Pig-Farming System
The main income source of the farmers is livestock. Pigs are reared intensively. These are well- organized piggaries owned by government or private sector. These farms are located in the peri- urban areas. As the animals are sold to the processing sector or organized butchers and the farmers get a reasonable price for their products. These farmers have direct access to breeding materials. Some of them have even imported stocks and maintaining pure lines. Only a handful of farmers come under this category.

2.1.3.3 Off-Farm Based Pig-Farming System
This is the least organized but self-sustaining small scale of production system. Mainly indigenous types of pigs are reared. This system is also known as back yard system. Herd size is 1-2. However, the number of animals depends on the availability of lands, kitchen refuses and garbage. In some farms crossbred animals are also raised relying on locally available garden or kitchen refuses. This is not a very productive system. The market weight of pigs is approximately 35 - 40 kg at 18 months of age. Very little inputs are required and feed cost is minimal. Very often the breeding materials are generated within the farm. Animals are sold to a local butcher or to a middleman. This is an enterprise in the hand of low- income groups. This system can be considered as the traditional pig rearing system seen in the “pig belt”.

2.1.4 Poultry Farming Systems
Poultry farming systems in Sri Lanka can be categorized into for major groups.

2.1.4.1 Intensive Commercial Scale Operations
This includes small, medium and large-scale operations. In these operations, the input of capital and recurrent expenditure per unit bird is almost equal. But the only difference is the scale of operation. As most of the inputs are imported, the cost of production is high. Most of the small-scale operations are in disadvantageous position due to market fluctuations and also due to low profit margins experienced in the recent past.
In all type of operations, out grower system (buy back) is also can be seen. Farmers are involved in an out grower system where day old broiler chicks, feed and other necessary advices are given by the processing agent. The birds are sold back to the processor keeping a profit margin. This system has become very popular among poultry farmers; as there is a ready market for their products.

2.1.4.2 Semi Intensive Small-Scale Operations
In this system 25-50 commercial birds are kept by a farmer. In addition to compounded feed agriculture by products are also widely utilized. This system is more on income generation to the unemployed women of the low-income groups. As some of the products are consumed by the family, this system helps to improve the family nutrition. However, this system is not self-sustaining as the farmers have to depend on external sources to obtain the follower stocks.

2.1.4.3 Small Scale Scavenging Village Chicken System (Family Poultry Sector)
There is a very high variability in the type of bird found in this sector. On phenotypic appearance these birds are categorized into small, medium and large sized birds. Large proportion of feed is obtained by scavenging. Kitchen wastes, (coconut residue, vegetable tops and skins) agricultural byproducts (paddy, broken rice grams) are also fed to the birds. The importance of this sector is that it provides essential nutrients in the form of eggs and meat to the low-income groups. It also generates a small income by selling the excess eggs and culled birds. The average flock size is 13. This is a self-sustaining system with locally adapted animals, which require no major inputs. Only the shelter is provided for the birds during the night. The farmers who rear scavenging village chicken consume more eggs and meat than the ordinary people. Village chicken contributes approximately, 15% of the total egg production in Sri Lanka.

2.2 Other Common Features of Animal Production
In most parts of the country farmers keep more than one animal species. eg : cattle, goat, chicken, and pigs. Under extensive system of management mostly the local species or locally adapted species, which require minimum inputs, are used. Recently introduced breeds, recommended by the National breeding policy guidelines are also being used in the extensive system. Eg. Sahaiwals, Jamnapari goats for upgrading the local stock. Under semi intensive or intensive systems also either locally adapted or recently introduced breeds are used. These species require higher inputs, such as quality feed, vaccination, better housing etc.

Owners of the intensively managed large herds very often operate individually with the exception of estate sector intensive farmers, where milk collection is done mainly through co-operative societies.

The Sri Lankan diet mainly consists of vegetarian components. They are the major sources for calories, protein and fat. As far as the contribution of different food items are concerned cereals account for 42.7% of the total calorie intake, and 77% of these come from rice. In addition, 18% of calorie intake is contributed by vegetables, nearly 11% by pulses and nuts and another 10% roots and tubers. According to this, the vegetarian components provide 90.7% of the energy component of total diet.

*The State of AnGR- Sri Lanka*
Extensive usage of imported exotic breeds in certain herds has gradually eliminated valuable local genetic resources. Use of exotic semen or bulls in extensively managed rural herds have produced many crossbred animals. As a result the local species are gradually disappearing. The exotic breeds locally adapted or frequently imported (eg. European breeds of cattle, exotic goats etc.) into the country has not perform up to the expectations, mainly due to lack of sufficient inputs such as advance management practices, good quality feed etc. The extensively managed local cattle and goat herds are the main source of beef and mutton in Sri Lanka. Due to poor growth rate, higher mortality rate and smaller mature weight of the local breeds, higher number of animals has to be slaughtered to meet the demand. This has resulted a phenomenon called “eating into the National herd”.

2.3 Risk Factors
There are many risk factors involved in different livestock production systems. Feed resource base used under extensive system is affected by the rainfall pattern prevailing in Sri Lanka. Many cattle herds graze on the poor quality roughages available on harvested paddy lands and tank beds. However, during drought season, as most of the small tanks get dried off the grazing area is increased and the grazing period is also increased. Therefore, the animals are getting sufficient amount of food even the dry season. Body condition score of the animals during draught period is a good indication of the level of feeding.

During rainy season, the tanks get filled and most of the paddy lands are cultivated reducing the grazing area for the animals. Many herds are sent to the jungle for grazing. Disease out breaks such as Hemorrhagic Septicemia (HS), Foot and Mouth Disease (FMD), Black Quarter (BQ) are common in these herds. Scavenging poultry is more prone to diseases such as Newcastle Disease or fowl pox. Due to the out breaks of Japanese Encephalitis in humans, there is a threat to the scavenging pig production system from the health authorities. Swine fever is another deadly disease affecting pig production in Sri Lanka. Pig husbandry is largely limited to the Christian farmer community, while there is no such discrimination to the cattle, buffalo and poultry farming in Sri Lanka. Goat husbandry is popular among Muslim and Tamil farmer communities.

Majority of the Sri Lankans are Buddhists (69.3%). As Buddhists do not like to rare livestock for meat purpose, most of them do not like to sell the animals to butchers. This has created a very informal meat industry in the country. In addition, there is no proper culling system and arranged cattle slaughter system practiced. Until June 2002, due to the total ban on slaughter of female cattle, the dairy farmers were unable to sell their culled or diseased female cattle for meat. The butchers offer very low price for there animals as they are illegally slaughtered. Therefore, these farmers do not get a reasonable price for their culled animals due to the involvement of the middleman. This has also affected the sustainability of the system.

Non-availability of capital and lack of skilled laboures are some other factors, which affect the livestock industry in Sri Lanka. There are few credit scheme operated by the private and state sector. Unfortunately these credit schemes have failed to attract the livestock farmers. Although, unemployment rate is high in Sri Lanka very little percentage of unemployed youths take part in livestock enterprises. Most of the unemployed youths are looking for a
“white collar jobs”. Above risk factors are common to every production system mentioned earlier.

2.4 Important Animal Products

Important Animal products in Sri Lanka are listed below.

Cattle – meat, milk (fresh and fermented), other milk products, draught, fertilizer, biogas
Buffalo – meat, milk (fresh and fermented), other milk products, draught, fertilizer, biogas
Goat – meat, milk, fertilizer
Pigs – meat, biogas
Poultry – eggs, meat, fertilizer
Rabbit – meat

Among the products of animal origin, milk plays the most important role providing more than 50% of the calories from animal origin. The average daily per capita availability of milk is 53gm. The amounts for fish, eggs and meat are 23, 6, and 4 gms respectively, demonstrating the low availability of these commodities and therefore their minor role in the Sri Lankan diet.

In Sri Lanka milk is the main animal product in all cattle and buffalo management systems. In addition to fresh milk, fermented milk products such as curd and Yoghurt are very common. Curd fetches a higher price than fresh milk. There are no special beef breeds in Sri Lanka. The main source of beef is the extensively managed Lankan herds in the Dry Zone. Draught power is another major animal product in the Dry Zone extensive cattle and buffalo system. Approximately 95% of the buffaloes reared in the Dry Zone are used for draught purpose.

Due to reduction in the farm extent mechanization is difficult. On the other hand use of machinery is expensive due to increasing oil price and cost of machinery. Therefore, use of animals, as draught power is common in Sri Lanka. Cattle and buffaloes are used for land preparation work (ploughing and puddling), harvesting (threshing), road haulage (cart bulls) and mixing clay (pottery industry). In certain remote villages of Sri Lanka where road facilities are limited, cattle are used as “pack” animals. Other important animal product is cow dung, which is widely used as a fertilizer in vegetable cultivation. Majority of the domestic animal products are for local consumption. A considerable foreign exchange has been earned by exporting animal products. The details are given in Table 16. Although the quantity of meat of bovines exported during 1992-2000 has been declined, the value has almost doubled. Both the quantity and value of sheep and goat, poultry and swine meat exported during 1992 and 2000 has dropped significantly. Income by exporting milk and milk products, eggs preserved meat, pig fat and poultry fat has been significantly increased during the same period. Income generated by exporting skin and hides is shown in Table 17. Quantity and value of the skins, hides and leathers exported during 1990 to 2000 has also been significantly reduced.

In the Dry Zone some of the large herds of cattle, goats and buffaloes are maintained only for monitory purpose. When the farmers require money, few animals are sold. It is very common
to give the animals as dowry to their daughters. Goats are specially reared for milk and meat. Goat dung is also used as a fertilizer. Sheep is mainly used for meat. In large coconut estates, sheep is also used for landscape management. They are very efficient weed controllers. There is no large-scale wool production in Sri Lanka. Poultry is mainly kept for eggs and meat. Alternative poultry such as Turkey, Ducks, Guinea fowl, etc. are kept for meat and leisure. Rabbits are also reared for meat and leisure. Donkeys are used as draught animals (pack animal) by certain community of people (Gypsies). Generally many of the animals are reared for economic purposes.

Geographical location of Sri Lanka has a positive effect on international trade. Especially the sea traffic through Colombo and Galle harbors promote international trade. However, due to high cost of production and poor standards of the animal products, the foreign demand for local animal products is low. Therefore, Sri Lanka is still unable to catch the international market. Even for local consumption, cheaper animal products from the countries such as India, Thailand, China, Hong-Kong and Indonesia are being imported.

As far as milk is concerned the gap between the local collection and imports are gradually widening. In 1960, 66% of the demand was locally produced. But in 2000 the local production has dropped to 43% of the demand. Poultry sector has been expanding rapidly during past decade. Intensive poultry rearing (commercial) has been expanded even to the rural sector through the by-back system. Due to the improvement in meat processing sector, Sri Lanka is gradually catching up foreign market. The complete ban on slaughter of buffaloes and female cattle was implemented in 1983 to avoid “eating into the national herd”. However, the buffalo population has been stable at 0.9 million during past decade. It is an indication of illicit slaughter of buffaloes for human consumption. Approximately 30-35% of beef produced in Sri Lanka is represented by buffalo meat. In 2002 the complete ban on slaughter of other female cattle and buffaloes was released. It is too early to comment on the impact of this decision.

During the period from 1973 – 1993 the proportion of dairy cows doubled from 20-40% at the expense of a reduction of non-dairy cow from 35-20%, bulls from 20-17% and calves from 25-23%. In buffaloes the number of dairy cows rose from 13-32% with reductions in non-dairy cows from 32-24%, bulls from 30-21% and calves from 24-23%.

Low farm gate price for raw milk has become the major issue for the development of dairy industry in Sri Lanka. Due to this reason a considerable number of farmers have given up dairying. At present the cost of production per liter of cow milk is approximately Rs. 17.00. According to the present milk pricing scheme recommended by the government the price per liter of milk is approximately Rs. 15.00 (3.5 fat, 8.0 SNF). Lack of proper milk collection network, low productivity of animals, lack of quality pasture and fodder, lack of quality concentrate feed for affordable price, poor consumption of raw milk and lack of quality breeding materials are other limiting factors and major constraints affecting dairy industry in Sri Lanka.

Fluctuation of egg and meat prices and high cost of poultry feed are major constraints affecting the poultry industry. As few wholesale collectors control the egg market, they
determine the egg price. This situation has very badly affected the small and medium scale egg producers. During some periods of the year the egg price is lower than the cost of production and many farmers have sold their birds premature and given up poultry farming. Newly emerging diseases are also one of the major constraints affecting the commercial poultry production. Alternative poultry rearing such as turkey, duck, gees, quail and guinea fowl etc. are not very popular in Sri Lanka.

Religious and social taboos affect the swine industry in Sri Lanka. During the recent past, due to outbreaks of Japanese Encephalitis many piggeries in the urban areas have been forced to close down and issue of new licenses to establish piggeries in urban areas has been stopped. Due to the environmental pollution (smell, noise and solid wastes) caused by the piggeries, some piggeries have also been closed down. The local government authorities are reluctant to issue new permit to establish piggeries in highly populated areas. Rabbit farming is also not very popular in Sri Lanka.

Lack of marketing facilities is also another major constraint for the development of livestock industry in Sri Lanka. Due to this reason many people are reluctant to take up livestock rearing and those who have experienced this problem, have even given up livestock farming.
CHAPTER 3

THE STATE OF GENETIC DIVERSITY

Sri Lanka has a vast genetic diversity of both fauna and flora. As far as farm animal genetic resources are concerned the situation is the same.

3.1 Locally Adapted Breeds

There are many locally adapted, recently introduced and continually imported breeds of farm animals scattered all over the island.

3.1.1 Cattle (*Bos indicus*)

I. Lankan/ native cattle (*Bos indicus var. ceylonicus*): Morphological, physiological and production parameters of this breed have been studied. This breed is used as a triple purpose (milk, draught and meat) animal. Same breed of cattle are being used as pack animals in certain rural parts of the island.

II. White cattle in Eastern coast of the island are also a different type of Lankan dairy cattle, which has been adapted to local conditions.

III. “Cape cattle” or “Hatton cow”: This was an excellent dairy cattle, which is believed extinct at the moment.

3.1.2 Buffaloes (*Bubalus bubalis*)

Buffaloes are probably not native to Sri Lanka. But their history is mixed with the earliest human immigrants to the island. The species was domesticated more than 4000 years ago and since then has been extensively draught animals. Water buffaloes have been exported to China in historical times.

I. Lankan buffalo (*Bubalus bubalis bubalis*): Although the Lankan buffalo is phenotypically similar to the swamp type (48 number of chromosomes), it possesses 50 numbers of chromosomes. Its Morphological, physiological and production parameters have been studied. Other than caryotyping, no genetic characterization has been done on this breed.

II. Sri Lankan wild buffaloes. Genetic relationship of this breed is not known. No systematic studies have been carried out on this breed.

III. Semi wild or feral buffaloes. History of these buffaloes is not very clear. No systematic studies have been carried out on this breed.

3.1.3 Goats

I. Indigenous goat. Morphological, physiological and production parameters of this breed have been carried out.

II. Kottukachchiya goat: Morphological, physiological and production parameters of this breed have been carried out.

3.1.4 Sheep

I. Native sheep (Jaffna sheep). Phenotypic characterization has been carried out
3.1.5 Pigs
   I. Indigenous pig. Phenotypic characterization has been carried out

3.1.6 Ponies
   I. Delft ponies or Local ponies: No systematic study has been carried out yet.

3.1.7 Donkeys
   According to the geographical distribution there are two eco-types found in Sri Lanka.
   I. Puttalam donkeys
   II. Mannar donkeys
       No systematic studies have been carried out yet on any of these eco-types.

3.1.8 Poultry
   I. Scavenging village chicken: Production parameters of this breed have been studied.
   II. Recently developed CPRS white and brown egg layers at the Central Poultry Research Station, Kundasale also can be considered as locally adapted poultry breeds. Production parameters of this breed have been carried out.
   III. Nacked neck breed of chicken: These birds are commonly found in the Eastern part of Sri Lanka.
   IV. Fighting cocks: In certain isolated areas cock fighting is taken place and few breeds are available.

3.1.9 Rabbits
   Wild rabbit (*Lepus nigricollis*) is the only locally adapted breed of rabbit found in Sri Lanka.

3.2 Recently Introduced Breeds
3.2.1 Cattle (*Bos taurus*)
   These are may recently introduced breeds of cattle. Friesian, Jersey, Ayershire, Dairy Short Horn, Red Poll, Sunandini, Holstein Friesian, AFS, AMZ, Brown Swiss, Mass-Rhine-Ijssel (MRY) are some of them.
   Cattle (*Bos indicus*):
   Sindhi, Sahiwal, Tharpakar, Haryana, Khillari, Kangayam, Gir, are the recently introduced *Bos indicus* type cattle into Sri Lanka.

3.2.2 Buffaloes (*Bubalus bubalis*)
   Few river type buffaloes have been introduced into Sri Lanka. They are Murrah, Surti, Nili-Ravi, Mehdana.

3.2.3 Goats
   Jamnapari, Saanen, Beetal, Boer, German Faun, are some breeds introduced into Sri Lanka.

3.2.4 Sheep
   Polled Dorset, Wiltshire Horn, Bikaneri, Bannur, Madras Red, South Down are some breeds of sheep.
3.2.5 Rabbits
Rabbit farming is not very popular in Sri Lanka. Very few breeds such as New Zealand White, New Zealand Red, Flemish Giant, Californian White, Vieana Blue and Belgium Red have been introduced during last few decades.

3.2.6 Poultry
Quite a large number of breeds of poultry have been imported to Sri Lanka. They belong to white egg layer types, brown egg layer types and meat types. Some of them are White Plymouth Rock, Cornish, Light Sussex, White Leg Horns, Rhode Island Red, Naked-neck strains etc.

3.2.7 Ducks
Duck farming is also not gained popularity among Sri Lankans. Few breeds such as Velovi, Petrock, Khaki Cambel, Muscovey, Vigro (Vietnam) have been imported.

3.2.8 Turkey
Turkey farming is also not very popular in Sri Lanka. Few breeds have been imported by the private and government sector organizations.

3.2.9 Geese and Quail
Geese and quail farming is also not popular among Sri Lankan farmers. Very few breeds have been imported from time to time.

3.2.10 Swine
Large Black, Large White, Land Race, Middle White and Durock are the newly introduced swine breeds into Sri Lanka.

3.3 Continually Imported Breeds
Following livestock breeds (live animals or semen) have been continually imported to upgrade the local stocks.

- Cattle: Holstein Friesian, Jersey, AMZ, AFS, Sahiwal
- Buffaloes: Nili-Ravi, Murrah, Surti
- Goats: Jamunapari, Saanan
- Sheep: None
- Pigs: Large white, Land race, Duroc
- Poultry: Many strains of white egg layer types, brown egg layer types and meat types
- Ducks: Dual purpose commercial birds (egg and meat types)
- Turkey: Negligible

3.4 The State of Knowledge of the Country’s AnGR
Phenotypic and physiological characterizations of some breeds, their conservation and management have been carried out under the FAO/UNEP funded collaborative project in 1984. But it was not comprehensive enough to include all the information. There is a great need for a systematic genetic characterization program of all the breeds in order to find out the genetic relationship of the breeds. Except the study mentioned above there were no
surveys of AnGR carried out in Sri Lanka. But very little information collected from other surveys on certain breeds of animal species, which are important for food and agriculture production (i.e. Lankan cattle and buffaloes and their crosses, pigs, goats, CPRS white and brown egg layer) are also available. These information though not continuous, are mainly based on production, reproduction and health status of the animal species concerned. There is no system to maintain information on the breeding structure and organization of each breed or group of breeds. There are no information on the actual number of the local breeds of livestock. Distribution of those important breeds and their current status are also not known. These gaps have reduced the ability to develop a database on AnGR and a programme for sustainable use of AnGR.

Due to the civil disturbances in the North and East provinces in which most of the indigenous (local) animals are available, there is a difficulty in carrying out surveys on AnGR. Even in other parts of Sri Lanka a proper study to record the AnGR is yet to be carried out.

There are few major factors preventing from collecting information. They are;

I. Lack of priority in the related areas.
II. Lack of funds and other infrastructure facilities.
III. Lack of manpower.
IV. Lack of knowledge on the importance of indigenous livestock breeds

Following priorities for capacity building are suggested.

I. Establishment of in-country AnGR center
II. Establishment of Regional Genetic Conservation Centers (RGCCs)
III. Data base on conservation and management of AnGR
IV. Human Resource Development on conservation and sustainable use of AnGR
V. Regular livestock census
VI. Email and internet linkages between the RGCCs and individual organizations involved in conservation activities
VII. Establishment of modern GIS system to facilitate location of important AnGR in the country
VIII. Establishment of liaison units to coordinate between local genetic centers and RGCCs.

Through the livestock census carried out so far, it is possible to get some idea about the status and trends of breeds of each species. However, it is difficult to get any information on certain breeds such as ducks, turkeys, donkeys, ponies etc. as they have not been included in the regular census. Even in the available information detail information such as breed, age group etc. are lacking.

The Ministry of Agriculture and Livestock and the central Department of Animal Production and Health (DAPH) have planning units, which collects information on economically important livestock breeds. This information can be used for monitoring the status of some breeds of livestock. The livestock census data from the Department of Statistics and Census also can be utilized in combination. However, as mentioned above it is difficult to collect the detail information of breed structure and their distributions using any of the above resources.
The information of the FAO/UNEP joint project in 1984 study is summarized in the Annexure II. Unfortunately the follow up work has not been carried out after this base line survey. Other than the study mentioned above no comparative characterization studies have been conducted so far. The information on production, quality traits, male-female reproduction performance, draught power, disease resistance, parasite resistance and feed efficiency have been published and most of these studies have been conducted under farm condition. In dairy cattle, comparison of performance of different crossbreds with exotic breeds has been conducted in three research stations namely Karagoda/Uyangoda, Undugoda and Weerawila farms. Results of those experiments are given in Table 18, 19 and 20. According to these results cross breeding of Zebu breeds to European breeds results in a higher production of milk in the F₁ progeny which is markedly superior to the base Zebu level production. Interbreeding of the F₁ progeny resulted a marked declining milk yield in F₁ and F₂ generations. Similar studies have been carried out in goats and buffaloes. Most of the studies were of short duration.

3.5 Assessment of Genetic Diversity

Following breeds of livestock species have been used by farmers in food and agriculture production throughout the country.

<table>
<thead>
<tr>
<th>Cattle</th>
<th>Breed</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lankan cattle and crosses</td>
<td>- triple purpose (draught, milk and meat) animals.</td>
</tr>
<tr>
<td></td>
<td>Other Bos indicus cattle</td>
<td>- triple purpose (draught, milk and meat) animals.</td>
</tr>
<tr>
<td></td>
<td>Bos taurus cattle and their crosses</td>
<td>- duel purposes (milk and meat) animals.</td>
</tr>
<tr>
<td>Buffaloes</td>
<td>Lankan buffaloes and crosses</td>
<td>- duel purpose (draught, milk) animals.</td>
</tr>
<tr>
<td></td>
<td>Exotic breeds of buffaloes</td>
<td>- dairy animals</td>
</tr>
<tr>
<td>Pigs</td>
<td>Scavenging indigenous pigs</td>
<td>- meat</td>
</tr>
<tr>
<td></td>
<td>Exotic breeds of pigs and crosses</td>
<td>- meat</td>
</tr>
<tr>
<td>Goat</td>
<td>Lankan goats and crosses</td>
<td>- meat</td>
</tr>
<tr>
<td></td>
<td>Exotic breeds of goats and crosses</td>
<td>- meat and milk</td>
</tr>
<tr>
<td>Sheep</td>
<td>Jaffna sheep and crosses</td>
<td>- meat</td>
</tr>
<tr>
<td></td>
<td>Exotic coarse wool type of sheep and crosses</td>
<td>- meat and wool, sheep are also used to control weeds in larger estates.</td>
</tr>
<tr>
<td>Donkey</td>
<td>Indigenous breeds</td>
<td>- draught</td>
</tr>
<tr>
<td>Chicken</td>
<td>Scavenging village</td>
<td>- eggs and meat</td>
</tr>
<tr>
<td></td>
<td>Exotic breeds of chicken</td>
<td>- eggs and meat</td>
</tr>
<tr>
<td></td>
<td>Broiler chicken</td>
<td>- meat</td>
</tr>
<tr>
<td>Quail</td>
<td>Exotic breeds</td>
<td>- eggs</td>
</tr>
<tr>
<td>Ducks</td>
<td>Exotic breeds</td>
<td>- eggs and meat</td>
</tr>
<tr>
<td>Turkey</td>
<td>Exotic breeds</td>
<td>- meat</td>
</tr>
<tr>
<td>Guinea Fowl</td>
<td>Exotic breeds</td>
<td>- meat and ornamental</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Exotic breeds and crosses</td>
<td>- meat</td>
</tr>
</tbody>
</table>

In addition to the pure bred animals mentioned above, crosses of Lankan cattle, Lankan buffaloes, goats, sheep and swine are being widely used in food and agriculture production. Exotic blood levels of these crosses vary from 25% to about 87.5%. Percentage of buffalo holdings carrying improved breeds in different agro climatic zones is shown in Table 21.
In the Wet Zone the reduction in the percentage of buffalo holdings may be either due to closing down of the farms or diversification in to any other kind of farming. The percentage of holdings in the other major buffalo rearing agro-ecological zones has increased significantly during 1985 and 1990. This can be due to the successful cross breeding programs implemented or due to taking up of buffalo farming by more people.

Ducks, Turkey, Quail, Guinea Fowl, Rabbit, and Donkey breeds, which are reared in small numbers in isolated units, do not significantly contribute food and agriculture production in Sri Lanka. None of these breeds are being conserved using a managed process. Unfortunately, Sri Lanka does not have any program in place to assist farmers or organizations to conserve specific breeds.

3.6 Livestock Population
Livestock population (species and type wise classification is shown in Table 22). The milch cow population has increased by 22.9% from 1990 to 2000. Although, the other cow population has decreased during the same period, the change is not significant. The bull population has also decreased by 8.4% and the calf population has increased by 7.3% during the same period. In buffaloes the milch cow population has decreased by 2.6% during 1990 to 2000. The change in other cow population is significant and it has decreased by 19.1%. The buffalo bull and calf population have decreased by 27.7% and 13.3% respectively during the same period. Decrease in calf population may be due to higher mortality rate prevailing in the field. In goats, the female and male populations has increased by 20.6% and by 0.6% respectively. The sheep and pig populations have decreased by 49.3% and 12.6% respectively from 1990 to 2000. The Duck population has significantly reduced by 46.2% while the poultry population has remarkably increased during the same period. The cock bird and laying hen populations have increased by 22.5% and 20.7% respectively and the other hens and chick populations have increased by 29.8% and 45.7% respectively during the same period.

The trends in buffalo population in different agro-ecological zones are shown in Table 23. During 1981 to 1997 the buffalo population has been decreased in all agro ecological zones. The overall decline rate was 15.45%. The decreasing trend is shown even in the year 2000. Although, slaughter of buffaloes was prohibited until recent times, illicit slaughter for human consumption can be the main reason for the reduction in buffalo population. Lack of proper breeding programme and marketing facilities for wool and lack of preference for sheep meat are the main reasons for lack of interest of people in sheep farming. As a result the sheep population has declined gradually. Slaughter of breedable females for human consumption may have caused reduction in goat population.

The situation in poultry sector is different from that in other livestock sectors. Poultry industry has increased by 2–3 folds during the past decade. The main reasons could be the private sector involvement and availability of improved genetic materials, quality feed, good health care and marketing facilities.
The distribution of the livestock breeds within the country is shown in Table 24 and Annexure I. Due to the civil disturbances prevailing in the North and Eastern provinces in Sri Lanka, estimated figures are given for Jaffna, Batticoloa, Amparai, Puttlam and Kilinochchi districts. The neat cattle and buffalo populations are highest in Kurunegala district (North Western Province), where intensive and semi intensive type of management is prominent under coconut cultivation. As paddy cultivation is prominent in this area plenty of crop residues are also available for cattle and buffaloes. In addition, most of the livestock farms belong to the National Livestock Development Board are also situated in this province. Mainly exotic breeds (Bos taurus), their crosses and Lankan buffaloes, their crosses with exotic types (Nili-ravi and Murrah) are found in this area. The next highest cattle population is found in Anuradhapura district (North Central Province) situated in the Dry Zone of Sri Lanka. The predominant type of cattle found in this area are Lankan and their crosses with Bos indicus breeds. In Jaffna district intensively managed small herds of high producing Bos taurus crosses are common. The goat population is highest in Jaffna district. The predominant types are Saanen, Jamunapari and their crosses. The sheep population is also highest in Jaffna district. The predominant type is “Jaffna sheep”. The pig population is highest in the western coastal area extending from Puttlam, Negombo, and Kalutara, which is known as the “pig belt”. The predominant types are exotic breeds and the scavenging indigenous pigs. Poultry population is highest in Kurunegala and Gampaha districts. Ducks are mainly found in Kandy (Mid Country) and Gampaha districts. Information on the distribution on other breeds of livestock are not available.

Use of exotic genetic resources on indigenous breeds have reduced the genetic diversity and even has threatened the existence of certain indigenous and locally adapted livestock breeds. It is believed that the famous “Cape cattle/ Hatton cow” which was a locally adapted superior dairy cow is now extinct due to the indiscriminate cross breeding using exotic germplasm. The Jaffna sheep, Puttlam donkey, Delft ponies, and indigenous pigs are some other local breeds, which are threatened at the movement.

3.7 Wild Relatives
There are few wild relatives of domestic species in the country. They are wild buffaloes (Bubalus bubalis), wild pigs (Sus scrofa), wild rabbits (Lepus nigrigollis), small ruminants of cervus family such as spotted deer (Axis axis ceylonensis), hog deer (Axis porcious oryzus), sambar (Cervus unicolor unicolor), barking deer (Muntiacus muntjak malabaricus), mouse deer (Moschiola memminna), jungle fowl (Gallus lafayetti), wild ducks such as common moorhen (Gallinula chloropus) and purple swamp hen (Porphyrio porphyrio). Except wild buffaloes, wild pigs, wild ducks and wild rabbits other wild animal species are protected in Sri Lanka. They are conserved ‘in-situ’ in the wild parks and law prohibits rearing, slaughtering and selling of any product of these animals. Among conserved breeds, sambar population is rapidly increasing. But breeds such as spotted deer and jungle fowl are still threatened. None of these wild relatives are actively being used in breeding programs for domestic species.
3.8 Feral Population of Domestic Animals

There is a large feral buffalo population and a small feral donkey population in Sri Lanka. This feral population has created a critical management issue due to the degradation of pasturelands and water resources in the National Wild Life Parks. It has been estimated that between 40 - 60,000 feral buffaloes are grazing on these National Parks. The wild buffalo population is more or less around 1,500. There are no information available on the numbers of wild pigs, wild donkeys, ponies, jungle fowl and other wild species. The contribution of these wild species to food and agriculture is negligible. These wild species have become a threat to the agriculture sector. However, the wild pigs and feral buffaloes could be incorporated into the food chain of human beings. It is also possible for integration of these species into domestic animal production systems.

In addition to the feral buffaloes the free grazing cattle in some districts have become a serious environmental problem. Due to overgrazing, invasive plants such as “Lantana” have dominated the ecosystem. Food for the wild animals especially for elephants becoming low therefore elephant try to encroach farmland and villages.
CHAPTER 4

THE STATE OF UTILIZATION OF FARM AnGR

4.1 Policy and Legal Instruments
There are several Acts, Legislations and Policy Decisions to facilitate utilization of animal genetic resources and management of environment in Sri Lanka. Sri Lankan environmental legislation has a long history. The first piece of legislation related to environment was passed by the British Colonial Government to control the land resource by the government taking over unused or unutilized land from the public. The Crown Lands Ordinance (1840) declared that all forests, waste, unoccupied or uncultivated land shall be presumed to be the property of the Crown until the contrary thereof be provided. This ordinance encouraged the utilization of bare abandoned land, leading to increased environmental damage. Subsequently, a number of conservation and protection oriented Acts such as Forest Ordinance (1907), Fauna and Flora Protection Ordinance (1937) and the Soil Conservation Act (1951) were passed to mitigate the environmental damage. Later, more than 100 separate statutes that have some connection with environmental protection and natural resources management have been enacted during the past century.

4.1.1 Constitutional Provisions
Sri Lankan Environmental Management Policy originates from the country’s supreme law that is the Constitution. The 1978 Constitution recognizes that the “state shall protect, preserve and improve the environment for the benefit of the community” (Article 24-14), as principles of state policy. The Constitution also recognizes that it is the duty of every person in Sri Lanka “to protect nature and conserve its riches” (Article 28-f). The pledge given in the 1978 Constitution to safeguard the environment as formally institutionalized with the enactment of the National Environmental Act No. 47 of 1980. This Act established the Central Environmental Authority (CEA) in 1981 as the premier state agency responsible for the “formulation and implementation of policies and strategies for the protection and management of environment in Sri Lanka”.

However, the subject of land, which is the important aspect of the environment, has been devolved to the provincial councils, subject to special provision. Some of these provisions are:

a. National Land Commission appointed by the Central Government would be responsible for formulation of National Policy with regard to the use of state land
b. The Commission will include representatives of the Provincial Councils in the Island
c. This Land Commission will have a technical secretariat representing all the relevant disciplines required to evaluate the physical and socio-economic factors relevant to natural resource management
d. National Policy on land use will be based on technical aspects (not on political or communal aspects) and the commission will lay down general norms with regard to the use of land, soil, climate, rainfall, soil erosion, forest cover, environmental factors and economic viability.
e. Provincial Councils should exercise the power vested on them with regard to the land
with due consideration to the National Policy formulated by the National Land
Commission.

Details of the important legislations related to the farm AnGR are listed below. Since the
technologies and the functional needs are changing with time, some of the sections of the
existing legislations have to be amended in such a way to facilitate the executing authority.
Further, most of the acts and legislations listed here do not specially mention anything about
conservation of the AnGR. Acts, legislations and policy documents are listed below.

<table>
<thead>
<tr>
<th>Principle Act/ Amendment</th>
<th>Areas covered by the Act/ Regulation</th>
<th>Execution Institution/ Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>State Agriculture Cooperation Act.</strong> No. 11 of 1972 by a gazette order dated 4th May 1972</td>
<td>Establishment of the National Livestock Development Board to process, supply and market meat.</td>
<td></td>
</tr>
<tr>
<td><strong>Agricultural Development Authority of Sri Lanka, No. 11 of 1972</strong></td>
<td>Coordinate the activities between the Agriculture Department and other government organizations.</td>
<td></td>
</tr>
<tr>
<td><strong>Agricultural Products Ordinance.</strong> No. 29 of 1939</td>
<td>Importation of Agricultural products License from commissioner of Agriculture for restricted goods and application of custom ordinance</td>
<td></td>
</tr>
<tr>
<td><strong>Agricultural Productivity Law No. 2 of 1972</strong></td>
<td>Farming and management of -Agricultural lands, Agricultural Productivity Committee, Agricultural Tribunals, Agricultural co-operative societies</td>
<td></td>
</tr>
<tr>
<td><strong>Animals Act.</strong> No. 29 of 1958, 20 of 1964, 10 of 1968, 46 of 1988</td>
<td>Slaughter and removal of animals, Breeding of cattle, Trespass by animals, Castration and breeding</td>
<td>DG/ APH</td>
</tr>
<tr>
<td><strong>Animal Disease Act.</strong> No. 25 of 1909, 16 of 1912, 26 of 1921… 29 of 1947, Act. No. 33 of 1957, 59 of 1992</td>
<td>Sealing of infected premises, areas, power to close animal traffic, immunization of animals, destruction and disposal of infected animals, testing of animals, registration of premises, manufacture of veterinary drugs and biological products. Issue of license for stud bulls and cows, import and export of animals and animals products, Veterinary drug control authority.</td>
<td>DG/ APH</td>
</tr>
<tr>
<td><strong>Animal Feed Act.</strong> No. 15 of 1986</td>
<td>Approval of Animal Feed Sale of approved animal feed Minimum standard to be maintained.</td>
<td>DG/ APH</td>
</tr>
<tr>
<td><strong>Butchers Ordinance.</strong> No. 09 of 1893, 44 of</td>
<td>Where and when animals to be slaughtered, permits to slaughter of cattle, slaughtered cattle to be registered,</td>
<td>Local government</td>
</tr>
<tr>
<td>Act/Ordinance</td>
<td>Description</td>
<td>Authority</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
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<tr>
<td><strong>Contagious Disease Act. No. 44 of 1961</strong></td>
<td>Establishment of the Oils and Fats corporation to manufacture and sale of all kinds of oils oleaginous and saponaceous substances, food products, detergents, emulsifiers, fats and sale of byproducts such as animal feed</td>
<td></td>
</tr>
<tr>
<td><strong>Corporation Act. No. 19 of 1955 and State Industrial Corporation Act. 49 of 1957</strong></td>
<td>Killing animals with unnecessary cruelty, using animals unfit for draught, penalty for permitting diseased animals to die in any streets.</td>
<td></td>
</tr>
<tr>
<td><strong>Cruelty to animals Ordinance</strong></td>
<td>General regulations of customs Import of products of animal origin, coordinate the application of written laws with the customs ordinance. Section 12, Schedule B</td>
<td>DG/ Customs</td>
</tr>
<tr>
<td><strong>Fauna and Flora Protection Ordinance. No. 2 of 1937, Act. No. 49 of 1993.</strong></td>
<td>Prohibition of manufacture, importation, sale and distribution of food, labeling, packaging and advertising of food.</td>
<td>Local government authority</td>
</tr>
<tr>
<td><strong>First Authoritative Forest Policy Statement 1929 – Amended in 1938</strong></td>
<td>Prohibition or regulation of transport or removal of food or cattle</td>
<td></td>
</tr>
<tr>
<td><strong>Food Act. No. 26 of 1980, 20 of 1999</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Law or Act</td>
<td>Summary</td>
<td>Authority</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>Food production (Estates) Ordinance.</strong> No. 02 of 1943 Act. No. 40 of 1954</td>
<td>Law relating to forest and selling and transport of timber. Application of customs ordinance for regulation to export</td>
<td>Govt. Agent (District Secretaries)</td>
</tr>
<tr>
<td><strong>Import and Export Control Act.</strong> No. 01 of 1969</td>
<td>Provide for the application of the customs ordinance, stipulates, restrictions and prohibition of imports and exports.</td>
<td></td>
</tr>
<tr>
<td><strong>Mahaweli Authority of Sri Lanka Act.</strong> No. 23 of 1979</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Milk Board Act.</strong> No. 12 of 1954, 28 of 1955, 09 of 1957, 18 of 1964,</td>
<td>Establishment of the milk board to establish and maintain efficient and cheap milk production, promotion of milk and milk product marketing</td>
<td></td>
</tr>
<tr>
<td><strong>National Environmental Act.</strong> No. 47 of 1980, 56 of 1988</td>
<td>Protection, management and enhancement of the environment, for the regulations, maintenance and control of the quality of the environment, prevention abatement and control of pollution</td>
<td></td>
</tr>
<tr>
<td><strong>National Forest Policy</strong> Restated in 1972 and 1980</td>
<td>Conserving forests to preserve and ameliorate the environment and to protect fauna and flora for aesthetic, scientific, historic and socio economic reasons</td>
<td></td>
</tr>
<tr>
<td><strong>National Zoological Gardens Act.</strong> No. 41 of 1982</td>
<td>Provide for the administration and management of the National Zoological Gardens, to provide for the establishment of the zoo, development and welfare funds and for matters connected therewith or incidental thereto.</td>
<td></td>
</tr>
<tr>
<td><strong>Plant Protection Act.</strong> No. 35 of 1999</td>
<td>Introduction and spreading of any organism harmful to, or injurious to, or destructive of plants and the sanitation of the plants. Prohibition and restriction for importation of plants, fruits, seeds, vegetables, and their products etc.</td>
<td>DG/ Agriculture</td>
</tr>
<tr>
<td><strong>Pasture Land Act.</strong> No. 04 of 1983</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rabies Ordinance.</strong> No. 07 of 1893, Act. No. 22 of 1955, 23 of 1956,</td>
<td>Stray dogs to be seized destruction of disease dogs, destruction of suspected dogs and diseased animals other than dogs.</td>
<td>Local government authority</td>
</tr>
<tr>
<td><strong>Sri Lanka Council for Agriculture Review Policy Act.</strong> No. 47 of 1987</td>
<td>Provide the establishment of the SLCARP to advice the government on all matters regarding the organization; coordination, planning and execution of agriculture research</td>
<td></td>
</tr>
</tbody>
</table>
and such other related matters may be referred to it by the Minister. Formulate national agricultural research policy and priorities.

**Suburban Dairies and Laundries Ordinance. No. 38 of 1908**
Regulate establishment of suburban dairies

Registration and training of veterinarians, discipline and code of conduct.

**Wildlife Protection Society of Ceylon Act. No. 29 of 1968**
To assistant cooperate in the prevention of and destruction of wild animals and plants and to encourage the preservation wherever possible of wild life in Sri Lanka in natural conditions.

As shown above there are many policies and legal instruments on the use of AnGR in Sri Lanka. These policies prevent uncontrolled use of AnGR in the country. Many of the legislations ensure sustainability of the existing breeds and also enforce strict control measures on the breeds that are introduced from other countries. With the implementation of the animals act, cattle trespass ordinance, cattle breeding ordinance and buffalo protection ordinance were replaced. In addition to the above acts and legislations, Biodiversity Act that covers access and benefit sharing of genetic resources including domestic animals is being prepared.

### 4.1.2 International Policies and Legislations

International trade policies for the marketing of animals, animal products and other commodities are provided by the international trade agreements according to the rules of the General Agreement on Tariffs and Trade (GATT), the World Trade Organization (WTO) or regional block such as North America Free Trade Agreement (NAFTA) and Economic Community (EC). The most important agreement in the animal health field is the Agreement of Sanitary and Phyto–sanitary (SPS) measures. As regards the export and import of wild animal species the Center for Internal Trade and on Endangered Species (CITES) provides international guidelines as regards conservation of the respective species are concerned.

The WTO designated Office International Des Epizooties (OIE) is dealing with animal health technical issues, thus it lays down guidelines for trade and trade disputes concerning animals and animal products. The FAO Codex Alimentarius provides international requirements for food safety the Hazard Analysis and Critical Control Point System (HACCP), ISO 9000 series, ISO 14000 series etc. control the requirements for food quality, in the livestock product manufacturing process. In addition regional blocs such as EC, and NAFTA have also imposed some rules and regulations. By lateral agreements between countries also bind matters pertaining to import and export trade. Present Indo-Sri Lanka by lateral trade agreement provide duty free concessions in India for processed meat and milk products from Sri Lanka.

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Sri Lanka has implemented major trade policy reform measures to create an internationally competitive environment for the Sri Lankan agricultural and manufacturing products during last two decades. Private sector agencies including farmer organizations will be facilitated for the delivery of extension services and input supply for livestock development in the country. The government will also adopt measures to ensure a level playing field between competitive domestic livestock commodities, products and imported food products, which directly compete with them by the adoption of tariff rates compatible with the existing agreements such as SAPTA (South Asian Preferential Trading Agreement) and SAFTA (South Asian Free Trade Area). SAPTA and SAFTA were formulated by the South Asian Association for Regional Cooperation (SAARC) in 1995, in order to promote regional trade integration. At present seven countries namely Sri Lanka, India, Pakistan, Maldives, Bhutan, Nepal and Bangladesh are the member countries of SAARC. Tariff policy liberalization in line with the GATT/Uruguay Round Agreement on Agriculture (GURAA), SAPTA and SAFTA on non-plantation agricultural sector, (food crops and livestock products) indicated that these products have been exposed to import competition after implementation of the policies. Indo-Sri Lanka Free Trade Agreement (FTA) was implemented to eliminate custom tariff in trade between India and Sri Lanka, subject to the negative lists of both countries. This will reduce domestic consumer price, improve imports and exports and improve market opportunities of both countries. Action has been already taken to implement a similar trade policy between Sri Lanka and Pakistan.

Liberalization of trade will be pursued further in that no licenses, permits or other government administered requirements, other than needed for technical reasons will be used to restrict legitimate trading of livestock species, livestock products and inputs. Pricing for livestock production inputs and products will be a function of market forces. The government will be responsible for the maintenance of a pool of specific livestock genetic material of potential economic importance to future livestock sector development. Dairy cattle will be given a major emphasis in the livestock sector development programs. The above policy objectives does not mention of the preservation of the indigenous farm animal AnGR and some of the policies such as the wavering of government administered requirements may spell out the un regulated use and export of valuable farm animal AnGR and the government role in the maintaining of a pool of genetic material though not clearly stating whether it also includes indigenous farm animal AnGR.

4.1.3 Policy Documents
There are few policy decisions, which will facilitate the use of AnGR.

1. Pasture subsidy scheme, 1979
2. National conservation strategy, 1988
3. Ministry for environmental affairs, establishment, 1990
5. Livestock sector policy review – 1992
Information on the state of actual enforcement of many of the above policies are not available. However a brief explanation of the present situation of some of the policies are given below.

This document was the first to point out the authorities that the development of the livestock sector had been constrained in the past mainly by lack of confidence for both public and private sector participation in the industry. It further stresses that a clearly defined policy framework is urgently needed for the improvement and expansion of the livestock sector.

This led to the preparation of a Memorandum submitted to the Cabinet in 1992. The policy issues discussed and the policy measures recommended in the Memorandum were concentrated on the following areas.

a. Import protection of the local dairy industry

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b. Raw milk pricing and payment for raw milk  
c. Tax regimes and input subsidies  
d. Dairy cooperatives  
e. Slaughter regulations and standards for the meat industry  
f. Promotion of growing of raw materials for the feed industry

This policy review was completed according the above memorandum and the policies developed for the livestock sector were collaborated under eight principles as given below.

a. An increased level of self reliance in the dairy sector  
b. A phase reduction in public ownership in the livestock sector.  
c. An increase in private sector investment in the sector.  
d. An increase in rural income levels, rural nutrition and employment opportunities  
e. Support for balance of payments either through expansion in, or diversification of, the export base and/or import substitutes.  
f. A more efficient allocation of resources by liberalizing trade.  
g. An increase in efficiency in Government operations in the sector.  
h. An increased recognition of gender perspectives in the sector planning.

Basically the policy statements describes the shifting the role of government to facilitate the private sector in the development process of the livestock sector (i.e. production, processing, marketing and service delivery). Government was to concentrate on the regulatory and supervisory aspects of the industry. The primary institutional framework for development of the dairy sector had been defined as farmer cooperatives. Relaxing trade impediments, phasing out import subsidies, applying uniform tax regimes to all existing operations and new entrants in the industry were also among recommendations. Environmental standards for process activities in the industry to be monitored and enforced. Gender perspectives incorporated in project planning, implementation and monitoring activities. However, the implementation phase of these policy recommendations was not satisfactory.

III. Draft Proposal on Development Program for Self-sufficiency in Milk by the Year 2005 - (1994)
The document had been formulated with the aim of bringing forward various policy issues related to the development of local dairy industry highlighted by various reports. The proposal included recommendations and suggestions to those policy issues. The policy issues listed were as follows.

a. Low farm gate price of milk  
b. Influx of imports and heavy advertising by the multinational companies  
c. Lack of inputs for dairy development  
d. Diverse production systems and development needs  
e. By product of dairy industry: meat and draught  
f. High cost of veterinary drugs  
g. Credit and tax rebates  
h. Consumer demand
In 1989, the first breeding policy for livestock (dairy sector) was formulated. This was published as an expanded document in 1994 for all livestock animals (cattle, buffalo, goat, sheep and pigs).

In this policy document, breeding objectives and strategies have been defined with respect to the various species of livestock in the various agro-climatic zones under different management systems. The overall breeding strategy is to upgrade the national herds using genetically superior breeds.

Breeding of farm animals has become more systematic after the implementation of the breeding policy guidelines. As one of the objectives of the breeding policy guidelines is to reduce the number of breeds available in Sri Lanka, use of some breeds of livestock on the systematic breeding programs was gradually phased out e.g. Dairy Shorthorn, Surti, Sindhi, Gir, Sunanthani etc. As a result those breeds are slowly vanishing. On the other hand, certain breeds, which have been used extensively, have become more predominant in some areas. Some examples are Lankan x Zebu crosses, Sahiwals and Crossbred buffaloes in the Dry Zone, Friesians - the up country, AMZ and AFS crosses in Mid Country and Low Country Wet Zone etc.

The breeding policy guidelines have overlooked the other aspects such as availability of feed, improved management, health care and marketing facilities and more importantly the conservation strategies of AnGR. Therefore it is the time to review the progress of the resulting generations and do the changes if necessary.

Temperate pure breeds such as Holstein Friesian and Jersey or Breeds such as AMZ or AFS have also been increased due to importation of semen. Similarly, semen of LW, LR, Durock, Jamnapari, Saanan also had been imported from time to time. Details of Semen imported from 1990 to 2001 and Livestock imported during the same period are shown in Table 25 and 26 respectively.

V. Milk Board Act - 1954
With the implementation of the Milk board Act, the National Milk Board was established in 1954. In 1965 the average daily milk collection from 12 collecting centers was 46,000 pints. The number of collecting points and the average daily collection gradually increased and in 1976 the daily collection was 308,000 pints from 44 collecting points (600% increased over 11 years). In 1979 for the first time in Sri Lanka, subsidies for pasture establishment was introduced.

This policy document has been formulated by a group comprised of five sub-committees on livestock production. They are ruminant production, non-ruminant production, processing and marketing of livestock products, supporting services and animal health. Accordingly the suggestion and policies have been drawn for these sub sector activities. Short-term recommendations were focused on the milk imports and marketing, herd improvements,
production of breeding materials, product processing, and improvement on livestock supporting services and improvement of nutritional status of the livestock.

VII. Dairy Industry in Sri Lanka
Status, Limitations and Suggestions for Revival – 1997
The document included the recommendations for sustainable development of the dairy sector discussed over the three sub-headings given below.
   a. Development of cohesive national policy for livestock sector, and increase coordination among the line ministries and agencies.
   b. Strengthening of producer participation production, value addition and marketing of livestock products and removal of market distortions.
   c. Strengthening animal health, breeding and extension.

VIII. Rapid Appraisal Dairy Sector – 1998
The recommendations of this document were focused only on the dairy sector and its related activities. The recommendations have been drawn under five areas of dairy sector. Those areas were,
   a. Breed improvement
   b. Feed resources
   c. Management of common properties (grazing lands, public lands)
   d. Improving the nutritional value of milling by products
   e. Technical information – public/private sector

IX. Policy Framework and Strategies for the Livestock Sector – 1998
A review of all the policy recommendations forwarded to the Ministry of Livestock Development and Estate Infrastructure (MLDEI) was carried out to develop a policy framework and strategies applicable to entire livestock sector with the support of the government of Germany.

There are no policies and regulations that support and promote the preservation and use of indigenous knowledge and practices relevant to the use of AnGR. However, The Sri Lanka Resource Centre for Indigenous Knowledge (SLARCIK) at the Forestry Unit, University of Sri Jayawardanapura, Sri Lanka has initiated preparation of a National Policy for conservation and sustainable use of indigenous knowledge. Helvetas Sri Lanka (Swiss Association for International Corporation) initiated a network on ecological and sustainable family systems in 1997 to contribute towards improving sustainable farming systems in general and organic agriculture in particular. Helvetas has also involved in compiling of indigenous knowledge in Sri Lanka. The basis of indigenous knowledge is the utilization or practicing of indigenous techniques according to the requirement targeting indigenous animal species. When the indigenous livestock species are disappearing the indigenous knowledge is also slowly getting depleted. Transferring of indigenous knowledge from generation to generation has ended because it has been replaced by modern scientific knowledge, introduction of exotic breeds and migration of people from villages to cities. The present generation is not prepared to carry the indigenous knowledge over to the next generation. Therefore, in view of its value to the AnGR conservation and sustainable utilization immediate steps should be taken to collect document and preserve the indigenous knowledge.

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before it is lost forever. Currently few documented evidence are available on traditional husbandry practices, their indigenous knowledge on selection, conservation and utilization of AnGR. Very little is known on traditional practices rituals and their believes.

There are few institutes that enable and support the use of AnGR. National Livestock Development Board (NLDB), which was established under No. 11 of Agriculture cooperation Act. of 1972 is responsible for maintenance of the majority of the livestock farms in Sri Lanka. NLDB plays an important role in conservation and utilization of many livestock genetic materials. NLDB is also provides facilities to conduct research. Presently the NLDB is under the Ministry of Agriculture and Livestock (MAL). Department of Animal Production and Health (DAPH), which is also under the MAL is the main government department responsible for disease surveillance and control planning and monitoring. Establishment of research institutes, universities, farm schools and co-operative societies etc., which are contributing for the research and development activities in livestock sector have also been established under respective Acts and Legislations.

National Research Council (NRC), National Science Foundation (NSF) and Council for Agricultural Research Policy (CARP) provide financial support for research and training in livestock sector. Mahaweli Authority of Sri Lanka (MASL) also provides facilities for research and extension. Agricultural Development Authority of Sri Lanka (ADA), coordinates the relevant authorities and provides extension facilities.

There is no specific institution with specific facilities for preservation of germplasm of animal origin. Facilities for conserving the genetic material of wild species of animals and local breeds of livestock are considered inadequate. There are no policies or legal instruments to support and promote sharing of benefits that are derived from the use of AnGR. However, there are several policies, Acts and legal mechanisms related to environmental protection that have an impact on AnGR. Some of them are Fauna and Flora Act, Forest Ordinance, National Environmental Act etc. (please see the list of Acts and legislations above).

4.2 Value of Different AnGR

Improvement of AnGR is considered a primary element in Sri Lanka’s strategy for enhancing food and Agricultural production and productivity. Breed improvement programmes such as upgrading and cross breeding of local species is the recommendation for the improvement of the productivity of local animals. However, as animal power is still being widely used in Sri Lanka, farmers prefer to maintain the local animal species pure in certain areas. Experiments have shown that the genetic potential of the local animals is fully exploited in their natural environment. Any improvement in the management, health, husbandry or feeding has not improved their productivity.

In Sri Lanka the price of cattle and buffalo milk is based on the fat content and the Solid Non Fat (SNF) content. Therefore the milk from Lankan cattle fetch higher price than that of Taurine breeds, because of the high fat content in milk. Low milk yield of Lankan cattle is compensated by the higher milk price. Curd made up of buffalo milk is delicacy in Sri Lanka. Curd from the Southern and Eastern provinces is world famous. Because of this reason the market price of a pregnant female buffalo is more than double the price of a pregnant cow.
Sri Lanka price of a brown egg is always higher than that of a white egg. Therefore the demand for white egg laying strains is low. Broiler meat fetches higher price over salvage value of a layer commercial. But village chicken is in demand for both meat and egg, hence fetches a higher price. Some of the up country estate sector dairy farmers prefer brown and white cattle to black and white animals. Therefore in certain areas brown and white animals (Ayershire and crosses) are predominant.

Some livestock species have significant influence in cultural, religious, and recreational or other social aspects. As pure Lankan Cattle are small made and resilient the males can run faster than other cattle. Therefore these males are used for cart races during festive seasons (especially in April). It is very common in Sri Lanka to release the cattle or buffaloes meant for slaughter as an appeasement to the God so that a closed relative or a friend will recover from serious illness. Once these animals are released they become the property of the God and such animals are known as “Pin-gona”. Goats are being sacrificed in some Hindu and Muslim religious functions. Chicken blood taken by pricking the comb is used in cultural ritual functions known as “Shanthi Karma” or “Thovil”. Similar ritual functions are carried out, in order to drive away demons, where people assume that diseases are the manifestations caused due to a person being possessed by devils and demons. Such rituals are very common in the Southern part of Sri Lanka. Beside, sacrificing the animals other offerings such as food also can be seen in these activities.

Strong Buddhists in Sri Lanka do not consume any meat. Similarly the Hindus do not consume the beef. Muslims do not consume pork. ‘Ghee’ made up of cow or buffalo milk is widely used in indigenous medicine. Other than curd, ghee and fresh milk other milk products are not very popular in Sri Lanka.

There are some livestock breeds that are currently not making a significant contribution to food and agriculture, one such breed is Delft ponies; a locally adapted species available only in an island in the war-affected Northern region. There is no program to improve or use of this valuable germplasm. Puttlam donkeys, which are found in the North Western region, are also not utilized in any activities. Although no proper investigation has been done on these species, it is believed that both these species are threatened. The same situation is true with the Jaffna sheep, which is also found only in the Northern peninsula. Feral buffaloes, which has become a threat to the wild life, is also presently do not contribute to food and agriculture.

4.3 Breeding Patterns
There is no proper identification or recording system in the extensively managed herds. Therefore, uncontrolled breeding is taking place. But in some extensively managed herds where milk collection is practiced, systematic crossbreeding can be seen. The main exotic type used for upgrading under extensive system is Sahiwal. Crossbreeding using Friesian or Jersey breeds is also recommended. In well-managed herds, systematic cross breeding using Jersey or AMZ semen is common. In the extensively managed buffalo herds, where no milking is practiced unstructured breeding using the non-descript local bulls can be seen. But if milking is practiced, systematic cross breeding using studs of Indian River types such as Murrah, Nili Ravi or Surti is common. In the intensively or semi- intensively managed cattle
and buffalo herds, systematic cross breeding or upgrading is predominant. In the nucleus herds where purebred animals are maintained straight breeding is recommended. In the systems where unstructured breeding is taken place the males and females are self-replacing. But under systematic cross breeding or straight breeding the breeding males are replaced periodically to avoid inbreeding.

Very limited studies have been carried out to evaluate the existing breeding systems. Performance of the crossbreds of the Lankan Cattle, (Table 18,19 and 20), Lankan buffaloes (Table 27) and goats has been measured. The $F_1$ progeny has given more than doubled the yield of Lankan buffaloes. This increase can be further improved by continuous upgrading. Cross breeding experiments of Lankan cattle have shown that incorporating exotic germplasm will improve the milk production of Lankan cattle.

As far as pure breeding is concerned there is a continuous supply of breeding stock. But in the crossbreeding system where maintenance of 50% exotic genetics composition is recommended, the sustainability of the breeding program is questionable as there is no proper programme to produce $F_1$ breeding sires or semen for field use. Mainly the cross breeding system is used to upgrade the Lankan cattle and buffaloes in the extensively managed herds to produce a triple purposes (meat, milk and draught) animals. Crossbreeding is practiced with goats, sheep and pig as well. But systematic evaluation of these crosses has not performed.

The breeding strategy for Lankan cattle in the Dry Zone extensive system is continuous upgrading using Zebu breeds such as Sahiwal. The objective is to produce a dairy dominated dual purpose animal. In the Dry Zone intensive system the recommended breeding strategy is to upgrade the existing herd to 50% exotic level and maintain at that level. The breeding strategy for Lankan buffalo is continuous upgrading using exotic breeds. The objective is to produce a dairy type animal. If draught power is required, it is recommended to maintain 50% exotic blood level. Breeding strategy for the extensively managed local goats is continuous upgrading using exotic breeds, such as Jamnapari, Beetal or Sri Lanka Boer. In all these recommendations improvement of the production has been considered as the primary objective.

In cattle, buffalo and goats the main breeding system is natural breeding. Although the field AI service in cattle has been started in Sri Lanka, in 1942 still the national coverage is less than 15%. The slow progress of the AI service indicates a need of planning and popularizing the AI service among the smallholder farmers. Buffalo and goat AI is not very popular among farmers. There are no records available on the number of buffalo and goat AIs performed annually. AI performance during last ten years is shown in Table 28. The yearly average increase was 9,383 inseminations. It has taken ten years to increase the number of AIs from 52,790 to 137,240 from 1991 to 2000. At this rate of increase it will take another 46 years to achieve a target of 600,000 AI per annum.

As the majority of cattle, buffaloes and goats are naturally bred, breeding records, performance recording of the offspring, and evaluation of genetic gain are not taking place in those herds. Even in the organized farms where, AI is the main breeding system a proper
performance recording or genetic evaluation are not taking place. In swine the main breeding system is natural breeding. Recently AI using deep frozen pig semen has been made available to the needy farmers. Only in few large-scale breeding herds, performance recording and selection are taking place.

Under natural breeding the efficiency in genetic improvement is poor, because of the poor quality of the studs used. Many of those studs are selected by the farmers without proper evaluation. The genetic potential of the upgraded offspring is not fully exploited under the poor management condition prevailing in many farms.

4.4 State of Capacity for Development of AnGR
As animal breeding is a devolved function, the provincial governments have to play a major role in providing technical assistant, extension services and training for the staff as well as for the farmers. The research capacity is available in the central Department of Animal Production and Health and the relevant departments of the universities.

Performance recording (milk recording) scheme is available only for cattle in very limited number of farms in the Mid Country. The main purpose of milk recording is genetic improvement via selection. As the milk recording is done at the farmers’ premises, the superior germplasm available in the field is also incorporated into the National Level breeding programs. Farmers will be able to judge the genetic superiority of their own animals. In the past, milk recording was the function of the central department. But now it has been handed over to the provincial government.

The farmers are organized into producer societies and the products are sold to the private/government sector through the societies. Animal insurance scheme, credit facilities, feed and drugs etc. are provided by the societies. Subsidy schemes provided by the public sector have both positive and negative impacts. Field extension service, which is operating through the range government veterinarian provide most of the services to the farmers. Even the private sector works through this extension network. The DAPH is the main organization, which provide training and research facilities within the country. There is one Veterinary Research Institute under the DAPH. The NLDB and MASL are also providing training and research facilities.

DAPH does formal training programmes of trainers as well as farmer extension program for livestock sector. Extension material is prepared by the DAPH on production, management, health care breeding, feeding etc. In poultry sector training and extension work are conducted by both private and government organizations.

Commercialization of poultry industry has changed the composition of animal population in the country with a large increase in commercial poultry population. Limitation of land holdings have become a threat to all locally adapted breeds.

4.5 Trends and Future Use of AnGR, by Species
Advancement in technologies such as AI, ET and IVF etc potentially affect the genetic improvement of livestock. Although the present AI coverage is very much low, this technique can be successfully utilized in dissemination of male germplasm all over the country. ET
being the opposite of the AI can be used to utilize the superior female germplasm widely. IVF technology can be used to produce viable embryos of known genetic composition using even the slaughter-house ovaries. Advancement of technologies requires capital. But borrowed capital, which offers 3% or 6% for large animals or small animals respectively, will not be profitable. Hence as the profit margins are low the pay off for new technologies may not be adapted readily. Imported cheaper products may hinder the growth of the local industry. Thus the need for AnGR will not be high as in the past. Policies of importation of subsidized milk and milk products have very badly affected the livestock industry. There is no clear animal husbandry policy to develop the AnGR in Sri Lanka. Continuous importation of livestock species and semen of exotic breeds have also resulted in dilution of the local animal genetic resources. Lack of proper breeding and selection programme to utilize the local germplasm has also affected the sustainable use of the AnGR in Sri Lanka.

The Animal Breeding Division and the Veterinary Research Institute in the DAPH support the development of AnGR through genetic improvement research, extension, and training. In addition to these organizations relevant Departments of the universities through out the country are also engaged in the development of AnGR. MASL, the NLDB and milk collecting agencies such as Nestle Lanka Ltd., Milk Industries Lanka Ltd. Co. (MILCO) and coconut triangle milk union are other organizations, which support the development of the AnGR.

Genetic improvement alone will create other problems such as feed shortage health problems and marketing of the products of genetically improved breeds. Therefore the aspects of non-genetic development such as feeding, healthcare, marketing and general management have to be given equal consideration and genetic improvement should go hand in hand with the non-genetic development.

There are no specific breeds developed for export market. But there is different local market for different animal products. Retail price of livestock products have been changed during 1994-2001. The average price change of livestock products is shown in Table 29. Price of fresh milk has increased by 212.5% during the period. Increase of milk powder produced locally (Highland) was 82.9% while the price of imported milk powder has increased by 112.3%. Among other livestock products beef price has shown a significant increase (107.1%). Village chicken, eggs and meat are considered as a “bio food” and have a higher demand. Brown chicken eggs are sold at a higher price than the white eggs. Wild boar meat is a delicacy in Sri Lanka. However, sale of wild boar meat is prohibited in Sri Lanka. Curd made up of buffalo milk is very popular among Sri Lankans. It is believed that the goat milk prevents asthmatic conditions in humans. Ghee is widely used in indigenous medicine.

Alternative poultry rearing such as duck, geese, turkey and quail also have a potential among farming communities of the country. Although other farming such as ostrich, deer and crocodile are not practiced in Sri Lanka, it can be introduced for use over the next decade.

4.6 State of Genetic Development
There are few breeds, which are currently making a significant contribution to food and agriculture in Sri Lanka. They are listed below.
1. Locally adapted breeds - Lankan cattle (Bos Indicus var ceylonicus) is being upgrading using Bos indicus (Indian) and Bos taurus. The initial upgrading program has started in the 50’s. Mostly over 35% of the population is in various stages of F₁, Back cross (BC₁), BC₂, BC₃, BC₄. Taking the generation interval of 46 – 50 months, the exotic blood levels in this population may range from 25 – 65 % (estimation from past records). Genotype X environment interactions of these crosses were not properly studied.

2. White cattle in the Eastern province - This is also a locally adapted breed, which has been selected for draught and meat. According to the records available there is no genetic characterization of this breeds has been carried out. Although the actual number of the animals is not known the numbers are gradually decreasing. Approximately 85% of the beef requirement is supplied by the extensively managed cattle and buffalo herds.

3. Pack animals - Mechanization has drastically reduced the use of these animals. Genetic characterization or potentials of this breed is not yet studied.

4. Swine - The scavenging pigs reared along the Western Coastal area is the main source of wet pork in the city of Colombo. Farmers prefer these breeds because little inputs are required to manage these animals. The feed cost is also very little as they are scavenging. There is a ready market for these animals.

5. Goats - Extensively managed local goats in the Dry Zone are the main source of mutton in Sri Lanka. There is very little genetic improvement taken place in these herds. Main reasons may be lack of sufficient numbers of quality studs and negative attitude of the farmers towards upgraded stocks. They prefer to maintain unimproved local animals, as these animals are well adapted to the management system in the Dry Zone. Upgraded stocks require more attention.

6. Sheep – Jaffna sheep is the locally adopted breed. There is no demand for sheep wool in Sri Lanka. Sheep are mainly reared for meat. Therefore the farmers prefer the coarse wool type tropical breeds.

7. Poultry - Scavenging village chicken contributes approximately 15% of the egg production in Sri Lanka. Farmers who rear these birds do not like to upgrade these birds because they are very well adapted to the scavenging system in the rural areas. The genetic variation exist among village chicken is very high but yet to be estimated. There is no input required for these birds.

8. Rabbit – Though the rabbit farming is not very popular few large-scale farms are in operation in limited places in the country.

In the nucleus herds and medium or small-scale commercial farm units where intensive and semi intensive management systems are practiced, active breed improvement is taking place using natural breeding or artificial insemination. There is no system of evaluating the
performance of the progeny. For natural breeding program there is no proper system to produce quality bulls with required genetic make up.

There is no systematic breeding, selection and culling program adapted in other livestock. Most of the breeding animals are selected by the farmers on phenotypic characteristics. However, the production traits such as milk yield (total or daily), fat content, growth rate, congenital defects etc. are being considered, at the time of selection in the state owned farms.

Provincial governments are the main organizations responsible for straight breeding programs in cattle, buffaloes, goat and swine at the field level. The NLDB and the MASL are also carrying out straight breeding programs in their nucleus herds. Until recent times there were no breeder organizations or private companies engaged in large-scale animal breeding activities. A private company, which purchased two of the NLDB Up Country farms, recently, has embarked on straight breeding program on the Friesian and Ayershrie herds.

For straight breeding programs mainly the production traits have been incorporated. They are product yield, growth rate and reproduction rate, back fat thickness, litter size, egg number, egg weight, feed efficiency etc. The type and number of traits will depend on the breeding goal. eg. Dual purpose, or triple purpose

4.7 Obstacles, Opportunities and Needs for Use and Development of AnGR

There is no action plan in place for improved use of AnGR, other than Artificial Insemination in cattle, buffaloes and goats and pigs. AI in goats is not very popular in Sri Lanka. In swine AI using deep frozen semen was introduced very recently. Poultry AI is done in breeder farms. There is no strategy for conservation and sustainable utilization of locally adapted breeds. Therefore no opportunities to use locally adapted AnGR for diversification of animal production, to improve product quality and develop new agricultural products etc.

Lack of information collection system is the main draw back. Collection of information on characterization (production and adaptation characteristics) of locally adapted, recently introduced and continually introduced breed groups is lacking. Therefore no prioritization for additional characterization work has been carried out so far.

Enhancing public understating and awareness of the roles and values of AnGR and the need for conservation and sustainable utilization of these resources is difficult because there are no intensives for the farmers for conservation of unproductive local animals species.

There are many opportunities to improve the efficiencies of utilization of AnGR through proper recognition of the roles of women, men and children in livestock sector. Animal husbandry is a family affair in the rural sector and use of hired labour is very much limited. Family members are involved in the activities such as looking after the animals, milking, milk transport, feeding etc. Although record keeping is a pre-requisite of any improvement programs, it is lacking in the majority of rural herds. The children and women can be successfully utilized in record keeping. Family members can also be utilized in phenotypic characterization work. They can be taught to take body measurements of the animals and even for measurement of the production traits.
The primary constraints to the improved use of AnGR are lack of a national policy, lack of knowledge and training on conservations and sustainable use of AnGR and lack of incentive scheme for conservation programs.

Poultry production has been expanded significantly due to increased consumption levels and newly established foreign market. As a result the number of farmers who rear poultry has been significantly increased. With the development of the industry, most of the infrastructure facilities were also developed. Fluctuation of egg and meat prices is still a problem unsolved.

Large, medium and small-scale commercial operations have been increased significantly and most of the rural small-scale farmers have now shifted to out-grower poultry rearing system. Swine industry is badly affected by the existing environmental issues. Japanese Encephalitis and Swine Fever are major exotic diseases, which affected the swine industry in Sri Lanka. Environmental issues such as waste management and air pollution are the other drawbacks for the expansion of swine industry.

At the regional level across countries use and development of AnGR should be promoted. At present there are no network established for sharing resources, data, information and knowledge. As suggested earlier the regional level AnGR centers should be established and linkages between those AnGR centers should be established. For this purpose SAARC, the biggest international organization in the region could be used to enhance the regional cooperation in the management of AnGR. The SAARC Agricultural Information Center (SAIC), the first regional institution of SAARC started function in 1989 could be utilized to establish network among member countries. The main objective of SAIC is sharing information mutually for the advancement of Agriculture, Livestock, Fisheries, Forestry and Allied disciplines. Other objectives of SAIC are;

- Identify and document agricultural and pertinent literature
- Identify user–specific formats for information storage and dissemination
- Compile directories, bibliographies etc of regional importance
- Produce and collect audio-visual media products (microfilms, microfiche, video-films)
- Render SDI and current awareness services
- Organize training on information and communication sciences
- Function as the regional information center for South “Asia
- Establish linkages with international information networks like AGRIS, CARIS,CABI.

Each country should establish an AnGR center to deal with the AnGR in the respective countries. These AnGR centers should liaise with the regional level AnGR centers, which have close links with the world AnGR center. This arrangement can be shown as follows;
CHAPTER 5

THE STATE OF CONSERVATION OF FARM ANIMAL GENETIC RESOURCES

5.1 Justification and Use
The sustainable use of farm animal genetic resources has been central to the sustenance of the people of Sri Lanka since historical times. Among the domesticated animals, cattle and buffaloes have been an integral component of crop based agricultural production system in Sri Lanka during the 1st millennium AD. From the second half of the 1st millennium BC to date, rice has been the staple diet of the majority of Sri Lankans. The main thrust of the agricultural production system is directed towards the cultivation of rice. The buffalo and cattle, the main sources of draught power in paddy cultivation played an important role in the then Sri Lankan economy. Being a valuable source of draught power in the production of food, the ownership of buffaloes and cattle had an important status in the pre and post AD era. There is a dearth of information on the role played by the small ruminants and poultry in Sri Lanka.

Though there has been a continuous introduction of animal germplasm from the Indian sub continent, it is only with the arrival of the Europeans in the 16th Century AD that a large influx of farm animal germplasm occurred. In the last decade due to the print and electronic media campaigns and as a result of NGO activities, there was a greater awareness on the conservation of biodiversity and the genetic resources. This awareness was mainly on the wild or naturally occurring biodiversity and genetic resource conservation and did not include farm AnGR. However, under FAO funded project physiological characterization of some breeds of livestock had been carried out about 3 decades ago. There had been no attempts made to develop a niche market or specific products to support the conservation of the indigenous AnGR.

5.2 Progress in Characterization
Under a FAO funded project physiological characterization of the domestic animals has been carried out in early 1980’s. Following breeds have been included in the study. So far no genetic characterization has been carried out on any of the domestic livestock breeds.

Cattle and Buffalo breeds:
- Pure breeds: Lankan cattle, Friesian, Jersey, Ayershire, Short horn, Lankan and Murrah buffaloes
- Crossbred cattle: F1, F2, F3 crosses of Fri x Lankan, F1, F2, B1, B2 crosses of Jersey x Lanka, F1, F2, B1 crosses of Jersey x Sindhi, F1, B1, B2 crosses of Sindhi x Lanka, F1, B1, crosses of Short horn x Sindhi.

Pigs: Indigenous Pigs
Sheep: Native sheep, Wiltshire horn, Wiltshire horn Local Bikanery (WLB)

The details of characterization are given in Annexure II. The domestic livestock breeds, which have not been characterized either phenotypically or genetically, are listed in Table 30.
Some of the stakeholders had recognized the importance of the local breeds such as the “Kinniya” cattle, which the farmers in the east coastal areas had used to upgrade their local cattle population in order the bulls could be used for draught purposes. In rural areas where road facilities are not available, cattle were used as pack animals to transport goods. Even today in very remote hilly and sloppy areas cattle are being used as pack animals. A certain community of people in Sri Lanka uses donkeys as a draught animal. The rural people from ancient times have consumed village poultry meat and eggs. Therefore those breeds had been conserved involuntarily in many of the rural areas. However, the government and the sector decision makers have not given adequate recognition for the values of these indigenous breeds.

Continuous introduction of exotic breeds within the policy framework of increasing the production of existing breeds without giving due consideration for the values and roles of indigenous AnGR had led to the eroding of valuable genetic resources. Except for village poultry, which plays an important role in the nutrition of family members and their economy and for buffaloes used for land preparation, neither the indigenous small ruminants nor large ruminant breeds are recognized as indispensable. The stakeholders do not understand the role of conservation in terms of sustainable use. The policy makers until recent times disregarded this issue by not incorporating conservation component in to development plans and strategies.

There is no systematic conservation program for livestock in Sri Lanka. As a result it is believed that the famous ‘Cape’ cattle or ‘Hatton’ cow is extinct already. It seems that the value of indigenous breeds are not yet recognized. Financial constraints, lack of understanding of the role of conservation in term of sustainable use and development of AnGR are main reasons for not implementing conservation programmes. Presently there are no niche markets or products except for village poultry eggs to support conservation of breeds at risk.

Due to the increasing trend for “bio-food” the demand for egg and meat of scavenging village chicken is gradually increasing. Similarly there is a prime market for wild boar meat. But unfortunately there are no programmes to conserve and sustainable use of these animal species in Sri Lanka. Due to the fact that there was no assessment of the existing AnGR has been undertaken, the values of the present AnGR is not known and also breeds at risk have not being identified. This is a serious deficiency in planning a programme for the conservation of AnGR in Sri Lanka. There are no reports available on the conservation strategies implemented in the past.

The upgrading programme via artificial insemination or natural breeding has focused only on the improvement of milk and meat production. In the past and at present the conservation of genetic resources is the responsibility of the government sector. Conservation of farm AnGR mainly consists of maintaining breeds, which are introduced to the country in the past and at present in government (NLDB) farms. Funds for the maintenance of such sites are not secured over long periods. At present, management of those herds has become a serious burden and there is a move to privatize all the NLDB farms. Under a such situation the fate of those breeds is not very clear. Moving animals from farm to farm and mixing the herds
without a proper plan are other problems encountered in maintaining the purebred herds. As a result, recently introduced cattle breeds such as Gir, Sindhi, Tharpakar, Khillari, Kangayam and indigenous goat breed “Kottukachchiya” are gradually decreasing in numbers.

There is a great need for a well-defined conservation programme. Yet so far no action has been taken for the conservation of AnGR. As mentioned earlier the main factors which are affecting the security of each breed within each species are that the continuing replacement of indigenous breeds by crossbreeding and upgrading. Social disturbances due to the civil war in North and Eastern provinces of Sri Lanka have very badly affected the sustainability of certain indigenous livestock breeds. The systematic upgrading programmes, which were effective for several decades have been disturbed in the war affected areas. The ready-made market available for livestock and livestock products in those areas was also badly affected due to lack of transport and other infra structure facilities such as fuel, electricity etc. In spite of the regular disease monitoring and control programs there had been disease out breaks such as Hemorrhagic Septicemia (HS), Foot and Mount Disease (FMD), Black Quarter (BQ), which has affected the security of local and locally adapted extensively managed cattle herds. In addition to the endemic diseases there had been several reports of newly introduced exotic diseases such as Brucella melitensis (goats), Swine fever, Parvo-virus infection, PRRS (pigs) very virulent form of Infectious Bursal Disease ‘Gamboro’ disease (VVIBD), very virulent form of Mareks Disease (VVMD), Salmonella infection, (poultry) which directly affected the use of AnGR. Urbanization and market forces are also affecting the security of local AnGR in Sri Lanka.

Use of AI technology and bulls of exotic breeds in the breed improvement programme, have also affected the sustainability of straight breeds. Introduction of cockerels and hatching eggs in the past to the rural community to improve the scavenging village chicken has resulted in the maintenance of straight breeds of scavenging poultry in rural communities.

As far as farm AnGR are concerned, breeds, which are at risk have not been yet declared due to lack of information as to their population size. This is a need, which have to be carried out as of high priority. However few livestock breeds in Sri Lanka are thought to be ‘at risk’. They are the Delft ponies, Puttalam donkeys, Jaffna sheep, and the wild relatives of some livestock species such as Sri Lanka jungle fowl (Gallus laffayetti), members of the cervus family (spotted deer – Axis axis ceylonensis, sambhur -Cervus unicolor unicolor, barking deer – Muntiacus muntjak malabaricus, hog deer- Axis porcius oryzus, Mouse deer – Moschiola memminna). Although proper records are not available, the local goats and Kottukachchiya breed are also at risk due to indiscriminate crossbreeding programs. The nucleus herd of Kottukachchiya breed, which was maintained in a Dry Zone farm has been closed down and there is no straight breeding program for ‘Kottukachchiya’ goats at the moment. In some isolated pockets of Sri Lanka, some herds are maintained pure and can be considered as ‘in-situ’ conservation. However, sustainability of these small herds cannot be assured, as there is no guarantee for long time use of these breeds. At present the Department of Animal Production and Health has launched a program to conserve and study the farm AnGR. Unfortunately due to lack of funds, human resources and infrastructure facilities the progress is slow. Though cryo-conservation facilities are available for ex-situ conservation of semen, these facilities are mainly used for breed upgrading programs by artificial
insemination. Other storage systems are not used in Sri Lanka at the moment. Although Cryopreservation, storage and subsequent use is the sole responsibility of the state authorities, involvement of the private sector and other stakeholders is essential for a long-term program. The in-situ conservation programs are not implemented due to the fact that there are no farmer groups who are keeping animals exclusively for conservation and the government has not realized yet the importance of in-situ and ex-situ conservation. However, some animal species such as village poultry breeds, which are used as game fowls, and the “Kinniya” cattle are being conserved by individual farmers for their use. There are few farmers who maintain small populations of other domestic animal species purely for aesthetic purpose.

Even for breeds, which are not at risk, there is no properly documented information such as their numbers, distribution and degree of crossbreeding etc. Therefore, it is correct to say that there are no proper conservation objectives & activities coordinated at the national level due to the fact that the low priority level given by the government for this kind of activities. Non-allocation of funds and lack of human resources are other major problems. It is expected with the formulation of the Action Plan where role of each sector will be outlined, things will improve as the private sector also may take up a decisive role, especially in the utilization of AnGR resources. Conservation, characterization and sustainable use of the AnGR are equally important components in a vicious circle. Therefore it is high time to embark on a program at least on one aspect of this circle, so that other components will also automatically get started.

Conservation of AnGR is the responsibility of the state sector. For any conservation programme joint efforts of the government and private sector, non-governmental organizations and the individuals who are interested in conservation AnGR are essential. The degree of involvement will depend on the type of breeds to be conserved. There are no incentives paid for the people who maintain the animal species at risk. Private sector could be able to embark on an awareness programme and promote sustainable use of AnGR giving publicity to the animal products of indigenous breeds. They even can establish in a network of contract farmers where exchange of breeding material and sharing of resources will be possible. At present the country does not have on country expertise or high level training facilities in this area. The stakeholders strive to procure breeds with high production potential which at as a disincentive for conservation of indigenous breeds. On the other hand, the sustainability of such improved breeds is a question, as they need high inputs and attention. Lack of prime prices for the products of indigenous animals is another disincentive to support their conservation. Constrains in conservation can be spelled out as the lack of a comprehensive policy. First of all the country is in need of an institutional policy development. Infrastructure facilities such as storage facilities and human resources would be secondary.

Change of policies dictated under the caption development and privatization has narrowed the options available to the farmers in selecting the breeds of their choice by closing and privatization of some facilities and disposal of some breeds as part and parcel of streamlining public enterprises. As a result the farmers are rearing breeds, which are not suitable for the farming systems practiced by them, thereby reducing the income and also at the same time increasing the risk of losses of valuable indigenous species.
Due to the publicity given by the electronic and other mass media, people have come to understand the value of conservation of the AnGR and shown interest recently. It is very early to assess the impacts of this trend. There are few constraints in implementing a viable conservation program within the country. Lack of interest, lack of awareness, lack of financial assistance, lack of efficient technologies and technical capacity, lack of trained skilled personnel are some of them. Out of all, low priority and lack of a policy for AnGR conservation can be considered as the major constraints.

For enhancing capacity to develop and implement a conservation programme, priorities have to be laid down. Following can be the areas, which should be considered by the authorities.

2. Acquire financial resources – again, the main responsibility lies on the Ministry of Agriculture and Livestock. Private sector can also get involved in providing the financial resources for a conservation program.
3. Human resource development/ training – DAPH, NLDB, MASL and Universities can get involved in a joint programme.
4. Research – DAPH and Universities could provide research facilities.
5. Infrastructural and storage facilities - Government and private sectors jointly can get involved in a programme to improve the infrastructure facilities for a successful conservation program.

At present the country has a well-established Veterinary Research Institute and few country expertise attached to the government and private sector organizations, which could be used in a program.
6.1 Policy Development and Institutional Arrangements

Though the policy of preservation of animal genetic resources is of recent origin, the known history of the island indicates that during the monarchial rule which existed before the colonial occupation, the inhabitants of Sri Lanka had in their cultural and religious believes recognition for the concept of biodiversity and actively conserved the rich biodiversity of the island, as it played a vital role in their economy. The advent of Buddhism strengthened this as it rejects slaughter of animals. The “Nithi Niganduwa” which contains the ancient Sinhala law prohibits the slaughter of animals and advocates severe punishment to whoever does it which includes even degrading to lower castes.

The various development activities, which had a marked impact in the modern times, took place in the past century accelerating just before and after the colonial period. The main thrust of such development activities has been the large irrigation schemes resulting in the clearing of large jungle tracts and settlement of people in new colonies. This coupled with the rapid increase in population has not only had an effect on the animal genetic resources but also severe stress on the islands rich diversity of fauna and flora. At present this process with the growing industrialization and the resulting demand on land and water resources are exerting severe stress on the traditional farming systems as well as on the animal breeds, which thrived under such farming systems.

Prior to the colonial era, introduction of exotic animal genetic material was restricted to that from South India, especially to that of the islands Northern and the North East coastal belt. The opening of vast areas for the plantations and the resultant human migration resulted in the introduction of exotic farm animal species such as turkey and exotic breeds of cattle. The advent of Artificial Insemination service in middle of the 20th Century started the erosion of the indigenous cattle breeds.

The macroeconomic goals as stated in the policy statement of the government, states that the government will pursue the objectives of economic growth and the equitable distribution of benefits of such growth amongst all classes of people, while ensuring a higher quality of life for all. In order to achieve it’s objectives the government has established sub-objectives from which the most relevant to the future development and evolution of the AnGR are to: Maintaining of an open economy where market forces will guide enterprise development. Withdrawals of the public sector activities from areas, which are commercial in nature and directly, compete with enterprises that can be more efficiently managed by the private sector. Foster technological innovations: Support strong and viable organizations and associations at all levels capable of negotiating equitable distributions of benefits of growth between their member and other participants.

There are several organizations, which are responsible for the activities of AnGR in Sri Lanka. The pattern of institutional interventions and organizations involved in AnGR
activities are shown in Table 31 and 32 respectively. The treasury sponsors the activities carried out by the government organizations while the private sector involved activities are self-funded.

Although there is no proper AnGR conservation program in operation at the moment, several upgrading and crossbreeding programs, milk collection, heifer calf rearing programs, pasture development programs, have been undertaken by the various organizations. In addition to the government and private organizations listed above, following organizations are also involved AnGR activities under different capacities.

1. All Island Poultry Association
2. Private goat breeders association
3. Dairy co-operatives
4. Swine development committee
5. National Animal Breeding Committee
6. ‘Gal gava mithuro’ Association for cart bulls

Unfortunately the present coordinating mechanisms do not promote or facilitate the conservation of AnGR. The government sector is more service oriented while the private sector is more towards the commercial operations. Therefore the interaction between the government and private sector is not that strong.

Sri Lanka was one of the early countries to ratify the Convention on Biodiversity (CBD) and as one of the first steps in implementing the CBD, a Biodiversity Conservation Action Plan (BCAP) was prepared and approved by the Cabinet of Ministers in August 1999. However, in this biodiversity conservation action plan no mention was made about the farm animal genetic resources.

The DAPH as the agency responsible for the farm animal genetic resources is at present preparing an action plan, which includes a series of workshops with academics and stakeholders to address the biodiversity conservation aspect of animal genetic resources. Financial support for this program is coming from the Ministry of Environment and Natural Resource Management.

At the same time the Ministry of Environment and Natural Resource Management with the support of IUCN has started the process of drafting legislation on the “Access to Genetic Resources, Benefit Sharing and Biodiversity” and on “National Bio-safety Guidelines” (targeting GMO’s) and the draft legislation will be presented in the near future to the Parliament of Sri Lanka and the Cabinet of Ministers for ratification.

There is no restriction on further involvement of any interested parties in policy development for AnGR. The government has to play a major role, as the policy planning and implementation is still the major function of the Ministry of Agriculture and Livestock and the Department of Animal Production and Health. Presently the AnGR activities are carried out mainly by the DAPH through its “Livestock sector Biodiversity Program” which mainly consist of identification of indigenous farm animal breeds, grasses, fodder plants, microorganisms (related to sector), indigenous knowledge (related to the sector) and the
preservation of identified resources both in-situ and ex-situ. Though the government funds this program there is neither formal national program, nor an integrated program addressing all levels combining the resources of all relevant organizations. The reason for this is there are no identified activities, which have to be carried out by different organizations at different levels. Due to this a concerted effort is lacking. As and when the Livestock Sector Action Plan is finally made available to the public, each organization and stakeholder, will be in a position to identify their role, the targeted activities and the modalities to be adopted. Then only a concerted effort can be made with integration at all levels.

There is no system to pay any incentives to the use and development of AnGR. The government has made significant investments to import and use of exotic AnGR. Details of importation of semen and livestock are shown in Tables 25, and 26. Few studies have been carried out to assess the impact of these exotic germplasm. Although the use of imported semen has been successful in upgrading the local stocks, the impact of imported, live animals was very poor. There are many records to prove that the exotic animals do not express their genetic potential to the maximum under local environment, indicating strong genotypic environmental interactions. The farmers are not interested in indigenous breeds except for village poultry as most of them have not recognized the value of the indigenous breeds as well as adapted animals for the farming systems practiced by them. Most of the farmers are interested in genetic improvement of the animals they are having at present without giving due consideration for improvements in management and feeding, resulting in same or lower production and losses. The NLDB is maintaining certain Indian breeds introduced to Sri Lanka a couple of decades back. Except for this there are neither organized sub-national authorities, research institutions, NGOs or farmer organizations catering to AnGR activities nor any private sector organization recognized to cater to this need.

Lack of a policy for conservation of AnGR is the biggest disadvantage. Secondly there is a need for facilities for conservation of AnGR. Detailed breed evaluations and characterizations is also lacking. There is a great need for the establishment of facilities for the live animal conservation, human resource development, statistical sampling, survey techniques, database management, animal breeding and genetics, molecular characterizations for an efficient conservation program.

There are few legislations and acts, which facilitate management and use of AnGR in Sri Lanka. Animals act; Disease Ordinance, Food Act etc are some of them (Chapter 4). Importation of livestock and livestock products are restricted by implementation of a license control system. The animal products, which require import license, are listed in the Annexure III. There is a chance of introducing exotic diseases through these products. Therefore the items, which require licence have to be revised in order to protect the local livestock populations. Items such as live poultry, meat and edible offal of poultry, meat of swine, all animal fats, skin and hides etc, which do not require licence to import at present, should also be included in the list. Though there is a National Policy document on Breeding it has no legal backing and it’s implementation is voluntary, as such there is no compliance to the guidelines given. The indigenous breeds except for the village poultry does not produce distinctive products or products which can be processed into distinctive products for which
there are niche markets or demand. This is one of the drawbacks in trying to preserve indigenous breeds.

Sri Lanka has few legislations and policies, which ethical concerns regarding the use and welfare of animals. They are,

1. Cruelty to animals
2. Animal welfare
3. Slaughter and disposal / sale of meat

6.2 Use and Release of Genetically Modified Organisms

It is seen that Sri Lanka has not yet passed any laws to specifically deal with the issue of GMOs. The only law that has the terms “genetically modified” and “living modified” is the Plant Protection Act, and that too, only in the interpretations. At the same time, it is seen that some provisions in the existing laws could be successfully used to such control, check and even ban the introduction of certain GMOs. Following are the relevant sections of the existing laws.


The purpose of this ordinance, as spelt out in the substituted long title is to provide for the protection, conservation and preservation of the fauna and flora of Sri Lanka, among others. The importation of animals to Sri Lanka has been dealt in part III.

1. The import of any animal, spawn, eggs, larvae of an animal can be done only under the authority of a permit issued by a prescribed officer of the Department of Wildlife Conservation. (Section 37-1).

These provisions are applicable to all animals except those named under Section 37 (3).

a) Domestic animals. The term is defined under section 11 of the ordinance as follows.

i. Cattle, sheep, goat, horse, ass, mule
ii. Dogs
iii. Cats
iv. Domesticated pigs
v. Domestic fowl reared by man as poultry.

The permit to import animals is given at the discretion of the Department and the relevant officers can deny permits to any GM-animal.

2. According to section 37 (2), the provisions have the same effect as if it formed part of the Customs Ordinance. This means that the Customs Department has been given authority to deal with any offences regarding import of animals.

3. The Minister can make regulations (under section 38 (b)) to

a) Prohibit the release of any imported animal
b) Prescribing areas where a release is permitted.

The provisions under section 38 (b) apply to those imported under the authority of a permit, whose release to the environment should be either prevented or controlled.

4. The provisions under section 37 and section 38 (b) can be taken together to allow an import of any GM-animal that would be necessary only for research purposes and to
prevent any releases subsequent to any import. (e.g. – GM-rats developed as medical research tools like the Harvard Oncomouse). There are still no regulations to give effect to section 38 (b), which could be to cover all “transgenic animals to be prohibited from being released in any part of Sri Lanka.”

B. Animals Act No. 29 of 1958
This act intends, among other things, the improvement of the breeds of animals and to restrict, control or regulate the removal of animals from one administrative district to another. The definition of animals for the purposes of this act includes oxen, buffaloes, sheep, goat and pigs. (Section 38, Interpretations)

There are no provisions in this act to even prohibit or regulate the import of any GM-animals falling under the definition.

According to section 28 of the act, no person should be in possession of a male animal species, which is over one year and three months of age unless

a) It had been castrated within three months after it has attained the age of one year, or,
b) Certified by a Veterinary Surgeon or an authorized officer to be fit for breeding.

According to section 33, when a Veterinary Surgeon or an authorized officer is of the opinion that any male animal over an year of age is unfit for breeding, the owner or the person who possess such animal could be directed to castrate it. Regulations for these can be made under section 34. These provisions, taken together, would help prevent any transgenic animal falling within the definition from breeding with native animals by ordering such males to be castrated. A deficiency in implementation of these provisions in the control of transgenic animals cross-breeding with native breeds is that these provisions relate only to male animals. If the transgenic animal is a female, there is no provision to stop it being mated with native male animals and producing offspring which could be carrying any modified or alien genes.

C. Animal Diseases Act No. 59 of 1992
This act provides for, among other things, the import of animals and animal products, veterinary drugs and veterinary biological products. The term “animal” for the purposes of this act (defined under section 38) include cattle, buffalo, sheep, goat, pig, fish, horse, mule, ass, dog, cat, bird and bees and include any other domesticated animal or wild animals kept in captivity. This definition includes all the domestic animals defined under section 11 of the Fauna and Flora Protection Ordinance (FFPO). Therefore this act can cover all those that cannot be dealt with under the FFPO.

1. The import of an animal, animal product, animal semen or embryos should only be done under a permit issued by the controller of imports which has to be done upon the recommendation made by the Director of Animal Production and Health, (section 21-1)
In making the recommendation to import any of these, the Director should also specify the port of entry (section 21-2). The process in this section has two steps. The most important step is the recommendation to import made by the Director, who can use discretion in making it to ascertain whether the item should be allowed to be brought in. Therefore, this discretion can be used to prevent the introduction not only any GM-animal, but their sperm or embryos as well. The Controller of Imports and Exports has no discretting power, but has to issue a permit once he receives the recommendation.

2. These are intended to prove that the animals, products or semen and embryos are free from diseases and infective material. As GM-animals cannot be termed as “infected” or “diseased”, it is not possible to make it mandatory for the Director to make an order to
withdraw any semen or embryos and to get them destroyed as provided to by section 9 and 33-4

3. All imports of veterinary drugs and veterinary biological products should only be done under the authority of a permit issued by the controller of Imports and Exports upon the recommendation made by the Director of Animal Production and Health. The term veterinary biological product includes vaccines, sera, micro-organisms and their extracts and by-products that are intended for use in the diagnosis, treatment or prevention of diseases of animals. (Section 38). This could be used to prevent, control or regulate the import of vaccines and microbes produced through genetic engineering process or all products made by using such GM-microbes. The recommendation itself can be done only if the importer produces a certificate from the chief veterinary officer or an authorised veterinary surgeon of the country of import (section 31-1)

4. The act also provides for the setting up of a Veterinary Drug Control Authority (sec.32-1).

5. The powers and functions of the authority can be exercised not only to prohibit and control all veterinary biological material and drugs but the local production, sale or use of any veterinary biological material using genetic engineering within the country as well. A manufacturer of these in Sri Lanka can do only under a licence issued by the Director (section 17-1)

D. Animal Feed Act No 15 of 1986

The aim of this act is to regulate, supervise and control the manufacture, sale and distribution of animal feed and to provide for related matters. The term animal feed is defined in section 32 to include simple and compound products.

1. The minister can appoint an Animal Feed Advisory Committee (section 8-1). The functions of this committee include the setting of minimum standards as to the composition, strength, quality and purity of any approved animal feed. Therefore, this committee can under setting up minimum standards of composition, quality and purity, set standards to limit any GM-feed ingredient, or to ban the use of same. If an ingredient or feed has some unusual compound then the use of such could be even banned to maintain quality and purity. An example is the StarLink maize that has the endotoxin Cry 9 which is produced by a gene from Bacillus thurengiensis. This brand of maize is known to cause allergic reactions in human beings but has been recommended for animal feed in U. S. A. Such ingredients could be banned to maintain purity.

2. A person who has got approval for an animal feed could be prevented from adding GM-ingredients substantially. Regulations could be made to classify approved feed and to prescribe the composition, quality and character of any approved animal feed (sec. 31-2/a). This could be used to control or prevent the inclusion of GM-ingredients as it could be deemed to affect the quality and character of feed.

3. An authorized animal feed manufacturer, adding a GM-ingredient without approval can be charged for adultering (section 18-b). An approved animal feed is deemed to be adulterated if its composition, strength, quality and purity fails to conform to the standards prescribed under the act (section 19). These sections could only come into effect if regulations have been made under section 31.

4. In case of imports, the consignments can be examined by an officer authorized by the Director, for the purpose of obtaining an examination report (section 25-1). If the report states that the feed does not confer to the minimum standards, the feed shall not be
admitted into Sri Lanka for use as an animal feed. These provisions can be successfully used to prevent the import of any animal feed with unwanted or undeclared GM-material.

E. Plant Protection Act No 35 of 1999

The purpose of this act is to make provisions to prevent the introduction and spread of any organism harmful or injurious to plants or destructive to plants found in Sri Lanka and connected matters. The definition of the term “organism” is broad and includes all active infective or dormant stages of life forms such as viroids, plasmids and all genetically-modified living entities. Therefore, these provisions can be used not only to prevent the entry of plants and animals, but to prevent the import of any genetically-modified plasmids that could be potentially harmful to plants. Similarly, all the other interpretations (section 15) are broad enough to include genetically modified material. It is also the only enactment in Sri Lanka that has defined “Genetically modified” and “living modified”.

6.3 Intellectual Property Rights

There is an act relating to intellectual property rights. This act is cited as the Code of Intellectual Property Act No. 52 of 1979, which was amended in 1983 and 1990. The concept of intellectual property entered our legal system during the British occupation. Being a ceded colony, the British rulers were legally bound to administer justice according to the prevalent laws, but the English law in many areas entered the domestic legal system through several means including legislation and judicial activism. Commercial law, and then the concept of Intellectual Property were gradually introduced to Sri Lanka. The British Inventor’s Ordinance of 1859 became the first law under which the first patent in Sri Lanka was granted on January 12, 1861. This law was replaced by the Patents Ordinance No. 15 of 1906, which was based on the English Patents Law. It was in operation until the present law was enacted and implemented. An Ordinance to provide for the registration of designs was passed in 1904. The English Law of Trademarks was introduced to Sri Lanka in the year 1888. The first trademark was registered on March 28, 1889, under the Ordinance No. 14 of 1888. The Ordinance No. 15 of 1925, which was enacted in line with the 1919 English Trademarks Act replaced the law referred to above and was in force, subject to certain amendments, until the present law came into operation. There were some other statues in existence in Sri Lanka relating to industrial property, such as the Patents, Designs and Trademarks, (the Neuchatel Agreement) Ordinance; the Patents, Designs, copyright and Trademarks (Emergency) Ordinance and the Merchandise Marks Ordinance which was passed in 1888 and made provisions regarding inter alia fraudulent marks on merchandise. As far as copyright was concerned, Sri Lanka followed the U.K. law of copyright. However the prevalent law and administrative system failed to achieve the desired objectives especially in the modern era due to various reasons such as cumbersome technicalities and lack of a proper administrative system.

Modeled on a draft prepared by the World Intellectual Property Organization (WIPO), the Code has incorporated internationally recognized principles and concepts of Intellectual Property in the light of the local conditions and requirements. Sri Lanka has been party to Paris Convention (since 1952), Madrid Agreement for the repression of false or deceptive indication of source on goods (since 1952), Nairobi Treaty (since 1984), Patent Co-operation
Treaty (since 1982), Berne Convention (since 1959), Universal Copyright Convention (since 1983) and Convention establishing the WIPO (since 1978).

Under Section 59 of Chapter 11 the following notwithstanding they are inventions within the meaning of sub section (f) shall not be patentable.

The following, notwithstanding they are invention within the meaning of subsection (1), shall not be patentable.

(a) Discoveries, scientific theories and mathematical methods
(b) Plant or animal varieties or essentially biological processes for the production of plants or animals, other than micro-biological processes and the products of such processes
(c) Schemes, rules, or methods for doing business, performing purely mental acts or playing games;
(d) Methods for the treatment of the human or animal body by surgery or therapy, and diagnostic methods practiced on the human or animals body

Provided, however, that this paragraph shall not apply to the products used in any such methods.

Particulars on the primary institutions and organizations that are involved in AnGR research education, training, and policy development are given in Table 32.

As far as research capacity is concerned, lack of training facilities for the research staff and non-availability of funds for research can be considered as major deficiencies. Therefore, priority should be given in providing training opportunities for both researchers and middle level technical staff. In additions to research funds, there should be a flexible financial management system to facilitate the procurement, employment of research staff etc. This will facilitate the smooth running of the projects. Lack of incentives for the researchers and lack of a system to appreciate the activities of the researchers is another serious constraint in developing research capacity.

There are no adequate educational and training facilities in characterization, utilization and conservation of AnGR in Sri Lanka. Therefore those who are interested will have to get trained in a foreign country. But such opportunities are extremely limited. Therefore, providing training facilities also should be given a priority. More opportunities for training on management and utilization, characterization etc. should be made available in the Universities, Postgraduate Institutes and other institutes.

Education system both secondary, and tertiary (University education) should be targeted on the current issues on AnGR. Value of existing genetic resources, their conservation and sustainable use should be taught at the school level to make the students aware of the value of conservation of the AnGR. Once this is done exploitations of AnGR will be minimized and implementation of conservation programs will be easy. Policy development alone does not solve the existing problems. Prompt implementations of the policies and regular monitoring are essential in order to achieve the final objectives. Most of the acts and regulations are outdated and need revisions. Following areas in the existing legislations have to be updated.

*The State of AnGR- Sri Lanka*
a. Transport of livestock  
b. Slaughter and disposal/ sale of meat (animals suffering from contagious diseases)  
c. Cruelty to animals/ animal welfare  
d. Cattle theft (branding of animals)  
e. Export of livestock products  
f. Import of veterinary drugs  
g. Importation of live animals/ semen and frozen embryos  
h. Quarantine of Animals/ Livestock Products  
i. Regulation required for animal breeding  
j. Legislations needed for milk collection, local processing, storage and sale  
k. Registration of dairies and dairy farms  
l. Registration of laboratories for providing diagnosis test for livestock, poultry and pet animals  
m. Private veterinary clinics/ hospitals  
n. Registration of poultry hatcheries and processing factories, feed mills, establishments  
o. Protection of local animals gene pool  
p. Law related to wild life animals health, zoo animals’ health etc  
q. Livestock Insurance  
r. Seizure of stray of dogs/ destruction of diseased/ suspected dogs. Diseased animals other than dogs  
s. Legislation related to animal waste management/ environmental pollution

There are certain areas where new acts and regulations are also needed. Priority should be given on these areas and appropriate rules and regulations should be made available to conserve the animal species, which are at risk.
Figure I. Agro Ecological Regions of Sri Lanka and Rainfall Expectancy

Annexure 1.

Distribution of Cattle Population in Sri Lanka

Cattle Pop.- Year 2000
2700 - 15000
15001 - 50800
50801 - 84300
84301 - 126300
126301 - 198400

The State of AnGR- Sri Lanka
Annexure I. Contd...

Distribution of Buffalo Population in Sri Lanka.

Buff.Pop - Year 2000
- 0 - 6300
- 6301 - 13500
- 13501 - 23800
- 23801 - 93500
- 93501 - 203400

The State of AnGR- Sri Lanka
Annexure I. Contd...

Distribution of Goat Population in Sri Lanka

Goat Pop.- Year 2000
- 3200 - 7500
- 7501 - 14100
- 14101 - 20300
- 20301 - 33800
- 33801 - 60060

Annexure I. Contd…

The State of AnGR- Sri Lanka
Annexure I. Contd…

Poultry Population Distribution in Sri Lanka

The State of AnGR- Sri Lanka

I. Species: Cattle (*Bos indicus*)
   Breed: Lanka (Syn. Sinhala, Native)
   Earliest: Fourth Century A.D.
   Present Population: 750,000 (Approx.)
   Distribution: Island-wide (Largely Dry Zone)

a.) External Characters:
   (1) Coat: Colour: Black or Red
      Solid (x) Spotted (x) Brindle ( )
      Hair: Length: Short (x) Medium ( ) Long ( )
      Sheen: Glossy (x) Dull ( )
      Curl: Curly ( ) Straight (x)
      Diameter: Fine (x) Coarse ( )

(2) Skin: Pigmentation: Present (x) Absent ( )

(3) Head: Shape: Long (x) Wide ( )
      Concave (x) Convex ( )
      Length (39.8 ± 0.3)
      Width (9.3 ± 1)
      Horns: Male - Present (x) Absent ( ) Female - Present (x) Absent ( )
      Shape: (Male) - Straight (x) Curved ( ) Scur ( )
      Attachment: - Firm (x) Curved ( )
      Size: Small (x) Medium ( ) Large ( ) Very Large ( )
      Male (x) (x) ( ) ( )
      Female (x) (x) ( ) ( )
      Ears: Direction: Erect (x) Drooping ( )
      Size: Small (x) Medium ( ) Large ( )

(4) Body:
   Shape: Stocky (x) Angular ( )
   Hump: Present Absent Large Small
      Male (x) ( ) (x) (x)
      Female (x) ( ) (x) (x)
   Dewlap: Size: Small (x) Medium ( ) Large ( )
   Navel Flap: Small Large
      Male (x) ( )
      Female ( ) ( )
   Sheath: Loose Tight
      Male ( ) (x)

(5) Udder:
   Size: Small (x) Medium ( ) Large ( )
   Shape: Trough (x) Hanging ( )
   Shape of teats: Cylindrical ( ) Tapered (x) Bulbous ( )
   Size of teats: Small (x) Medium ( ) Large ( )
   Placement of teats: Equal (x) Unequal ( )
   Relative size of quarters: Small (x) Medium ( ) Large ( )

(6) Tail: Length: Short ( ) Medium (x) Long ( )

II. Species: Cattle (*Bos Indicus*)
   Breed: Sindhi
   Earliest: 1908
   Present Population: 15,000 (Approx.)
   Distribution: Dry zone, Coconut plantation, wet zone
### The State of AnGR- Sri Lanka

#### a.) External Characters :

1. **Coat**
   - Colour: Red
     - Solid (x)
     - Spotted ( )
     - Brindle ( )

2. **Hair**
   - Length: Short (x)
     - Medium ( )
     - Long ( )

3. **Sheen**
   - Glossy (x)
     - Dull ( )

4. **Curl**
   - Curly ( )
     - Straight (x)

5. **Diameter**
   - Fine (x)
     - Coarse ( )

6. **Skin**
   - Pigmentation: Present (x)
     - Absent ( )

7. **Head**
   - Shape: Long ( )
     - Wide (x)
     - Convex ( )
     - Concave ( )

8. **Horns**
   - Male: Present (x)
     - Absent ( )
   - Female: Present (x)
     - Absent ( )

9. **Shape of Male Horns**
   - Straight ( )
     - Curved (x)
     - Scur ( )

10. **Attachment**
    - Firm (x)
     - Curved ( )

11. **Size**
    - Small ( )
     - Medium (x)
     - Large ( )
     - Very Large ( )

12. **Ears**
    - Direction: Erect (x)
     - Drooping ( )

13. **Body**
    - Shape: Stocky (x)
     - Angular (x)

14. **Hump**
    - Male: Present (x)
     - Absent ( )
     - Large ( )
     - Small ( )

15. **Female**
    - (x)
     - ( )

16. **Dewlap**
    - Size: Small ( )
     - Medium (x)
     - Large ( )

17. **Navel Flap**
    - Male: Small ( x )
     - Large ( )

18. **Sheath**
    - Loose ( )
     - Tight ( )

19. **Udder**
    - Size: Small ( )
     - Medium (x)
     - Large ( )

20. **Shape**
    - Trough (x)
     - Hanging ( )

21. **Shape of teats**
    - Cylindrical (x)
     - Tapered ( )
     - Bulbous ( )

22. **Size of teats**
    - Small (x)
     - Medium ( )
     - Large ( )

23. **Placement of teats**
    - Equal (x)
     - Unequal ( )

24. **Relative size of quarters**
    - Small (x)
     - Medium ( )
     - Large ( )

25. **Tail**
    - Length: Short ( )
     - Medium (x)
     - Long ( )

#### b.) Production data :

1. **Average daily gain (kg)**
   - Male: 0.35 (20)
2. **Female: 0.3**

3. **Calving Interval (days)**
   - 426

4. **Age at 1st calving (days)**
   - 148.8 ± 7.9 (304)

5. **Milk Production**
   - Mean 305 d milk yield: 908
   - Mean total milk yield: 1818.4 ± 12.67 (1247)
   - Lactation length (days): 247 (c.v. = 34%)
   - Milk production: Mean 305 d milk yield: 908
   - Mean total milk yield: 1818.4 ± 12.67 (1247)
   - Lactation length (days): 247 (c.v. = 34%)

6. **Meat Production**
   - Mean dressing %
     - Male: 44.4 (480 d)
     - 45.6 (660 d)
     - 46.1 (780 d)
   - Bone %
     - Male: 29.5 (480 d)
     - 26.2 (660 d)
     - 25.3 (780 d)

---

*The State of AnGR- Sri Lanka*
The State of AnGR- Sri Lanka

II. Internal Organs

<table>
<thead>
<tr>
<th>Organ</th>
<th>Male</th>
<th>Female</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver %</td>
<td>1.5</td>
<td>2.0</td>
<td>0.5 – 3.0</td>
</tr>
<tr>
<td>Heart %</td>
<td>0.43</td>
<td>0.52</td>
<td>0.3 – 0.6</td>
</tr>
<tr>
<td>Lungs %</td>
<td>1.9</td>
<td>2.1</td>
<td>1.5 – 2.5</td>
</tr>
<tr>
<td>GI tract %</td>
<td>6.7</td>
<td>7.3</td>
<td>6.0 – 8.0</td>
</tr>
<tr>
<td>Head %</td>
<td>6.3</td>
<td>7.0</td>
<td>5.5 – 7.5</td>
</tr>
<tr>
<td>Hide %</td>
<td>8.7</td>
<td>9.3</td>
<td>8.0 – 9.5</td>
</tr>
<tr>
<td>Spleen %</td>
<td>0.43</td>
<td>0.5</td>
<td>0.3 – 0.6</td>
</tr>
</tbody>
</table>

III. Species

Species: Cattle (Bos Taurus)
Breed: Friesian
Earliest: 1901
Present Population: 6000 (Approx)
Distribution: Hill and Mid Country (Above 400 m altitude)

a.) External Characters:

(1) Coat: Colour: Black and White
   - Solid ( )
   - Spotted ( x )
   - Brindle ( )

   Hair:
   - Length: Short ( x )
   - Medium ( x )
   - Long ( )

   Sheen:
   - Glossy ( x )
   - Dull ( )

   Curl:
   - Curly ( x )
   - Straight ( )

   Diameter:
   - Fine ( x )
   - Coarse ( )

(2) Skin: Pigmentation:
   - Present ( x )
   - Absent ( )

(3) Head: Shape:
   - Long ( x )
   - Wide ( )

   Concave ( )
   - Convex ( x )

   Horns:
   - Male: Present ( x )
   - Female: Present ( x )

   Shape: (Male):
   - Straight ( )
   - Curved ( x )
   - Scur ( )

   Attachment:
   - Firm ( x )
   - Curved ( )

   Size:
   - Small ( )
   - Medium ( x )
   - Large ( x )
   - Very Large ( )

   Male:
   - ( )
   - ( x )
   - ( x )
   - ( )

   Female:
   - ( )
   - ( x )
   - ( x )
   - ( )

   Ears:
   - Direction: Erect ( x )
   - Drooping ( )

   Size:
   - Small ( )
   - Medium ( x )
   - Large ( x )

(4) Body: Shape:
   - Stocky ( x )
   - Angular ( x )

   Hump:
   - Present ( )
   - Absent ( x )
   - Large ( )
   - Small ( )

   Male:
   - ( )
   - ( x )
   - ( x )
   - ( )

   Female:
   - ( )
   - ( x )
   - ( x )
   - ( )

(5) Udder: Size:
   - Small ( )
   - Medium ( x )
   - Large ( x )

   Shape:
   - Trough ( )
   - Hanging ( x )

b.) Physiology (Normal Value):

   Rectal Temperature (°C):
   - 41.2

   Respiratory rate per minute:
   - 131

   Sweating rate gm/ of:
   - 405

   Behavioral Temperament:
   - Wild ( )
   - Docile ( x )

c.) Biochemistry:

   Blood: PCV %
   - 24.1 ± 1.09

d.) Production data:

   Growth: Body weight (kg)
   - M
   - F
   - C
   - Range 36.4 – 38.6

   Birth:
   - 28.81 ± 0.36 (700)
   - 27.41 ± 0.31 (665)

   7.5 m: 122
   12 m: 141
   19 m: 167

   Average daily gain (kg): 0.24
Reproduction:
- Age at puberty (days): 498.1 ± 8
- Calving Interval (days): 517.6 ± 19.8 (170)

Milk Production:
- Mean 305 d milk yield: 2195 ± 77 (140)
- Mean total milk yield: 2281.8 ± 70 (140)

Composition:
- Fat %: 3.5
- SNF %: 8.5
- Lactation length (days): 305.7 ± 7.3 (140)

Mean total milk yield: 2281.8 ± 70 (140)

Milk Production:
- Mean dressing %: 42.8
- Bone %: 35.5
- Lean %: 70.4
- Fat %: 4.0

Internal Organs:
- Liver %: 1.8
- Heart %: 0.61
- Lungs %: 1.9
- Head %: 6.7
- Hide %: 5.8
- Spleen %: 0.7
- GI tract %: 7.2

IV. Species:
- Breed: Cattle (Bos Taurus)
- Earliest: 1901
- Present Population: 12,000 (Approx)
- Distribution: Hill and Mid Country, Coconut plantation, Wet zone

a.) External Characters:
1. Coat:
   - Colour: Reddish Brown
   - Solid (x) Spotted ( ) Brindle ( )
   - Hair: Length: Short ( x ) Medium ( ) Long ( )
   - Sheen: Glossy ( x ) Dull ( )
   - Curl: Curly ( x ) Straight ( x )
   - Diameter: Fine ( x ) Coarse ( )
2. Skin:
   - Pigmentation: Present ( x ) Absent ( )
3. Head:
   - Shape: Long ( ) Wide ( x )
   - Concave ( x ) Convex ( )
   - Horns: Male - Present ( x ) Absent ( ) Female - Present ( x ) Absent ( )
   - Shape: (Male) - Straight ( ) Curved ( x )
   - Attachment: - Firm ( x )
   - Size: Small ( ) Medium ( x ) Large ( x ) Very Large
   - Male ( ) ( x ) ( ) ( )
   - Female ( ) ( x ) ( ) ( )
   - Ears:
     - Direction: Erect ( x ) Drooping ( )
     - Size: Small ( ) Medium ( x ) Large ( x )
4. Body:
   - Shape: Stocky ( x ) Angular ( x )
   - Hump:
     - Present ( x ) Absent ( ) Large Small
     - Male ( ) ( x ) ( ) ( )
     - Female ( ) ( x ) ( ) ( )
5. Udder:
   - Size:
     - Small ( ) Medium ( x ) Large ( x )
   - Shape: Trough ( ) Hanging ( x )
   - Shape of teats: Cylindrical ( x ) Tapered ( ) Bulbous ( )
   - Size of teats:
     - Small ( ) Medium ( x ) Large ( )
   - Placement of teats: Equal ( x ) Unequal ( )
   - Relative size of quarters: Small ( ) Medium ( x ) Large ( )
(6) Tail :
Length: Short ( ), Medium (x), Long ( )

b.) Physiology (Normal Value):
- Rectal Temperature (°F): 40.3
- Respiratory rate per minute: 96
- Sweating rate gm/ of
- Behavioral Temperament: Wild ( ), Docile (x)

Behavioral Temperament: Wild ( ), Docile (x)

V.) Species: Cattle (*Bos Taurus*)
Breed: Ayrshire
Earliest: 1926
Present Population: 6,000 (Approx)
Distribution: Hill and Mid Country, (Above 400 m altitude)

a.) External Characters:

b.) Physiology (Normal Value):
- Rectal Temperature (°F): 40.8
- Respiratory rate per minute: 108
- Sweating rate gm/ of:

<table>
<thead>
<tr>
<th>Growth</th>
<th>Body weight (kg)</th>
<th>M</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>36.4 – 38.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth</td>
<td>15.1 ± 0.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult</td>
<td>Range 240.9 – 263.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Milk Production:
- Mean 305 d milk yield: 1925 ± 74.5
- Mean total milk yield: 2318.2
- Composition:
  - Fat %: 5.0
  - SNF %: 9.6
  - Lactation length (days): 309.4 ± 2.08

VI.) Species: Cattle (*Bos Taurus*)
Breed: Shorthorn
Earliest: 1901
Present Population: 4,000 (Approx)
Distribution: Hill and Mid Country, (Above 400 m altitude)

a.) External Characters:

Reproduction:
- Calving Interval (days): 428.4 ± 9.2 (212)
- Age at 1st calving (days): 1133.8 ± 25 (191)

Milk Production:
- Mean 305 d milk yield: 201.0 (342) cv% 262
- Composition:
  - Fat %: 3.9
  - SNF %: 8.5
  - Lactation length (days): 340.7 cv% 23.8

Annual carving rate (%): 72.85 ± 0.16

---

The State of AnGR- Sri Lanka
VII. Species: Buffalo (*Bubalus bubalis*)
Breed: Lanka (Syn. Native, Indigenous local)
Earliest: Fourth Century A.D.
Present Population: 750,000
Distribution: Island-wide

a.) External Characters:

1. **Coat:** Colour:
   - Grey
   - Solid (x)
   - Spotted ( )
   - Brindle ( )

2. **Hair:**
   - Length:
     - Short ( )
     - Medium (x)
     - Long ( )
   - Sheen:
     - Glossy ( )
     - Dull (x)
   - Curl:
     - Curly ( )
     - Straight (x)

3. **Skin:**
   - Pigmentation:
     - Present (x)
     - Absent ( )

4. **Head:**
   - Shape:
     - Long (x)
     - Wide ( )
     - Concave ( )
     - Convex (x)

5. **Horns:**
   - Male:
     - Present (x)
     - Absent ( )
   - Female:
     - Present (x)
     - Absent ( )

6. **Ears:**
   - Direction:
     - Erect (x)
     - Drooping ( )

b.) Physiology (Normal Value):

1. **Rectal Temperature (°C):** 38.0
2. **Pulse rate per minute:** 53.5
3. **Respiratory rate per minute:** 23.1

4. **Behavioral Temperament:**
   - Wild (x)
   - Docile ( )

5. **Blood:**
   - PCV: 33.8 ± 1.6 % (S.D.)
   - Hb g per sl: 14 ± 0.7 (S.D.)

6. **Hormones:**
   - Progesterone (in fat free milk)
     - Follicular phase of cycle: 0.25 ng/ml
     - Luteal phase of cycle: 0.5 – 2.5 ng/ml
     - Pregnancy: 0.5 – 2.5 ng/ml

---

*The State of AnGR- Sri Lanka*
d.) Production data :

Growth : Body weight (kg)  
<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>F</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 m</td>
<td>153</td>
<td>153</td>
<td>295.5</td>
</tr>
<tr>
<td>Adult</td>
<td>340.9</td>
<td>295.5</td>
<td>71.8</td>
</tr>
</tbody>
</table>

Reproduction :
- Gestation period (days) 306
- Calving Interval (days) 474
- Age at 1st calving (days) 1326
- Annual carving rate (%) 71.8

Male :
- Semen : Volume 1.98 ± 0.34 2.11 ± 0.2
- Sp. gr. 0.317 ± 0.48 0.34 ± 0.3
- Motility 72.5 ± 4.8 75.6 ± 5.6

Milk Production :
- Mean 305 d milk yield 355
- Composition
  - Lactation length (days) 250 (c. v. = 34%)
  - Range 96-294

Dry period (days)

Meat Production :
- Mean dressing %
  - Male 49.7 Female 53.4
  - Lean %
    - Male 67.2 Female 70.8
  - Bone %
    - Male 25.8 Female 23.2
  - Fat %
    - Male 7.0 Female 6.1

Internal Organs :
- Liver % 1.5
- Heart % 3.5
- Lungs % 2.1

Resistance to parasitic diseases and viability

Meat Production : Internal Organs
- Spleen % 0.53
- Head % 6.2
- Hide % 9.2
- GI tract % 6.5

Working hours/ 3½ - 3½
Duration/ year 32 days: (ploughing)
No. of buffalo

Ploughing 1.9 ± (SD) 0.52 5.3 ± (SD) 86 1.09 ± 0.36 3.56 ± (5.0) 0.36
Puddling 0.52 ± (5.0) 0.36 1.09 ± 0.36
Levelling 0.36
Threshing 6.9 ± (S.D.) 0.09 52.3 ± (S.D.) 13.6

Land preparation Hours/ day 10.2 ± (S.D.) 1.8
Days/ year 28.5 ± (S.D.) 13.3

The State of AnGR- Sri Lanka
VIII. Species: Buffalo (Bubalus bubalis)

Breed: Murrah

Earliest: 1937

Present Population: 15,000 (Approx.)

Distribution: Island-wide

a.) External Characters:

(1) Coat: Colour: Jet Black
    Solid (x)  Spotted ( )  Brindle ( )
    Colour markings: White patch on forehead, switch of tail
    Chevon ( )  Muzzle ring ( )

    Hair: Length: Short ( )  Medium (x)  Long ( )
    Sheen: Glossy (x)  Dull ( )
    Curl: Curly (x)  Straight (x)
    Diameter: Fine (x)  Coarse ( )

(2) Skin: Pigmentation: Present (x)  Absent ( )

(3) Head:
    Shape: Long ( )  Wide (x)
    Concave ( )  Convex (x)

    Horns:
    Male - Present (x)  Absent ( )
    Female - Present (x)  Absent ( )

    Shape (Male):
    Straight ( )  Curved (x)  Coiled (x)

    Attachment:
    Firm (x)  Curved ( )

    Size:
    Male: Small ( )  Medium ( )  Large (x)  Very Large ( )
    Female: Small (x)  Medium (x)  Large ( )

    Length (cm): 95

    Ears:
    Direction: Erect (x)  Drooping ( )
    Size: Small ( )  Medium (x)  Large ( )

(4) Body:
    Shape: Stocky (x)  Angular (x)

(5) Udder:

    Size: Small (x)  Medium ( )  Large ( )
    Shape: Trough (x)  Hanging ( )

    Shape of teats: Cylindrical (x)  Tapered (x)  Bulbous ( )
    Size of teats: Small (x)  Medium ( )  Large ( )

    Placement of teats: Equal (x)  Unequal ( )

    Relative size of quarters: Small (x)  Medium ( )  Large ( )

(6) Tail:

    Length: Short ( )  Medium (x)  Long ( )

b.) Physiology (Normal Value):

    Rectal Temperature (°C): 38.0
    Pulse rate per minute: 53.5
    Respiratory rate per minute: 23.1

    Temperament: Wild (x)  Docile ( )

(c.) Biochemistry:

    Blood:
    PCV: $33.8 \pm 1.6\%$ (S.D.)

    Hormones:
    Progesterone (in fat free milk):
    Follicular phase of cycle: 0.25 ng/ml
    Luteal phase of cycle: 0.5 – 2.5 ng/ml
    Pregnancy: 0.5 – 2.5 ng/ml

(d.) Production data:

    Growth:
    Body weight (kg):
    Adult: 340.9  295.5
    Average daily gain (kg): 0.37
The State of AnGR- Sri Lanka

Reproduction:
- Gestation period (days) 306
- Calving Interval (days) 474
- Age at 1st calving (days) 1326
- Annual carving rate (%) 71.8
- Twinning rate (%)

Male
- Semen: Volume 1.98 ± 0.34  2.11 ± 0.2°
- Motility 0.317 ± 0.48  0.34 ± 0.3°
- Quality 72.5 ± 4.8  75.6 ± 5.6°

Milk Production:
- Lactation length (days) 250 (c.v. = 34%)

Meat Production:
- Mean dressing %
  - Male 49.7
  - Female 53.4
- Lean %
  - Male 67.2
  - Female 70.8
- Bone %
  - Male 25.8
  - Female 23.2
- Fat %
  - Male 7.0
  - Female 6.1

Resistance to parasitic diseases and viability
- Mortality
  - Year
  - 1 – 2 Year
  - 0 - 2 Year
  - Adult
  - 25.4
  - 21.5 %
  - 23.7%
  - 8.0

Meat Production
- Internal Organs
  - Spleen % 0.53,
  - Head % 6.2
  - Hide % 9.2,
  - GI tract % 6.5

Working hours/ 3¼ - 3½
- Duration/ year 32 days: (ploughing)
- 17.1 days/acre

No. of buffalo
- Days/ Ha
  - Ploughing 1.9 ± (S.D) 0.52 5.3 ± (S.D) 86
  - Puddling 1.09 ± 0.36
  - Levelling 3.56 ± (5.0) 0.36

Land preparation
- Hours/ day 6.9 ± (S.D) 0.09
- Days/ year 52.3 ± (S.D) 13.6

Threshing
- Hours/ day 10.2 ± (S.D) 1.8
- Days/ year 28.5 ± (S.D) 13.3

IX. Species:
- Breed: Pig
- Indigenous. Syn. Native, Local
- Earliest: Unknown
- Present Population: 90,000 (Approx.)
- Distribution: Western Coast

a.) External Characters:

(1) Coat: Colour
  - Solid (x) Spotted ( ) Brindle ( )
  - Colour markings: White patch on forehead, switch of tail

(2) Skin: Pigmentation
  - Present (x) Absent ( )

(3) Head:
  - Shape: Long (x) Wide ( )
  - Concave ( ) Convex (x)
  - Length ( ) Width ( )
Ears : Direction : Erect (x)  Drooping ( )
      Size : Small (x)  Medium ( )  Large ( )

(4) Body :
      Shape : Stocky (x)  Angular ( )

b.) Physiology (Normal Value) :
      Behavioral Temperament : Wild (x)  Docile ( )

c.) Production data :
      Growth : Body weight (kg)  M  F  C
       Birth (individual)  0.255 ± 0.005  0.258 ± 0.005
       Weaning (individual) 5.23  4.13
       6 m                  11.61 ± 0.38 (47)  11.29 ± 0.33 (50)
       12 m                 24.86 ± 1.03 (16)  23.90 ± 0.85
      Average daily gain (kg)
       Pre weaning        0.076  0.071

Reproduction :
       Litter size (at birth)  5.29 ± 0.33
       Litter size (at weaning)  4.17
       Age at 1st farrowing  251.6 ± 16.2
### Annexure III. Items Which Need Import License

<table>
<thead>
<tr>
<th>Item</th>
<th>Harmonious System Head</th>
<th>Harmonious System Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>01</td>
<td>Live animals</td>
<td>01.02 Live bovine animals</td>
<td>0102.10 - Pure-bred breeding animals</td>
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<tr>
<td></td>
<td></td>
<td>0102.90 Other</td>
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<td>01.03</td>
<td>Live Swine</td>
<td>0103.10 Other</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>0103.91 - Weighing less than 50 kg</td>
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<td>0103.92 - Weighing 50 kg or more</td>
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<tr>
<td>01.04</td>
<td>Live sheep and goats</td>
<td>0104.10 Sheep</td>
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<td>0104.10.01 - Pure-bred breeding animals</td>
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<td>0104.10.09 Other</td>
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<td>0104.20 Goats</td>
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<td></td>
<td>0104.20.01 Pure bred breeding animals</td>
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<td></td>
<td>0104.20.09 Other</td>
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<tr>
<td>01.06</td>
<td>Other live animals</td>
<td>- Mammals</td>
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<td>0106.11 Primates</td>
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<td></td>
<td></td>
<td>0106.12 - Whales, dolphins and porpoises (mammals of the order Cetacea) manatees and dugongs (mammals of the order Sirenia)</td>
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<tr>
<td></td>
<td></td>
<td>0106.19 Other</td>
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<tr>
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<td></td>
<td>0106.19.09 Other</td>
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<tr>
<td></td>
<td></td>
<td>0106.20 Reptiles (including snakes and turtles)</td>
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<tr>
<td></td>
<td></td>
<td>0106.20.01 Of a kind used for human food</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Birds</td>
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<tr>
<td></td>
<td></td>
<td>0106.31 Birds of prey</td>
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<td>0106.31.01 Of a kind used for human food</td>
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<td></td>
<td>0106.32 Psittaciformes (including parrots, parakeets, macaws and cockatoos)</td>
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<td>0106.32.01 Of a kind used for human food</td>
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<td>0106.39 Other</td>
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<td>0106.39.01 Of a kind used for human food</td>
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<td>0106.90 Other</td>
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<td>0106.90.01 Of a kind used for human food</td>
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<td>02</td>
<td>Meat and edible meat offal</td>
<td>02.01 Meat of bovine animals, fresh or chilled</td>
<td>0201.10 - Carcasses and half-carcasses</td>
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<tr>
<td></td>
<td></td>
<td>0201.20 Other cuts with bone in</td>
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<td></td>
<td>0201.30 Boneless</td>
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<td>0202.10 - Carcasses and half-carcasses</td>
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<td>0202.20 Other cuts with bone in</td>
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<td>0202.30 Boneless</td>
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<tr>
<td></td>
<td></td>
<td>0204.10 - Carcasses and half-carcasses of lamb, fresh or chilled</td>
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<tr>
<td></td>
<td></td>
<td>0204.20 Other cuts with bone in</td>
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<tr>
<td></td>
<td></td>
<td>0204.30 Boneless</td>
<td></td>
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<tr>
<td></td>
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<td>0204.39 Other</td>
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<td>0204.39.01 Of a kind used for human food</td>
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<tr>
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<td></td>
<td>0204.90 Other</td>
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<tr>
<td></td>
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<td>0204.90.01 Of a kind used for human food</td>
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*The State of AnGR- Sri Lanka*
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<td>Carcasses and half-carcasses</td>
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<tr>
<td>0204.22</td>
<td>Other cuts with bone in</td>
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<tr>
<td>0204.23</td>
<td>Boneless</td>
</tr>
<tr>
<td>0204.30</td>
<td>Carcasses and half-carcasses of lamb, frozen</td>
</tr>
<tr>
<td></td>
<td>Other meat of sheep, frozen</td>
</tr>
<tr>
<td>0204.41</td>
<td>Carcasses and half-carcasses</td>
</tr>
<tr>
<td>0204.42</td>
<td>Other cuts with bone in</td>
</tr>
<tr>
<td>0204.43</td>
<td>Boneless</td>
</tr>
<tr>
<td>0204.50</td>
<td>Meat of goats</td>
</tr>
<tr>
<td>02.06</td>
<td>Edible offal of bovine animals, swine, sheep, goats, horses, asses, mules or hinnies, fresh, chilled or frozen</td>
</tr>
<tr>
<td>0206.10</td>
<td>Of bovine animals, fresh or chilled</td>
</tr>
<tr>
<td></td>
<td>Of bovine animals, frozen</td>
</tr>
<tr>
<td>0206.21</td>
<td>Tongues</td>
</tr>
<tr>
<td>0206.22</td>
<td>Livers</td>
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<tr>
<td>0206.29</td>
<td>Other</td>
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<tr>
<td>0206.30</td>
<td>Of swine, fresh or chilled</td>
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<td>Of swine, frozen</td>
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<td>0206.41</td>
<td>Livers</td>
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<td>0206.49</td>
<td>Other</td>
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<td>0206.80</td>
<td>Other, fresh or chilled</td>
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<td>Other, frozen</td>
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<td>02.08</td>
<td>Other meat and edible meat offal, fresh, chilled or frozen</td>
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<tr>
<td>0208.30</td>
<td>Of primates</td>
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<td>0208.40</td>
<td>Of whales, dolphins and porpoises (mammals of the order Cetacea); of manatees and dugongs (mammals of the order Sirenia)</td>
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<td>0208.50</td>
<td>Of reptiles (including snakes and turtles)</td>
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<td>0208.90</td>
<td>Other</td>
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<tr>
<td>02.10</td>
<td>Meat and edible meat offal, salted, in brine, dried or smoked; edible flours and meals of meat or meat offal</td>
</tr>
<tr>
<td>0210.20</td>
<td>Meat of bovine animals</td>
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<tr>
<td></td>
<td>Other, including edible flours and meals of meat and meat offal.</td>
</tr>
<tr>
<td>0210.91</td>
<td>Of primates</td>
</tr>
<tr>
<td>0210.92</td>
<td>Of whales, dolphins and porpoises (mammals of the order Cetacea); of manatees and dugongs (mammals of the order Sirenia)</td>
</tr>
<tr>
<td>0210.93</td>
<td>Of reptiles (including snakes and turtles)</td>
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<tr>
<td>0210.99</td>
<td>Other</td>
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<tr>
<td>05</td>
<td>Products of animal origin, not elsewhere specified or included</td>
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<tr>
<td>05.04</td>
<td>Guts, bladders and stomachs of animals (other than fish), whole and pieces thereof, fresh, chilled, frozen, salted, in</td>
</tr>
<tr>
<td>0504.00</td>
<td>Guts, bladders and stomachs of animals (other than fish), whole and pieces thereof, fresh, chilled, frozen, salted, in</td>
</tr>
<tr>
<td>Chapter 80</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>05.06</td>
<td>Bones and horn-cores, unworked, defatted, simply prepared (but not cut to shape), treated with acid or degelatinised; powder and waste of these products</td>
</tr>
<tr>
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<tr>
<td>05.10</td>
<td>Ambergris, castoreum, civet and musk; cantharides; bile, whether or not dried; glands and other animal products used in the preparation of pharmaceutical products, fresh, chilled frozen or otherwise provisionally preserved</td>
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<tr>
<td></td>
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<tr>
<td>05.11</td>
<td>Animal products not elsewhere specified or included; dead animals of Chapter 1 or 3, unfit for human consumption</td>
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<tr>
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<tr>
<td>15.02</td>
<td>Fats of bovine animals, sheep or goats, other than those of heading 15.03; Products; prepared edible fats; animals or vegetable waxes</td>
</tr>
<tr>
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<tr>
<td>15.03</td>
<td>Lard stearin, lard oil, oleostearin, oleo-oil and tallow oil, not emulsified or mixed or otherwise prepared</td>
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<tr>
<td>16.01</td>
<td>Sausages and similar products, of meat, meat offal or blood; food preparations based on these products</td>
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<tr>
<td>16.02</td>
<td>Other prepared or preserved meat, meat offal or blood</td>
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*The State of AnGR- Sri Lanka*
<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>Extracts and juices of meat, fish or crustaceans, mollusks or other aquatic</td>
<td>1603.00</td>
<td>Extracts and juices of meat, fish or crustaceans, mollusks or other aquatic</td>
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<tr>
<td>invertebrates</td>
<td></td>
<td>invertebrates</td>
</tr>
<tr>
<td>Miscellaneou</td>
<td>21.04</td>
<td>Soup and broth preparations therefore; homogenized composite food preparations</td>
</tr>
<tr>
<td>Miscellaneous edible preparations</td>
<td></td>
<td>Homogenized composite food preparations</td>
</tr>
<tr>
<td>Residues and waste from the food industries; prepared animal fodder</td>
<td>23.01</td>
<td>Flours, meals and pellets, of meat or meat offal, of fish or of crustaceans,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mollusks or other aquatic invertebrates, unfit for human consumption; greaves</td>
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<td></td>
<td>2309.10</td>
<td>Dog or cat food, put up for retail sale</td>
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<td></td>
<td>2309.90</td>
<td>Other</td>
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<tr>
<td>Pharmaceutical products</td>
<td>30.01</td>
<td>Glands and other organs for organ therapeutic uses, dried, whether or not</td>
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<tr>
<td></td>
<td></td>
<td>powdered; extracts of glands or other organs or of their secretions for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>organo-therapeutic uses; heparin and its salts; other human or animal</td>
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<td></td>
<td></td>
<td>substances prepared for therapeutic or prophylactic uses, not elsewhere</td>
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<tr>
<td></td>
<td></td>
<td>specified or included.</td>
</tr>
<tr>
<td></td>
<td>3001.10</td>
<td>Glands and other organs, dried, whether or not powdered</td>
</tr>
<tr>
<td></td>
<td>3001.20</td>
<td>Extracts of glands or other organs or of their secretions</td>
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<td>3001.90</td>
<td>Other</td>
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<tr>
<td>Medicaments (excluding goods of heading 30.02, 30.05 or 30.06) consisting</td>
<td>30.03</td>
<td>Containing other antibiotics</td>
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<tr>
<td>of two or more constituents which have been mixed together for therapeutic</td>
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<tr>
<td>or prophylactic uses, not put up in measured doses or in forms or packing</td>
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<tr>
<td>for retail sale</td>
<td>3003.31</td>
<td>Containing hormones or other products of heading 29.37 but not containing</td>
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<td></td>
<td>antibiotics</td>
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<td></td>
<td></td>
<td>Containing insulin</td>
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<tr>
<td>Medicaments (excluding goods of heading 30.02, 30.05, or 30.06) consisting</td>
<td>30.04</td>
<td>Containing other antibiotics</td>
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<tr>
<td>of mixed or unmixed</td>
<td></td>
<td>Containing hormones or other products of heading 29.37 but not containing</td>
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<tr>
<td></td>
<td></td>
<td>antibiotics</td>
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*The State of AnGR- Sri Lanka*
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<tr>
<td>30.06</td>
<td>Pharmaceutical goods specified in Note 4 to this Chapter</td>
<td>3004.32 - Containing insulin Containing adrenal corticosteroid hormones, thir derivatives and structural analogues</td>
</tr>
<tr>
<td>3006.10</td>
<td>Sterile surgical catgut, similar sterile suture materials and sterile issue adhesives for surgical wound closure; sterile laminaria and sterile laminaria tents; sterile absorbable surgical or dental haemostatics</td>
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<tr>
<td>3006.20</td>
<td>Blood-grouping reagents</td>
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</tr>
<tr>
<td>3006.30</td>
<td>Opacifying preparations for X-ray examinations; diagnostic reagents designed to be administered to the patient</td>
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<tr>
<td>31.01</td>
<td>Animal or vegetable fertilizers, whether or not mixed together or chemically treated; fertilizers produced by the mixing or chemical treatment of animal or vegetable products</td>
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<tr>
<td>3101.00</td>
<td>Animal or vegetable fertilizers, whether or not mixed together or chemically treated; fertilizers produced by the mixing or chemical treatment of animal or vegetable products</td>
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<tr>
<td>35.03</td>
<td>Gelatin (including gelatin in rectangular (including square) sheets, whether or not surface-worked or coloured) and gelatin derivatives; isinglass; other glues of animal origin, excluding casein glues of heading 35.01</td>
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<tr>
<td>3503.00</td>
<td>Gelatin (including gelatin in rectangular (including square) sheets, whether or not surface-worked or coloured) and gelatin derivatives; isinglass; other glues of animal origin, excluding casein glues of heading 35.01</td>
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## Table 1. Distinguishing Characteristics of Agro–Ecological Regions

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<tr>
<th>AER symbol</th>
<th>Annual rainfall/ mm 75% expectancy</th>
<th>Terrain and Dominant soils</th>
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<tr>
<td><strong>WET ZONE</strong></td>
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<tr>
<td><strong>Up Country</strong></td>
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<tr>
<td>WU1</td>
<td>&gt;3175</td>
<td>Terrain: Mountainous, steeply dissected, hilly and rolling, Soils: Red-yellow podzolic and mountain regosols</td>
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<tr>
<td>WU2</td>
<td>&gt;1900</td>
<td>Terrain: Mountainous, steeply dissected, hilly and rolling, Soils: Red-yellow podzolic and mountain regosols (same as WU1)</td>
</tr>
<tr>
<td>WU3</td>
<td>&gt;1400</td>
<td>Terrain: Rolling, Soils: Red-yellow podzolic with dark B horizon and red yellow podzolic with prominent A1 horizon</td>
</tr>
<tr>
<td><strong>Mid Country</strong></td>
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<td></td>
</tr>
<tr>
<td>WM1</td>
<td>&gt;3150</td>
<td>Terrain: Steeply dissected, hilly and rolling, Soils: Red-yellow podzolic and red-rellow podzolic with semi prominent A1 horizon</td>
</tr>
<tr>
<td>WM2</td>
<td>&gt;1400</td>
<td>Terrain: Steeply dissected, hilly and rolling, Soils: Reddish brown latazolic, immature brown loams and red-yellow podzolic</td>
</tr>
<tr>
<td>WM3</td>
<td>&gt;1250</td>
<td>Terrain: Steeply dissected, hilly and undulating, Soils: reddish brown latazolic, immature brown loams and red-yellow podzolic</td>
</tr>
<tr>
<td><strong>Low Country</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WL1</td>
<td>&gt;2525</td>
<td>Terrain: Rolling and undulating terrain, Soils: Red-yellow podzolic and red-yellow podzolic with semi prominent A1 horizon</td>
</tr>
<tr>
<td>WL2</td>
<td>&gt;1900</td>
<td>Terrain: Rolling and undulating, Soils: Red-yellow podzolic, re-yellow podzolic with strongly mottled sub-soil and low humic gleys</td>
</tr>
<tr>
<td>WL3 &amp; 4</td>
<td>&gt;1525</td>
<td>WL3 – Terrain: Rolling and undulating, Soils: Red-yellow podzolic with soft and hard laterite&lt;br&gt;WL4 – Terrain: undulating and flat, Soils: Red-yellow podzolic with soft and hard laterite and BOG and half BOG</td>
</tr>
<tr>
<td><strong>INTERMEDIATE ZONE</strong></td>
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<tr>
<td><strong>Up Country</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IU1</td>
<td>&gt;2150</td>
<td>Terrain: Mountainous, steeply dissected, hilly and rolling, Soils: Red-yellow podzolic and mountain regosols</td>
</tr>
<tr>
<td>IU2</td>
<td>&gt;1400</td>
<td>Terrain: Mountainous, steeply dissected, hilly and rolling, Soils: Red-yellow podzolic</td>
</tr>
<tr>
<td>IU3</td>
<td>&gt;1150</td>
<td>Terrain: Steeply dissected, hilly and rolling, Soils: red-yellow podzolic</td>
</tr>
<tr>
<td><strong>Mid Country</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IM1</td>
<td>&gt;1400</td>
<td>Terrain: Rolling, hilly and steep, Soils: Reddish brown earths and immature brown loams</td>
</tr>
<tr>
<td>IM2</td>
<td>&gt;1150</td>
<td>Terrain: Rolling, hilly and steep, Soils: Reddish brown earths and immature brown loams</td>
</tr>
<tr>
<td>IM3</td>
<td>&gt;900</td>
<td>Terrain: Steeply dissected, hilly and rolling, Soils: Immature brown loams, reddish brown latazolic and reddish brown earths</td>
</tr>
<tr>
<td><strong>Low Country</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IL1</td>
<td>&gt;1020</td>
<td>Terrain: Rolling, undulating and flat, Soils: Red-yellow podzolic with strongly mottled sub-soil and regosols on old red yellow sands</td>
</tr>
<tr>
<td>IL2</td>
<td>&gt;1150</td>
<td>Terrain: Rolling, hilly and undulating, Soils: Reddish brown earths, immature brown lomas and low gley humic</td>
</tr>
<tr>
<td>IL3</td>
<td>&gt;900</td>
<td>Terrain: Undulating, Soils: Reddish brown earths, non-calcic brown and low humic gley</td>
</tr>
<tr>
<td><strong>DRY ZONE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Low Country</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DL1</td>
<td>&gt;775</td>
<td>Terrain: Undulating, Soils: Reddish brown earths and low humic gley</td>
</tr>
<tr>
<td>DL2</td>
<td>&gt;900</td>
<td>Terrain: Undulating and flat, Soils: non-calcic brown, reddish brown earth, soils on old alluvium, solodized solonet and regosols</td>
</tr>
<tr>
<td>DL3 &amp; 4</td>
<td>&gt;575</td>
<td>DL3 Terrain: Flat to slightly undulating, Soils: Red yellow latalasols and regosols, DL4 Terrain: Flat, Soils: Slolodized solonet, solonchak and gramusols</td>
</tr>
<tr>
<td>DL5</td>
<td>&gt;500</td>
<td>Terrain: Undulating and flat, Soils: Reddish brown earth with high amount of gravel in sub-soil and solodized solonet</td>
</tr>
</tbody>
</table>

*Source: Statistical Compendium on Natural Resources Management, Sri Lanka – 2000, Ministry of Forestry and Environment*
Table 2. The Basic Demographic Indicators

<table>
<thead>
<tr>
<th>Year</th>
<th>Mid-Year Population</th>
<th>Population Growth (b) %</th>
<th>Crude Birth Rate per 1,000 persons</th>
<th>Crude Death Rate per 1,000 persons</th>
<th>Net Migration per 1,000 persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>17,015</td>
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<td>21.1</td>
<td>6.1</td>
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<tr>
<td>1991</td>
<td>17,267</td>
<td>1.5</td>
<td>19.7</td>
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<td>-2.2</td>
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<tr>
<td>1994</td>
<td>17,891</td>
<td>1.4</td>
<td>20.2</td>
<td>5.5</td>
<td>-0.8</td>
</tr>
<tr>
<td>1995</td>
<td>18,136</td>
<td>1.4</td>
<td>19.4</td>
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<tr>
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<td>18.7</td>
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<td>18.5</td>
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<td>18,774</td>
<td>1.2</td>
<td>17.8</td>
<td>6.2</td>
<td>0.4</td>
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<td>19,043</td>
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<td>17.0</td>
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<td>3.2</td>
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<td>2000</td>
<td>19,360</td>
<td>1.7</td>
<td>-</td>
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</table>

Source: Registrar General’s Department, Central Bank of Sri Lanka
### Table 3. Main Milk Production Systems in Sri Lanka

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Estate System</th>
<th>Mid-country Smallholder system</th>
<th>Coconut Triangle System</th>
<th>Dry Zone system</th>
<th>Peri-urban system</th>
<th>Smallholder buffalo system</th>
<th>Vegetable based Jaffna system</th>
<th>Irrigated rice based system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone/ Region</td>
<td>Hill and Mid-country of the wet zone humid parts of the intermediate zone.</td>
<td>Wet and Intermediate zones of the hill and Mid-country of the</td>
<td>Part of Colombo, Gampaha, and Kurunegala district</td>
<td>Low country Dry Zone</td>
<td>In and around the major cities ie. Colombo, Homagama</td>
<td>Predominantly dry zone</td>
<td>Jaffna peninsula</td>
<td>Paddy growing area in low and mid country</td>
</tr>
<tr>
<td>Major agricultural operations</td>
<td>Limited employed on estates (tea, rubber)</td>
<td>Paddy and plus upland cash crop areas, incl. marginal land unsuitable for cash crop.</td>
<td>Low paddy land plus higher areas (coconuts and home gardens)</td>
<td>Shifting cultivation in uplands</td>
<td>Limited</td>
<td>Intensive farming on low land (paddy)</td>
<td>Intensive vegetable farming</td>
<td>Paddy and vegetables</td>
</tr>
<tr>
<td>Breed/ species</td>
<td>Temperate and Temperate crosses</td>
<td>Temperate crosses</td>
<td>Mainly Lankan cattle and their crosses with indicus and taurine breeds and buffaloes and their crosses</td>
<td>Lankan cattle and Bos indicus crosses</td>
<td>Temperate or Temperate crosses</td>
<td>Local and/or Indian origin buffaloes</td>
<td>Temperate crosses</td>
<td>Lankan crosses with indicus or Bos taurus</td>
</tr>
<tr>
<td>Feeding system</td>
<td>Stall feeding; Fodder from roadsides and farm boundaries.</td>
<td>Cut-and-carry: daily ration : 40-50 kg fodder + 2-3 kg concentrate: (fodder shrubs/ trees, grass, almyrah also fed)</td>
<td>Tethering on semi-improved pasture(mainly Bracharia sp.) supplemented with small amounts of poona.</td>
<td>Extensive grazing, often supervised by a stockman roughage, crop residues, tree fodder</td>
<td>Stall feeding; daily ration: 4-5 kg of concentrates plus bought-in roughage</td>
<td>Grazing on state land and/or paddy stubbles and rice straw</td>
<td>Stall fed, Improved fodder and pasture crop residues</td>
<td>Crop residues, Improved pasture</td>
</tr>
<tr>
<td>Cost of production</td>
<td>High (mainly on animals and feed)</td>
<td>High (mainly on animals and feed)</td>
<td>Generally low (animals and fodder production)</td>
<td>Low (mainly on labour)</td>
<td>High (animal feed labour, housing insurance)</td>
<td>Low</td>
<td>High (animal feed)</td>
<td>Low</td>
</tr>
</tbody>
</table>

Table 4: Production of Main Crops Cultivated in Sri Lanka (MT)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tea</td>
<td>258.4</td>
<td>276.9</td>
<td>280.1</td>
<td>283.8</td>
</tr>
<tr>
<td>Rubber</td>
<td>112.5</td>
<td>105.8</td>
<td>95.8</td>
<td>96.6</td>
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<tr>
<td>Coconut</td>
<td>2,546</td>
<td>2,631</td>
<td>2,565</td>
<td>2,700</td>
</tr>
<tr>
<td>Paddy</td>
<td>2,061.5</td>
<td>2,239.4</td>
<td>2,692.3</td>
<td>2,857</td>
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</table>


Table 5. Land Use and Current Trends (1000 ha)

<table>
<thead>
<tr>
<th>Category</th>
<th>Area (1000 ha) 1980</th>
<th>Area (1000 ha) 1997</th>
<th>Current trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arable land Agriculture (%) of total area</td>
<td>13.2</td>
<td>13.4</td>
<td>- stable</td>
</tr>
<tr>
<td>Permanent crops (%) cropped land</td>
<td>15.9</td>
<td>15.8</td>
<td>- stable</td>
</tr>
<tr>
<td>Permanent pastures</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Agricultural area (%) cropped land</td>
<td>3.3</td>
<td>1.6</td>
<td>- decreasing</td>
</tr>
<tr>
<td>Land area sq. km</td>
<td>62,705 (6.2 mil. Ha.)</td>
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<td></td>
</tr>
<tr>
<td>Total Area</td>
<td>65,610</td>
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Table 6. Farm Structure and Distribution

<table>
<thead>
<tr>
<th>Category</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>&gt; 1 acre</td>
<td>42</td>
</tr>
<tr>
<td>&gt; 1-2 acres</td>
<td>22</td>
</tr>
<tr>
<td>&gt; 2-3</td>
<td>14</td>
</tr>
<tr>
<td>&gt; 3-20</td>
<td>22</td>
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</table>
Table 7. Livestock Population in Sri Lanka (000’s) during 1990 - 2000

<table>
<thead>
<tr>
<th>Year</th>
<th>Cattle</th>
<th>Buffalo</th>
<th>Goats</th>
<th>Sheep</th>
<th>Pigs</th>
<th>Poultry</th>
<th>Ducks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>1,773</td>
<td>958</td>
<td>522</td>
<td>26</td>
<td>85</td>
<td>8,797</td>
<td></td>
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<tr>
<td>1991</td>
<td>1,477</td>
<td>825</td>
<td>460</td>
<td>20</td>
<td>84</td>
<td>8,261</td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>1,604</td>
<td>897</td>
<td>528</td>
<td>22</td>
<td>91</td>
<td>8,852</td>
<td></td>
</tr>
<tr>
<td>1993</td>
<td>1,704</td>
<td>794</td>
<td>583</td>
<td>20</td>
<td>90</td>
<td>9,261</td>
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<tr>
<td>1994</td>
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<td>588</td>
<td>20</td>
<td>94</td>
<td>9,466</td>
<td></td>
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<tr>
<td>1995</td>
<td>1,704</td>
<td>764</td>
<td>591</td>
<td>19</td>
<td>87</td>
<td>9,573</td>
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<tr>
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<td>535</td>
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<td>85</td>
<td>9,148</td>
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<tr>
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<td>726</td>
<td>521</td>
<td>11</td>
<td>80</td>
<td>9,323</td>
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<td>1998</td>
<td>1,599</td>
<td>721</td>
<td>519</td>
<td>12</td>
<td>76</td>
<td>9,866</td>
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<tr>
<td>1999</td>
<td>1,617</td>
<td>728</td>
<td>514</td>
<td>12</td>
<td>74</td>
<td>9,920</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>1,557</td>
<td>698</td>
<td>495</td>
<td>11</td>
<td>71</td>
<td>10,622</td>
<td>9.9</td>
</tr>
</tbody>
</table>

Ref: Central Bank of Sri Lanka, Economic and social statistic of Sri Lanka-1999
Department of Censes & Statistics, Agriculture Division

Table 8. Import of Milk and Milk Products (1990 - 2000)

<table>
<thead>
<tr>
<th>Year</th>
<th>Milk &amp; Cream</th>
<th>Milk Powder (Fat &lt; 1.5%)</th>
<th>Milk Powder (Fat &gt; 1.5%)</th>
<th>Condensed Milk</th>
<th>Cheese &amp; Curd</th>
<th>Butter &amp; other fats and oils derived from milk</th>
<th>Butter milk curdled milk etc.</th>
<th>Whey and whey powder</th>
<th>Total value of imports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity (Kg)</td>
<td>Value (Rs.)</td>
<td>Quantity (Kg)</td>
<td>Value (Rs.)</td>
<td>Quantity (Kg)</td>
<td>Value (Rs.)</td>
<td>Quantity (Kg)</td>
<td>Value (Rs.)</td>
<td>Quantity (Kg)</td>
</tr>
<tr>
<td>1990</td>
<td>1,836</td>
<td>444,789</td>
<td>1,831</td>
<td>444,789</td>
<td>2,185,000</td>
<td>444,789</td>
<td>2,185,000</td>
<td>444,789</td>
<td>2,185,000</td>
</tr>
<tr>
<td>1991</td>
<td>1,520</td>
<td>1,118,084</td>
<td>1,520</td>
<td>1,118,084</td>
<td>1,518,092</td>
<td>1,118,084</td>
<td>1,518,092</td>
<td>1,118,084</td>
<td>1,518,092</td>
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<tr>
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<td>2,034</td>
<td>2,034</td>
<td>2,034</td>
<td>2,034</td>
<td>2,034</td>
<td>2,034</td>
<td>2,034</td>
<td>2,034</td>
</tr>
<tr>
<td>1993</td>
<td>2,243</td>
<td>2,243</td>
<td>2,243</td>
<td>2,243</td>
<td>2,243</td>
<td>2,243</td>
<td>2,243</td>
<td>2,243</td>
<td>2,243</td>
</tr>
<tr>
<td>1996</td>
<td>2,272</td>
<td>2,272</td>
<td>2,272</td>
<td>2,272</td>
<td>2,272</td>
<td>2,272</td>
<td>2,272</td>
<td>2,272</td>
<td>2,272</td>
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<tr>
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<td>1,864</td>
<td>1,864</td>
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<td>1,864</td>
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<td>1,690</td>
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<td>1,690</td>
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<td>2000</td>
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<td>1,570</td>
<td>1,570</td>
<td>1,570</td>
<td>1,570</td>
<td>1,570</td>
<td>1,570</td>
<td>1,570</td>
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</table>

Source: Sri Lanka Customs Dept.
Table 9.  Trend in Milk and Egg Production during 1990 – 2000

<table>
<thead>
<tr>
<th>Year</th>
<th>Cow Milk (Litres 000')</th>
<th>Buffalo Milk (Litres 000')</th>
<th>Eggs (Number 000')</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>215,792</td>
<td>75,961</td>
<td>817,349</td>
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<tr>
<td>1991</td>
<td>208,822</td>
<td>70,889</td>
<td>784,772</td>
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<tr>
<td>1992</td>
<td>232,665</td>
<td>85,294</td>
<td>812,265</td>
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<tr>
<td>1993</td>
<td>244,567</td>
<td>81,119</td>
<td>856,824</td>
</tr>
<tr>
<td>1994</td>
<td>250,499</td>
<td>81,800</td>
<td>863,303</td>
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<tr>
<td>1995</td>
<td>253,447</td>
<td>79,859</td>
<td>861,700</td>
</tr>
<tr>
<td>1996</td>
<td>249,460</td>
<td>81,936</td>
<td>855,852</td>
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<tr>
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<td>251,928</td>
<td>79,106</td>
<td>854,868</td>
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<td>256,337</td>
<td>85,044</td>
<td>875,801</td>
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<td></td>
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<tr>
<td>2000</td>
<td>263,057</td>
<td>82,522</td>
<td>922,984</td>
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</table>

Agriculture Division, Dept. of Census & Statistics

Table 10.  Number of Animals Slaughtered (000') during 1990 - 2000

<table>
<thead>
<tr>
<th>Year</th>
<th>Cattle</th>
<th>Goats &amp; Sheep</th>
<th>Pigs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>152</td>
<td>83</td>
<td>23</td>
</tr>
<tr>
<td>1991</td>
<td>171</td>
<td>79</td>
<td>31</td>
</tr>
<tr>
<td>1992</td>
<td>190</td>
<td>102</td>
<td>33</td>
</tr>
<tr>
<td>1993</td>
<td>179</td>
<td>109</td>
<td>23</td>
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<td>1994</td>
<td>193</td>
<td>129</td>
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<td>1995</td>
<td>202</td>
<td>114</td>
<td>32</td>
</tr>
<tr>
<td>1996</td>
<td>179</td>
<td>97</td>
<td>31</td>
</tr>
<tr>
<td>1997</td>
<td>187</td>
<td>96</td>
<td>30</td>
</tr>
<tr>
<td>1998</td>
<td>183</td>
<td>80</td>
<td>16</td>
</tr>
<tr>
<td>1999</td>
<td>174</td>
<td>83</td>
<td>23</td>
</tr>
<tr>
<td>2000</td>
<td>211</td>
<td>85</td>
<td>24</td>
</tr>
</tbody>
</table>

Agriculture Division, Dept. of Census & Statistics

The State of AnGR- Sri Lanka
Table 11.  Import of Meat and Meat Products (1990 - 2000)

<table>
<thead>
<tr>
<th>Year</th>
<th>Meat of Bovines</th>
<th>Sheep &amp; Goat</th>
<th>Poultry Meat &amp; Offals (including liver)</th>
<th>Meat of Swine</th>
<th>Other Meat &amp; Edible Offals</th>
<th>Preserved Meat &amp; Pig Fat, Poultry Fat etc.</th>
<th>Total meat imports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity (Kg)</td>
<td>Value (Rs.)</td>
<td>Quantity (Kg)</td>
<td>Value (Rs.)</td>
<td>Quantity (Kg)</td>
<td>Value (Rs.)</td>
<td>Quantity (Kg)</td>
</tr>
<tr>
<td>1991</td>
<td>97,891</td>
<td>17,016,459</td>
<td>325,514</td>
<td>24,200,418</td>
<td>2,237</td>
<td>402,301</td>
<td>4,877</td>
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<tr>
<td>1992</td>
<td>27,738</td>
<td>19,937,295</td>
<td>59,158</td>
<td>1,552,047</td>
<td>155</td>
<td>55,768</td>
<td>13,211</td>
</tr>
<tr>
<td>1993</td>
<td>64,293</td>
<td>22,571,291</td>
<td>199,074</td>
<td>18,063,372</td>
<td>59,158</td>
<td>4,317,164</td>
<td>10,056</td>
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<tr>
<td>1994</td>
<td>51,674</td>
<td>18,618,816</td>
<td>32,498</td>
<td>12,320,381</td>
<td>26,861</td>
<td>2,253,067</td>
<td>154</td>
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<tr>
<td>1995</td>
<td>20,852,954</td>
<td>60,137,475</td>
<td>14,391,055</td>
<td>52,043,548</td>
<td>7,303</td>
<td>2,821,933</td>
<td>9,733</td>
</tr>
<tr>
<td>1996</td>
<td>14,391,055</td>
<td>52,043,548</td>
<td>797,468</td>
<td>73,627,719</td>
<td>26,947</td>
<td>3,507,334</td>
<td>18,658</td>
</tr>
<tr>
<td>1998</td>
<td>578,179</td>
<td>87,038,577</td>
<td>1,031,378</td>
<td>55,251,826</td>
<td>1,105</td>
<td>307,449</td>
<td>23,263</td>
</tr>
<tr>
<td>2000</td>
<td>62,651,324</td>
<td>87,648,081</td>
<td>1,488,742</td>
<td>90,582,753</td>
<td>7,507</td>
<td>1,347,218</td>
<td>30,805</td>
</tr>
</tbody>
</table>

Source: Sri Lanka Customs Dept.

Table 12.  Per-capita Availability of Animal Products

<table>
<thead>
<tr>
<th>Product/period</th>
<th>1995 (kg/year)</th>
<th>1999 (kg/year)</th>
<th>Change %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>1.52</td>
<td>1.24</td>
<td>-18.4</td>
</tr>
<tr>
<td>Chicken</td>
<td>2.17</td>
<td>3.09</td>
<td>+42.4</td>
</tr>
<tr>
<td>Mutton</td>
<td>0.16</td>
<td>0.12</td>
<td>-25.0</td>
</tr>
<tr>
<td>Pork</td>
<td>0.13</td>
<td>0.09</td>
<td>-30.8</td>
</tr>
<tr>
<td>Egg</td>
<td>2.65</td>
<td>2.63</td>
<td>+0.75</td>
</tr>
<tr>
<td>Fresh cow milk</td>
<td>8.34</td>
<td>8.34</td>
<td>0</td>
</tr>
<tr>
<td>Buffalo milk</td>
<td>3.72</td>
<td>3.66</td>
<td>-1.6</td>
</tr>
<tr>
<td>Powdered milk</td>
<td>2.83</td>
<td>3.02</td>
<td>+6.7</td>
</tr>
<tr>
<td>Milk foods</td>
<td>0.13</td>
<td>0.09</td>
<td>-30.8</td>
</tr>
<tr>
<td>Condensed milk</td>
<td>0.25</td>
<td>0.23</td>
<td>-8.0</td>
</tr>
</tbody>
</table>

Reference: Food Balance Sheet, 1995-1999 (Department of Census and Statistics)
Table 13. Poverty, All Island and by Sector

<table>
<thead>
<tr>
<th></th>
<th>1985/86</th>
<th></th>
<th>1990/91</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Incidence of Poverty (Head Count Index)</td>
<td>Depth of Poverty (Poverty Gap Index)</td>
<td>Severity of Poverty (Poverty Gap Index Squared)</td>
<td>Incidence of Poverty (Head Count Index)</td>
</tr>
<tr>
<td></td>
<td>Reference Poverty Line: SLR 421.20 per person per month*</td>
<td></td>
<td></td>
<td>Higher Poverty Line: SLR 565.44 per person per month*</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>27.33</td>
<td>6.54</td>
<td>2.31</td>
<td>22.36</td>
</tr>
<tr>
<td>Urban Sector</td>
<td>16.43</td>
<td>3.48</td>
<td>1.11</td>
<td>18.31</td>
</tr>
<tr>
<td>Rural Sector</td>
<td>31.67</td>
<td>7.67</td>
<td>2.75</td>
<td>24.41</td>
</tr>
<tr>
<td>Estate Sector</td>
<td>14.31</td>
<td>3.81</td>
<td>1.37</td>
<td>12.62</td>
</tr>
<tr>
<td></td>
<td>Sri Lanka</td>
<td>40.60</td>
<td>11.09</td>
<td>4.30</td>
</tr>
<tr>
<td></td>
<td>Urban Sector</td>
<td>26.78</td>
<td>6.52</td>
<td>2.29</td>
</tr>
<tr>
<td></td>
<td>Rural Sector</td>
<td>45.48</td>
<td>12.81</td>
<td>5.04</td>
</tr>
<tr>
<td></td>
<td>Estate Sector</td>
<td>30.85</td>
<td>6.79</td>
<td>2.54</td>
</tr>
</tbody>
</table>

Note: * at 1990/91 prices, All poverty measures are given in percentage.
Source: World Bank, 1995

Table 14. Level and Distribution of Per-capita Consumption Expenditures by Province

<table>
<thead>
<tr>
<th>Province</th>
<th>Per-Capita Consumption Expenditure (Rs.)</th>
<th>Gini Coefficients of Expenditure Inequality Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western</td>
<td>934.38</td>
<td>33.64</td>
</tr>
<tr>
<td>Central</td>
<td>710.69</td>
<td>25.23</td>
</tr>
<tr>
<td>Southern</td>
<td>732.06</td>
<td>26.35</td>
</tr>
<tr>
<td>North Western</td>
<td>746.97</td>
<td>25.76</td>
</tr>
<tr>
<td>North Central</td>
<td>738.10</td>
<td>27.41</td>
</tr>
<tr>
<td>Uva</td>
<td>715.49</td>
<td>22.05</td>
</tr>
<tr>
<td>Sabaragamuwa</td>
<td>738.89</td>
<td>27.96</td>
</tr>
</tbody>
</table>

Source: Calculated from Household Income and Expenditure Survey, 1990/91
### Table 15. Labour Force Employed and Unemployed in Sri Lanka (000’) 1990 –2000

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour force</td>
<td>6,001</td>
<td>5,877</td>
<td>5,808</td>
<td>6,032</td>
<td>6,079</td>
<td>6,106</td>
<td>6,242</td>
<td>6,266</td>
<td>6,661</td>
<td>6,673</td>
<td>6,854</td>
</tr>
<tr>
<td>Employed</td>
<td>5,047</td>
<td>5,016</td>
<td>4,962</td>
<td>5,201</td>
<td>5,281</td>
<td>5,357</td>
<td>5,537</td>
<td>5,608</td>
<td>6,049</td>
<td>6,083</td>
<td>6,308</td>
</tr>
<tr>
<td>Unemployed</td>
<td>954</td>
<td>862</td>
<td>846</td>
<td>831</td>
<td>798</td>
<td>749</td>
<td>705</td>
<td>658</td>
<td>611</td>
<td>591</td>
<td>546</td>
</tr>
<tr>
<td>Unemployment %</td>
<td>15.9</td>
<td>14.7</td>
<td>14.6</td>
<td>13.8</td>
<td>13.1</td>
<td>12.3</td>
<td>11.3</td>
<td>10.5</td>
<td>9.2</td>
<td>8.9</td>
<td>8.0</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Year</th>
<th>Meat of Bovines</th>
<th>Sheep &amp; Goat</th>
<th>Poultry Meat</th>
<th>Meat of Swine</th>
<th>Milk &amp; Milk Products</th>
<th>Eggs</th>
<th>Preserved meat &amp; Pig fat, Poultry fat etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity (Kg)</td>
<td>Value (Rs)</td>
<td>Quantity (Kg)</td>
<td>Value (Rs)</td>
<td>Quantity (Kg)</td>
<td>Value (Rs)</td>
<td>Quantity (Kg)</td>
</tr>
<tr>
<td>1992</td>
<td>260,160</td>
<td>20,062,536</td>
<td>7,896</td>
<td>1,085,842</td>
<td>90,242</td>
<td>8,084,804</td>
<td>218,657</td>
</tr>
<tr>
<td>1993</td>
<td>228,217</td>
<td>15,931,402</td>
<td>17,021</td>
<td>3,235,305</td>
<td>55,364</td>
<td>5,528,616</td>
<td>195,898</td>
</tr>
<tr>
<td>1994</td>
<td>61,421</td>
<td>7,0936,39</td>
<td>558</td>
<td>65,854</td>
<td>87,795</td>
<td>7,094,296</td>
<td>235,904</td>
</tr>
<tr>
<td>1995</td>
<td>65,950</td>
<td>13,790,127</td>
<td>300</td>
<td>60,859</td>
<td>9,829</td>
<td>1,031,358</td>
<td>79,602</td>
</tr>
<tr>
<td>1996</td>
<td>192,135</td>
<td>36,453,000</td>
<td>1,098</td>
<td>137,605</td>
<td>449,719</td>
<td>38,951,586</td>
<td>15,200</td>
</tr>
<tr>
<td>1997</td>
<td>135,440</td>
<td>47,162,156</td>
<td>153</td>
<td>28,212</td>
<td>533,129</td>
<td>41,493,296</td>
<td>7,125</td>
</tr>
<tr>
<td>1998</td>
<td>127,893</td>
<td>36,005,675</td>
<td>152</td>
<td>48,355</td>
<td>268,880</td>
<td>17,277,863</td>
<td>6,154</td>
</tr>
</tbody>
</table>

Source: Sri Lanka Customs Dept.
Table 17.  Export of Skins Hides and Leathers (1990 - 2000)

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity (Kg)</th>
<th>Value (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>1,102,162</td>
<td>65,837,215</td>
</tr>
<tr>
<td>1991</td>
<td>774,889</td>
<td>971,593,929</td>
</tr>
<tr>
<td>1992</td>
<td>748,772</td>
<td>39,664,269</td>
</tr>
<tr>
<td>1993</td>
<td>580,648</td>
<td>49,657,373</td>
</tr>
<tr>
<td>1994</td>
<td>316,668</td>
<td>47,929,186</td>
</tr>
<tr>
<td>1995</td>
<td>252,277</td>
<td>64,095,544</td>
</tr>
<tr>
<td>1996</td>
<td>222,754</td>
<td>80,188,030</td>
</tr>
<tr>
<td>1997</td>
<td>213,819</td>
<td>73,000,267</td>
</tr>
<tr>
<td>1998</td>
<td>216,365</td>
<td>66,914,966</td>
</tr>
<tr>
<td>1999</td>
<td>133,246</td>
<td>55,851,679</td>
</tr>
<tr>
<td>2000</td>
<td>123,586</td>
<td>45,577,550</td>
</tr>
</tbody>
</table>

Source: Sri Lanka Customs Department

Table 18.  Cross Breeding Experiments in Karagoda-Uyangoda Farm.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Milk yield (kg)</td>
<td>Lactation length (d)</td>
</tr>
<tr>
<td>Friesian X Sinhala</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F₁</td>
<td>1,573</td>
<td>327</td>
</tr>
<tr>
<td>F₂</td>
<td>987 (34)</td>
<td>302 (34)</td>
</tr>
<tr>
<td>F₃</td>
<td>987</td>
<td>-</td>
</tr>
<tr>
<td>Jersey X Sinhala</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F₁</td>
<td>1,215</td>
<td>313</td>
</tr>
<tr>
<td>F₂</td>
<td>809 (34)</td>
<td>273 (34)</td>
</tr>
<tr>
<td>B₁</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sinhala</td>
<td>570</td>
<td>224</td>
</tr>
</tbody>
</table>

Note: Figures in brackets give number in mean for less than 50 observations.
Source: Buvanendran and Mahadevan. World Animal Review FAO No. 15 1975
Table 19. Cross Breeding Experiments in Undugoda Farm.

<table>
<thead>
<tr>
<th>Breed</th>
<th>Milk yield (kg)</th>
<th>Lactation length (d)</th>
<th>Calving interval (d)</th>
<th>Age at 1st Calving (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayrshire</td>
<td>1,956</td>
<td>341</td>
<td>437</td>
<td>32.9</td>
</tr>
<tr>
<td>Jersey X Sindhi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F₁</td>
<td>1,929</td>
<td>295</td>
<td>368</td>
<td>33.7</td>
</tr>
<tr>
<td>F₂</td>
<td>1,115 (49)</td>
<td>265 (49)</td>
<td>430 (49)</td>
<td>33.0 (49)</td>
</tr>
<tr>
<td>5/8</td>
<td>884</td>
<td>265</td>
<td>373</td>
<td>36.3</td>
</tr>
<tr>
<td>B₁</td>
<td>1,700</td>
<td>317</td>
<td>434</td>
<td>39.6</td>
</tr>
</tbody>
</table>

Note: Figures in brackets give number in mean for less than 50 observations.
Source: Buvanendran and Mahadevan. World Animal Review FAO No. 15 1975

Table 20. Cross Breeding Experiments in Weerawila Farm.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Milk yield (kg)</td>
<td>Lactation length (d)</td>
</tr>
<tr>
<td>Sindhi X Sinhala</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F₁</td>
<td>770</td>
<td>228</td>
</tr>
<tr>
<td>B₂</td>
<td>760</td>
<td>253</td>
</tr>
<tr>
<td>Sindhi</td>
<td>908</td>
<td>247</td>
</tr>
<tr>
<td>Jersey X Grade Sindhi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F₁</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Shorthorn X Grade Sindhi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F₁</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: Figures in brackets give number in mean for less than 50 observations.
Source: Buvanendran and Mahadevan. World Animal Review FAO No. 15 1975

Table 21. Percentage of Buffalo Holdings Carrying Improved Breeds in the Different Agro-ecological Zones.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Percentage of Buffalo Holdings</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1985</td>
<td>1999</td>
</tr>
<tr>
<td>Wet-zone</td>
<td>26.5</td>
<td>24.2</td>
</tr>
<tr>
<td>Wet-intermediate</td>
<td>16.8</td>
<td>26.0</td>
</tr>
<tr>
<td>Dry-intermediate</td>
<td>31.8</td>
<td>38.0</td>
</tr>
<tr>
<td>Dry zone</td>
<td>30.25</td>
<td>33.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>26.3</strong></td>
<td><strong>30.4</strong></td>
</tr>
</tbody>
</table>

Source: Department of Census & Statistics
Table 22. Livestock Population (species and type-wise classification) 1990-2000

<table>
<thead>
<tr>
<th>Year</th>
<th>Cattle</th>
<th>Buffaloes</th>
<th>Goats</th>
<th>Sheep</th>
<th>Pigs</th>
<th>Poultry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Milch cows</td>
<td>Other cows</td>
<td>Bulls</td>
<td>Calves</td>
<td>Milch Cows</td>
<td>Other cows</td>
</tr>
<tr>
<td>1990</td>
<td>545.6</td>
<td>288.1</td>
<td>266.7</td>
<td>333.0</td>
<td>233.3</td>
<td>213.4</td>
</tr>
<tr>
<td>1991</td>
<td>590.0</td>
<td>281.4</td>
<td>257.0</td>
<td>348.0</td>
<td>248.1</td>
<td>206.3</td>
</tr>
<tr>
<td>1992</td>
<td>626.0</td>
<td>309.0</td>
<td>269.0</td>
<td>364.0</td>
<td>277.0</td>
<td>220.0</td>
</tr>
<tr>
<td>1993</td>
<td>671.0</td>
<td>340.0</td>
<td>281.0</td>
<td>396.0</td>
<td>240.0</td>
<td>208.0</td>
</tr>
<tr>
<td>1994</td>
<td>685.0</td>
<td>341.0</td>
<td>285.0</td>
<td>391.0</td>
<td>239.0</td>
<td>209.0</td>
</tr>
<tr>
<td>1995</td>
<td>696.0</td>
<td>333.0</td>
<td>282.0</td>
<td>394.0</td>
<td>232.0</td>
<td>203.0</td>
</tr>
<tr>
<td>1996</td>
<td>697.0</td>
<td>315.0</td>
<td>267.0</td>
<td>364.0</td>
<td>235.0</td>
<td>198.0</td>
</tr>
<tr>
<td>1997</td>
<td>674.0</td>
<td>295.0</td>
<td>259.0</td>
<td>351.0</td>
<td>226.0</td>
<td>188.0</td>
</tr>
<tr>
<td>1998</td>
<td>682.0</td>
<td>306.0</td>
<td>254.0</td>
<td>356.0</td>
<td>227.0</td>
<td>188.0</td>
</tr>
<tr>
<td>1999</td>
<td>690.0</td>
<td>304.0</td>
<td>258.0</td>
<td>365.0</td>
<td>236.0</td>
<td>183.0</td>
</tr>
<tr>
<td>2000</td>
<td>670.3</td>
<td>285.3</td>
<td>244.2</td>
<td>357.2</td>
<td>227.2</td>
<td>172.6</td>
</tr>
</tbody>
</table>

Source: Department of Census & Statistic

Table 23. Trends in Buffalo Population in Different Agro-ecological Zones

<table>
<thead>
<tr>
<th>Zone</th>
<th>Number of animals</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1981</td>
<td>1997</td>
</tr>
<tr>
<td>Wet-zone</td>
<td>155,700</td>
<td>123,900</td>
</tr>
<tr>
<td>Wet-intermediate</td>
<td>98,600</td>
<td>65,800</td>
</tr>
<tr>
<td>Dry-intermediate</td>
<td>289,300</td>
<td>268,600</td>
</tr>
<tr>
<td>Dry zone</td>
<td>354,700</td>
<td>301,206</td>
</tr>
<tr>
<td>Total</td>
<td>898,300</td>
<td>759,506</td>
</tr>
</tbody>
</table>

Source: Department of Census & Statistics

<table>
<thead>
<tr>
<th>District</th>
<th>Cattle</th>
<th>Buffaloes</th>
<th>Goats</th>
<th>Sheep</th>
<th>Pigs</th>
<th>Poultry</th>
<th>Ducks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colombo</td>
<td>24,100</td>
<td>15,200</td>
<td>15,700</td>
<td>7,800</td>
<td>5,900</td>
<td>3,200</td>
<td>n.a.</td>
</tr>
<tr>
<td>Gampaha</td>
<td>51,500</td>
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</tr>
<tr>
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</tr>
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<td>Hambantota</td>
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<tr>
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<td>4,600</td>
<td>-</td>
<td>6,400</td>
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<tr>
<td>Vavuniya</td>
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<td>-</td>
<td>1,300</td>
<td>-</td>
<td>7,300</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Mullaitivu</td>
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<td>6,300</td>
<td>-</td>
<td>11,300</td>
<td>-</td>
<td>300</td>
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<td>Batticaloa</td>
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<td>126,300</td>
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<td>31,500</td>
<td>32,900</td>
<td>100</td>
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<tr>
<td>Ampara</td>
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<td>96,800</td>
<td>56,700</td>
<td>43,600</td>
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<td>15,500</td>
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<tr>
<td>Trincomalee</td>
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<td>-</td>
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<td>-</td>
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<tr>
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<td>198,400</td>
<td>176,600</td>
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<td>56,300</td>
<td>59,700</td>
<td>3,700</td>
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<td>84,300</td>
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<td>47,600</td>
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<td>Anuradhapura</td>
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<td>158,100</td>
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<td>46,200</td>
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<td>55,300</td>
<td>39,300</td>
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<td>14,900</td>
<td>-</td>
</tr>
<tr>
<td>Badulla</td>
<td>79,500</td>
<td>78,000</td>
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<td>-</td>
</tr>
<tr>
<td>Kegalle</td>
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<td>23,700</td>
<td>19,100</td>
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<td>23,100</td>
<td>20,300</td>
<td>-</td>
</tr>
<tr>
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<td>8200</td>
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<td>4,500</td>
<td>-</td>
</tr>
<tr>
<td>Kilinochchi</td>
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<td>8200</td>
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<td>1,600</td>
<td>4,500</td>
<td>-</td>
</tr>
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Sri Lanka 1,476,800 1,557,000 825,000 697,600 460,000 495,200 20300 11200 83,500 70800 8,260,900 10,622,400 17,300 9,900

# Table 25. Details of Semen Imported During 1990 - 2001

<table>
<thead>
<tr>
<th>Date of importation</th>
<th>Breed of Semen</th>
<th>No. of doses imported</th>
<th>Country of Origin</th>
</tr>
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<tbody>
<tr>
<td>ADB project</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1990.07.28</td>
<td>Sindhi</td>
<td>596</td>
<td>India</td>
</tr>
<tr>
<td></td>
<td>Jersey</td>
<td>35</td>
<td>Australia</td>
</tr>
<tr>
<td></td>
<td>AMZ</td>
<td>25</td>
<td>Australia</td>
</tr>
<tr>
<td>1990.06.07</td>
<td>Murrah</td>
<td>500</td>
<td>Thailand</td>
</tr>
<tr>
<td>1990.07.28</td>
<td>Brown Swiss</td>
<td>270</td>
<td>Switzerland</td>
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<tr>
<td>1992.06.20</td>
<td>Ayrshire</td>
<td>1,500</td>
<td>New Zealand</td>
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<td>Ayrshire</td>
<td>2000</td>
<td>-</td>
</tr>
<tr>
<td>1994.11.22</td>
<td>Friesian</td>
<td>3000</td>
<td>Australia</td>
</tr>
<tr>
<td>1994.12.24</td>
<td>AFS</td>
<td>3000</td>
<td>Australia</td>
</tr>
<tr>
<td>1995</td>
<td>HF</td>
<td>46,000</td>
<td>New Zealand, Australia, Canada, Netherlands</td>
</tr>
<tr>
<td>1995</td>
<td>Jersey</td>
<td>13,000</td>
<td>Australia, Canada, Netherlands</td>
</tr>
<tr>
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<td>AMZ</td>
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<td>Australia</td>
</tr>
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<td>Canada</td>
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<td>Holland</td>
</tr>
<tr>
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<tr>
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<td>1996.01.02</td>
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<td>Australia</td>
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<td>AFS</td>
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<td>Australia</td>
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<td>1996.09.06</td>
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<td>Australia</td>
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<td>Australia</td>
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<td>1999.01.02</td>
<td>Jersey Type II</td>
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<td>Denmark</td>
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<td>1999.08.19</td>
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<td>2000</td>
<td>India</td>
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<td>2000.04.29</td>
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<td>2001</td>
<td>Duroc</td>
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</tr>
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<td></td>
<td>Land Race</td>
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<td>USA</td>
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Source: Dr. ADN. Chandrasiri, (personal communication)
Table 26. Importation of Livestock for Breed improvement (1990 - 2000)

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<th>Year</th>
<th>Country</th>
<th>Breed</th>
<th>Number</th>
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<tr>
<td></td>
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<td>Sahiwal</td>
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<tr>
<td></td>
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<td>Sahiwal</td>
<td>213</td>
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<tr>
<td></td>
<td>Pakistan</td>
<td>Nili Ravi</td>
<td>169</td>
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<td>1991</td>
<td>Pakistan</td>
<td>Sahiwal</td>
<td>33</td>
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<tr>
<td></td>
<td>Pakistan</td>
<td>Nili Ravi</td>
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</tr>
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<td>Australia</td>
<td>AMZ</td>
<td>100</td>
</tr>
<tr>
<td>1997</td>
<td>India</td>
<td>Jamnapari</td>
<td>368</td>
</tr>
<tr>
<td>1999</td>
<td>Denmark</td>
<td>Jersey</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Netherlands</td>
<td>Friesian</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Australia</td>
<td>AFS</td>
<td>05</td>
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<td></td>
<td>Buffaloes</td>
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<tr>
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<td>Pakistan</td>
<td>Nili Ravi</td>
<td>90</td>
</tr>
<tr>
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<td>Pakistan</td>
<td>Nili Ravi</td>
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<td>Goats</td>
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<td>Beetal</td>
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<td>Beetal</td>
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</tr>
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<td>German Faun</td>
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<td>-</td>
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<td>Holland</td>
<td>-</td>
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<td>Germany</td>
<td>Boer</td>
<td>22</td>
</tr>
<tr>
<td>1997</td>
<td>India</td>
<td>Jamnapari</td>
<td>368</td>
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<td></td>
<td></td>
<td>Pigs</td>
<td></td>
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<tr>
<td>1990</td>
<td>Australia</td>
<td>LR/ LW</td>
<td>120</td>
</tr>
<tr>
<td>1991</td>
<td>-</td>
<td>-</td>
<td>02</td>
</tr>
<tr>
<td>1996</td>
<td>USA</td>
<td>-</td>
<td>32</td>
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<td>USA</td>
<td>Large White</td>
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<td>08</td>
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<tr>
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<td>USA</td>
<td>Duroc</td>
<td>06</td>
</tr>
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<td>1998</td>
<td>USA</td>
<td>Land Race</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>Large White</td>
<td>13</td>
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<tr>
<td></td>
<td></td>
<td>Rabbits</td>
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</tr>
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<td>1993</td>
<td>-</td>
<td>-</td>
<td>78</td>
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</table>

Source: Dr. ADN. Chandrasiri, (personal communication)
Table 27. Productive and Reproductive Performance of Different Breeds and Crosses of Buffaloes.

<table>
<thead>
<tr>
<th>Breed Group</th>
<th>1st lactation/1 Lactation length (d)</th>
<th>Age at 1st calving (m)</th>
<th>Calving interval (m)</th>
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<tbody>
<tr>
<td>Lankan (L)</td>
<td>353</td>
<td>250</td>
<td>14.9</td>
</tr>
<tr>
<td>Murrah (M)</td>
<td>1,427</td>
<td>332</td>
<td>53.6</td>
</tr>
<tr>
<td>M x L (F₁)</td>
<td>829</td>
<td>283</td>
<td>51.2</td>
</tr>
<tr>
<td>M x F₁ (B₁)</td>
<td>1,096</td>
<td>318</td>
<td>50.2</td>
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Table 28. Performance of Artificial Insemination Service During Last Ten Years

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<th>Year</th>
<th>No. of AI performed</th>
<th>Annual increase</th>
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<tr>
<td>1991</td>
<td>52,790</td>
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</tr>
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<td>1992</td>
<td>66,901</td>
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</tr>
<tr>
<td>1993</td>
<td>73,194</td>
<td>6,293 (9.4%)</td>
</tr>
<tr>
<td>1994</td>
<td>81,482</td>
<td>8,288 (11.3%)</td>
</tr>
<tr>
<td>1995</td>
<td>96,138</td>
<td>14,656 (18.0%)</td>
</tr>
<tr>
<td>1996</td>
<td>109,008</td>
<td>12,870 (13.4%)</td>
</tr>
<tr>
<td>1997</td>
<td>115,418</td>
<td>6,410 (5.9%)</td>
</tr>
<tr>
<td>1998</td>
<td>122,480</td>
<td>7,062 (6.1%)</td>
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<tr>
<td>1999</td>
<td>125,426</td>
<td>2,946 (2.4%)</td>
</tr>
<tr>
<td>2000</td>
<td>137,240</td>
<td>11,751 (9.4%)</td>
</tr>
</tbody>
</table>

Table 29. Average Price Change of Livestock Products (1994 - 2001)

<table>
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<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh Milk (Rs./ Lit.)</td>
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<td>10</td>
<td>12</td>
<td>15</td>
<td>16</td>
<td>16</td>
<td>20</td>
<td>25</td>
<td>212.5</td>
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<tr>
<td>Powdered Milk</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Highland (Rs./400g pack)</td>
<td>52.50</td>
<td>52.50</td>
<td>65.00</td>
<td>67.50</td>
<td>72.00</td>
<td>74.00</td>
<td>84.00</td>
<td>96.00</td>
<td>82.9</td>
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<tr>
<td>2. Anchor (Rs./400g pack)</td>
<td>60.75</td>
<td>78.00</td>
<td>84.00</td>
<td>84.00</td>
<td>87.00</td>
<td>93.00</td>
<td>103.00</td>
<td>129.00</td>
<td>112.3</td>
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<td>Egg (Rs./egg)</td>
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<tr>
<td>1. Brown</td>
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<td>2. White</td>
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<td>2.85</td>
<td>3.80</td>
<td>3.10</td>
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<td>3.65</td>
<td>4.00</td>
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<td>Chicken (Rs./Kg)</td>
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<td>83</td>
<td>100</td>
<td>115</td>
<td>130</td>
<td>135</td>
<td>140</td>
<td>120</td>
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<td>Beef (Rs./Kg)</td>
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<td>120</td>
<td>110</td>
<td>120</td>
<td>145</td>
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<td>Mutton (Rs./Kg)</td>
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<td>180</td>
<td>200</td>
<td>240</td>
<td>240</td>
<td>245</td>
<td>260</td>
<td>280</td>
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<tr>
<td>Pork (Rs./Kg)</td>
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<td>90</td>
<td>120</td>
<td>160</td>
<td>160</td>
<td>140</td>
<td>140</td>
<td>75.0</td>
</tr>
<tr>
<td>Fish (Rs./Kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Large</td>
<td>200</td>
<td>200</td>
<td>240</td>
<td>320</td>
<td>280</td>
<td>260</td>
<td>260</td>
<td>280</td>
<td>40.0</td>
</tr>
<tr>
<td>2. Small</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>55</td>
<td>45</td>
<td>60</td>
<td>60</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Livestock Data 2001, Division of Livestock Planning and Economics, Peradeniya, March, 2002
Table 30. Domestic Livestock Breeds Available in Sri Lanka without Phenotypic or Genetic Characterization

<table>
<thead>
<tr>
<th>Local breeds</th>
<th>Exotic poultry</th>
<th>Exotic pigs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild buffaloes</td>
<td>PlymouthRock</td>
<td>Landrace</td>
</tr>
<tr>
<td>Wild rabbits (hare)</td>
<td>Light Sussex</td>
<td>Large white</td>
</tr>
<tr>
<td>Scavenging village chicken</td>
<td>White leg horn</td>
<td>Duroc</td>
</tr>
<tr>
<td>Jaffna sheep</td>
<td>Rhode Island Red</td>
<td></td>
</tr>
<tr>
<td>Delft ponies</td>
<td>Cornish</td>
<td></td>
</tr>
<tr>
<td>Puttalam Donkey</td>
<td>Broilers</td>
<td>Red Madras</td>
</tr>
<tr>
<td>Kottukachchiya Goats</td>
<td>Guinea fowl – imported strains</td>
<td>Bannur</td>
</tr>
<tr>
<td>Wild pigs</td>
<td>Turkey – imported strains</td>
<td>South Down</td>
</tr>
<tr>
<td></td>
<td>Ducks – imported strains</td>
<td>Polled Dorset</td>
</tr>
<tr>
<td><strong>Exotic breed of cattle</strong></td>
<td>Quail – imported strains</td>
<td>Dorset Horn</td>
</tr>
<tr>
<td>Sahiwal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gir</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Khillari</td>
<td>Jamnapari</td>
<td>New Zealand white</td>
</tr>
<tr>
<td>Kangayam</td>
<td>Saanen</td>
<td></td>
</tr>
<tr>
<td>Sunandani</td>
<td>Boer</td>
<td></td>
</tr>
<tr>
<td>AMZ</td>
<td>Beetal</td>
<td></td>
</tr>
</tbody>
</table>
### Table 31. Pattern of Institutional Interventions in the Livestock Sector

<table>
<thead>
<tr>
<th>Institution</th>
<th>Nature of Intervention</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(a) State Sector</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Ministry of Agriculture and Livestock</td>
<td>Policy formulation resource mobilization, monitoring of progress</td>
<td>Top-down, stakeholder consultation present to a reasonable extent</td>
</tr>
<tr>
<td>2. Central Department of Animal Production and Health, Peradeniya and its affiliated bodies such as Veterinary Research Institute, Veterinary Hospital etc.</td>
<td>Technical support for policy implementation Animal health and disease control systems Veterinary research, production of vaccines, Technical support for animal breeding, Enforcement of laws and regulations, Human resources development and training, Monitoring and evaluation and dissemination of information</td>
<td>Top-down functional approach, limited stakeholder consultation</td>
</tr>
<tr>
<td>3. Provincial departments of Animal Production and Health</td>
<td>Policy/ programme implementation through field veterinary units with an emphasis on animal health and breeding, Extension services through farmer contact and limited training, provincial level planning and program implementation, implementation of special projects determined at the central level.</td>
<td>Top-down service delivery with a limited extent of farmer participation and stakeholder consultation.</td>
</tr>
<tr>
<td>4. Relevant Faculties and Departments of the Universities</td>
<td>Offer academic degrees for development of higher-level expertise and skills for the livestock industry, livestock related research and dissemination of information through publications.</td>
<td>Structured academic approach, limited consultation of stakeholder, informal institutional relations.</td>
</tr>
<tr>
<td><strong>(b) Public enterprises</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. National Livestock Development Board (NLDB)</td>
<td>Breeding and supply of improved varieties of livestock to farmers. Training in livestock farming to selected groups of youth.</td>
<td>Coconut plantations-based business operation with limited capability to meet the demand for animals. Limited interaction with the stakeholders.</td>
</tr>
<tr>
<td>2. Milk Industries of Lanka Company Limited (MILKO)</td>
<td>Procurement and processing of milk and value added milk products, Institutional support for dairy farmer organizations.</td>
<td>Operate as a business organizations within capacity constraints, wide geographical spread and high contact with farmer organizations.</td>
</tr>
<tr>
<td>3. Mahaweli livestock enterprise of the Mahaweli Authority of Sri Lanka</td>
<td>Promotion of livestock farming among settler communities through maintenance of cattle and goat farms for multiplication and distribution</td>
<td>Vertically integrated business unit with relatively high farmer contact, limited plans for expansion.</td>
</tr>
<tr>
<td><strong>(c) Cooperative sector</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Various cooperative societies in the livestock sector including MILKFED</td>
<td>Provision of management and technical know-how to member societies, Promotion of procurement of milk and value added milk products, Welfare schemes for members</td>
<td>Organizations with carrying degree of farmer contact, which had received considerable assistance from the government</td>
</tr>
<tr>
<td><strong>(d) Private sector</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Poultry Industry; Bairaha farms, Maxies poultry products, Nel farm and Hatcheries, Prima, Shetna Poultry Farm, All Island Poultry Association (AIPA)</td>
<td>Production and marketing of poultry meat and eggs, hatcheries, contract operations, buyback arrangements. Acts as a representative of producers to ensure a level playing field to all producers and to ensure long-term growth of the industry.</td>
<td>Market driven business operations having links with small-scale producers. Represents organized producers and promote collective action</td>
</tr>
</tbody>
</table>

Table 32. Primary Institutions and Organizations Involved in AnGR Activities

<table>
<thead>
<tr>
<th>Institute</th>
<th>Activities Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Veterinary Research Institute (VRI)</td>
<td>Research, Education and Training</td>
</tr>
<tr>
<td>2. University of Peradeniya</td>
<td></td>
</tr>
<tr>
<td>Faculty of Agriculture, Department of Animal Sc.</td>
<td></td>
</tr>
<tr>
<td>Faculty of Veterinary Medicine and Animal Sc., Dep. of Animal Sc.</td>
<td></td>
</tr>
<tr>
<td>Faculty of Science, Department of Zoology,</td>
<td></td>
</tr>
<tr>
<td>University of Sabaragamuwa - Department of Livestock Production</td>
<td></td>
</tr>
<tr>
<td>University of Jaffna - Department of Animals Sc.</td>
<td></td>
</tr>
<tr>
<td>University of Rajarata - Department of Animal Sc.</td>
<td></td>
</tr>
<tr>
<td>University of Jayawardanapura</td>
<td></td>
</tr>
<tr>
<td>Department of zoology, Department of Forestry and Environmental Sc.</td>
<td></td>
</tr>
<tr>
<td>University of Colombo - Faculty of Science, Department of zoology</td>
<td></td>
</tr>
<tr>
<td>University of Kelaniya - Department of zoology</td>
<td></td>
</tr>
<tr>
<td>University of Ruhuna – Dept. of Animals Sc., Faculty of Sc., Dep. of Zoology</td>
<td></td>
</tr>
<tr>
<td>Wayamba University of Sri Lanka - Dep. of Livestock and Avian Sc.</td>
<td></td>
</tr>
<tr>
<td>Open University of Sri Lanka - Faculty of Natural Sciences, Dep. of Zoology</td>
<td></td>
</tr>
<tr>
<td>Postgraduate Institute of Agriculture, Peradeniya</td>
<td></td>
</tr>
<tr>
<td>1. Dept. of Animal Production and Health,</td>
<td>Training and extension</td>
</tr>
<tr>
<td>2. National Livestock Development Board,</td>
<td></td>
</tr>
<tr>
<td>3. Mahaweli Authority of Sri Lanka,</td>
<td></td>
</tr>
<tr>
<td>4. Department of Agriculture</td>
<td></td>
</tr>
<tr>
<td>5. Open University of Sri Lanka</td>
<td></td>
</tr>
<tr>
<td>6. Universities of Peradeniya and Ruhuna</td>
<td></td>
</tr>
<tr>
<td>1. Ministry of Agriculture and Livestock</td>
<td>Policy Development</td>
</tr>
<tr>
<td>2. Ministry of Environment and Natural resources</td>
<td></td>
</tr>
<tr>
<td>1. Non-governmental organizations involve in livestock activities</td>
<td>Training and extension</td>
</tr>
<tr>
<td>such as CARE International, Agromart, “Gami Seva Sevana” etc.</td>
<td></td>
</tr>
<tr>
<td>1. Industrial Development Board</td>
<td>Training and Product Development.</td>
</tr>
</tbody>
</table>