

Country Report

(For FAO State of the World's Animal Genetic Resources Process)

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Part 1

1.1 Japan's geographical conditions and the current status of animal production

Japan is located between longitudes 123° and 149° east and latitudes 24° and 46° north. Situated in East Asia, the country is made up of a group of islands surrounded by the Pacific Ocean to the east and the Japan Sea to the west, extending far longer in the south-north direction than in the east-west direction. It has a natural land area of 378,000 km² occupied by 127 million people (2000) (Figure 1). The climate differs greatly between the southern and northern regions; some regions belong to the subarctic zone while others are subtropical. Due to mountainous regions extending down through central of Honshu, seasonal winds have different influences on the eastern and western seaboard. The regions facing the Pacific Ocean receive a high summer rainfall while regions facing the Sea of Japan have heavy snowfalls in winter (Table 1 and Figure 2).

- **Fauna of Japan (the National Strategy of Japan on Biological Diversity 2002) (Table 2)**

Japan is in a zone (the east coast of the Eurasian Continent) that experiences high rainfall, and the fauna of Japan is characteristic of the Palearctic and the Oriental regions. Forested regions constitute 66% of the entire national land area, a significantly high proportion. Japan has abundant biota despite of its relatively small area for the following reasons:

- it extends across several latitudes in the north-south direction,
- it is made up of numerous islands,
- over millennia it has gone through successive cycles of separation from and connection with the continent, and
- it is located in a monsoon zone.

Mammals: In Japan there are 135 mammal species known including extinct species (241 species if subspecies are included, of which four are extinct and 30 are endangered). With the exception of the Japanese Serow (*Capricornis crispus*), medium to large-sized species included in the World Watch List for Domestic Animal Diversity (WWL-DAD3) such as Shika deer (*Cervus nippon*), Ezo deer (*Cervus hortlorum*), wild boar (*Sus scrofa leucomustax*), the Asiatic black bear (*Ursus tibetanus*), and the brown bear (*Ursus arctos*) have close relatives in neighboring countries, while the majority of small-sized mammals, such as the Large Japanese Field Mouse (*Apodemus speciosus*) and Japanese Dormouse (*Glirulus*

japonicus), commonly seen in Honshu, Shikoku, and Kyushu, are indigenous.

Birds: 538 species (approximately 700 species if subspecies are included, of which 13 are extinct or Extinct in the Wild (EW) and 42 are endangered) including relatives of domesticated bird, Anatidae (47 species), Phasianidae (7 species), Clumbidae (9 species), and Phalacrocoracidae (3 species) are seen in Japan, with more than 60% of these being migratory. Since the Japanese Archipelago is located on the eastern margin of the Eurasian Continent and extends in a north-south direction, the country is an important breeding place or wintering location for birds, as well as being a stopover for migratory birds.

Some exotic avian and mammalian species such as goat (*Capra hircus*), nutria (*Myocastor coypus*), raccoon (*Procyon lotor*), and budgerigar (*Melopsittacus undulates*) escaped and breed in a wild state.

- **Relationship between production systems, agricultural ecosystems, socio-economic conditions and livestock diversity**

Japan can be divided into seven regions by grouping regions that are geographically adjacent to each other (beginning from the north): Hokkaido, Tohoku, Kanto, Chubu, Kinki, Shikoku, Kyushu and Okinawa (Figure 3).

On the other hand, Japan can be divided into agricultural areas that are mainly determined by landform conditions: mountainous agricultural areas, hilly agricultural areas, flatland agricultural areas, and urban agricultural areas (Figure 4). Mountainous-hilly agriculture areas account for approximately 70% of all the agricultural areas and produce 36.6% of agricultural crude production. Animal production is 33.9% for mountainous-hilly areas compared to 23.0% for other areas (Table 3). Areas in which animal production is being most actively engaged are the Hokkaido and Tohoku Districts, southern Kyushu, and the mountainous-hilly areas extending across regional borders.

There is a difference in the scale of animal production and the form of feeding and management among area categories within Japan. It is unlikely that this has a close relation to livestock diversity. The possible reasons for this are: (1) from a historical viewpoint livestock have been raised for their meat for less than 150 years, and their principle use hitherto was as draft animals or pets, and livestock products in the form of food were not incorporated into the traditional agricultural system; (2) Although increasing livestock production and utilizing livestock as food were promoted in the course of modernization and

the mechanization of agriculture, increases in livestock production (to produce more animal products) depended on the introduction of foreign breeds with high productivity, rather than using traditional breeds well-adapted to the region and that had been primarily used for tilling or transport. Since the Meiji era, of the many ways livestock can be used, food production has been the major focus due to mechanization and the introduction of compound fertilizers. As a result, most of the native livestock have lost their original niche. The production systems for major livestock and poultry farming adopted exotic breeds that have high yields in order to satisfy increasing public demand for livestock products, resulting in a sharp rise in production levels. This achievement can be attributed to the following reasons: (1) Since Japan is located between a temperate zone and a subarctic zone, its climatic conditions are generally favorable to breeds developed in the West, where modern animal production developed, and there were few diseases endemic to Japan likely to have an adverse impact on these breeds. (If diseases that posed a risk were present, most can now be prevented by vaccines or treated with pharmaceuticals.); (2) Thanks to high economic growth, demand for the superior quality feed needed for high yielding breeds could be met by imports rather than by relying on domestic production. As a result, the level of self-sufficiency for feed in 2000 on the basis of TDN has declined overall to 26%, with 22% of crude feed and 89% of concentrated feed being imported.

Japanese agriculture is characterized by a concentration on rice cultivation, not only on flatlands but also in mountainous areas from north to south. Cropping takes several forms: single cropping (regions bordering the Sea of Japan); double cropping (regions on the Pacific Ocean side), and second cropping (Kochi, Kyushu and Okinawa). Animals were bred and incorporated into this tradition as beasts of burden until around 1960. After this time, animal production in Japan became established primarily for food production, meaning that new breeds were required and the traditional role for livestock as a burden animal gradually disappeared.

- **Importance of animal production in the Japanese economy**

Agricultural production in Japan is valued at 9.12 trillion yen, 72.3% of which is accounted for by field husbandry. That is to say, 26.9% (2.45 trillion yen) of the value of total production is generated by livestock farming, which exceeds the figure for rice production (25.5%), Japan's major crop (Table 4). If food related industries, which are related to agriculture, are added to the agricultural industry, production amounts to 55.80 trillion yen, accounting for 11% of GDP.

The population of Japan is 127 million, with 47.06 million dwellings. Of these, the farming population totals 13.46 million people with 3.12 million dwellings, while households involved in livestock farming account for 160,000 dwellings. Agricultural households account for 10.6% of the population and 6.6% of all dwellings, while households involved in livestock farming account for 5% of these figures, which is equivalent to 0.7% of the total national figure. In addition, 3.62 million people are engaged in agriculture or food related sales industries (1997), 4.10 million people work in restaurants(1996), and 1.70 million people work for agricultural or food related manufacturers(1996), which in total accounts for approximately 15% of the total labor force(62.8 million people). It is estimated that nearly 25% of the total population are involved in food and agriculture including the people who are directly engaged in agriculture (because of part-time farm households, this may be an overestimate).

Although Japan has a decreasing birth-rate, the population is still increasing due to greater longevity. According to estimates of Japan's future population (2002), the peak will be reached between 2004 and 2009, and then begin to decline. The decrease in the population, the aging of society, and the ongoing decline in the birth-rate will shrink demand for agricultural and livestock products. Those working in the agricultural sector are also aging, making it a matter of priority to secure people who can take responsibility for the agricultural and livestock industries.

1.2 Conservation status of the farm animal diversity

The types of species/breeds (for milk, meat and eggs) and their conservation status (except non-edible species such as dogs and cats)

With the exception of major breed in major species, many animal species and breeds are at risk and can be classified as either 'critical' or 'endangered' according to the FAO criteria. The following describes the current status of diversity for individual species.

- **Diversity among domestic livestock species and breeds**

Major livestock species utilized in Japan includes cattle, pigs, chicken, horse, sheep, and goat. Statistics for animal production cover beef cattle, dairy cattle, pig, chickens for layer and broiler, while statistics for meat distribution cover pig, cattle, horse, sheep and goat. In addition, these statistics list Aigamo (F₁ between duck and mallard), Japanese quail (*Coturnix*

coturnix), duck, turkey, geese, Guinea fowl, and Japanese green pheasant (*Phasianus colchicus versicolor*) as edible birds (Relevant data on breeding chickens and eggs, 2000). “Data related to livestock improvement” covers rabbit, mink (*Mustela vison*), Inobuta (F₁ between pig and wild boar), wild boar (*Sus scrofa leucomystax*), Shika Deer (*Cervus nippon*), Red Deer (*Cervus elephus*), Sambar (*Cervus unicolor*), Fallow Deer (*Cervus dama*), and Formosan Shika Deer (*Cervus taiwanus*).

There are many exotic animal breeds covered in these statistics. As native breeds, in accordance with the FAO definition, the statistics cover Japanese Cattle (Japanese Black, Japanese Brown, Japanese Polled, Japanese Shorthorn); the Berkshire pig (most of these are Kagoshima Black Pig (Berkshire)); Japanese native chickens (Nagoya, Shamo, Hinaidori, Satsumadori), chicken breeds being included in the list of native chicken in accordance with the Japanese Agricultural Standards (JAS) (Rhode Island Red, Barred Plymouth Rock); Japanese Saanen goats; Japanese Corriedale sheep; and Japanese White rabbits (some of these breed are positioned midway between native breed and exotic breed). The names of native breeds other than those mentioned above do not appear in these statistics.

Table 5-1 shows livestock (mammals). The breakdown is: 9 breeds of beef cattle (6 are native breeds), 7 breeds of dairy cow (all are exotic breeds), 12 breeds of pig (3 are native breeds, and one is a wild variety. Kagoshima Black Pig and Berkshire are counted independently), 12 breeds of horse (8 are native), 3 breeds of goat (one was developed in Japan, and 2 are native breeds), 2 breeds of sheep (one was developed in Japan), and one breed of rabbit (native breed) and 5 other species (of these, 5 are deer, one of which is a wild Japanese breed).

Table 5-2 shows poultry (birds) including 38 chicken breeds. Among bird species in Japan, the chicken is represented by the largest number of indigenous breeds. In picture books introducing the Japanese Chicken, especially focusing on chickens kept as pets or for cockfighting, a lot of breeds and variations in plumage within a breed are evident. Because many generations have passed since Barred Plymouth Rock and Rhode Island Red were introduced into Japan, these breeds are categorized as being native under the JAS. In addition to these, 6 avian species are introduced; for ducks, there is one native duck called the Osaka Duck. Although Japanese quail have never undergone breed differentiation, it is the only one species that has been domesticated in Japan.

With regard to birds, there are ducks, Aigamo (F₁ of a duck and a wild duck), turkeys, geese, Guinea Fowl, and Japanese Green Pheasant. The meat industry only exploits 0.24% of the entire bird population, even if quail are included in this figure (an outline of the results of a

survey on edible birds slaughterhouses in 2000). Currently, mammals other than cattle and pigs make a negligible contribution to domestic production. These are thought to be mainly gourmet items rather than daily food.

In addition to these, various species and breeds of livestock and poultry such as Meishia Pig, Jinhua Pig, Black Minorca, Araucana, Fayoumi and ostriches have been introduced into Japan, but apart from major breeds of cattle, pigs and chickens, most of these other breeds have not played an important role in animal production in Japan. Even breeds included in data related to livestock improvement still remain at the stage of tentative introduction and many breeds cannot be said to have established within Japan. In All animal species, except 1-3 major breeds, most breeds have experienced a sharp decline in numbers and the diversity of livestock and poultry is declining as a whole.

The following is the present conservation status of native livestock and poultry breeds in Japan.

Cattle (Table 6): Since the Meiji era, exotic cattle breeds have been introduced and crossbreeding between Japanese cattle and exotic breeds has been promoted in most regions nationwide. As a result, there are only two cattle populations that escaped hybridization with exotic breeds---Mishima Cattle, which have survived in Mishima Island off the coast of Hagi city in Yamaguchi Prefecture and Kuchinoshima Cattle living on Kuchinoshima of the Tokara Islands in Kagoshima Prefecture. Cattle other than the above-mentioned populations were roughly categorized into 4 types depending on the types of exotic cattle introduced into the region; Japanese Black, Japanese Brown, Japanese Shorthorn, and Japanese Polled were developed through crossbreeding. Even within the Japanese Black population, significant variations exist depending on the characteristics of the cattle in the region and the foreign breeds used for crossbreeding. These differences are reflected in the existing 4 breeds (Table 7). Mishima Cattle have been designated as a natural monument, and conserved and maintained by the Mishima Cattle Conservation Group, Hagi city, Yamaguchi Prefecture, and Yamaguchi University. As a result of these efforts, this breed is now increasing in numbers, but is still regarded as being in a 'critical-maintained' state. Bulls not selected to participate in the breeding program are shipped for beef use and F₁ produced using frozen semen is being utilized as cattle that have a high brand value (due to increased fat within muscle). Kuchinoshima Cattle are being raised at farms affiliated with both Kagoshima and Nagoya Universities to counter the risk of extinction. There are about 55 head in Kuchinoshima, and 20 and 24 head at both the universities respectively. In 2000, approximately one-third of the population in Kuchinoshima Island died of a disease transmitted by a mite. This breed is also regarded as being in the 'critical-maintained' state. Among native cattle, Japanese

Polled is in the most dangerous state at present (although the Japanese Polled Public Corporation has been established and is striving to use and conserve the cattle, this breed faces the greatest risk of extinction if differentiation of Japanese Polled beef from imported beef and beef derived from domestic Holstein cannot be achieved).

Pigs: Before Japanese people began to eat pigs nationwide, a native pig called Shima Pig or Aguh existed in Kagoshima and Okinawa. It is well known that this variety had been bred in western regions located westwards from Kansai except for Kagoshima and Okinawa, but it was only after the beginning of the Meiji era (approximately 130 years ago) that the pig began to be commonly used. At present Black Pig (it is thought to be of Berkshire origin) has gained popularity as a special brand product in Kagoshima Prefecture. The population of the popular Black Pig was around 240,000, accounting for nearly 100% of the pigs in Kagoshima Prefecture in 1961. However, under the influence of the introduction of exotic breeds with more desirable characteristics, the figure dropped to 13,000, representing only 1% of the total pig population in the prefecture in 1975. However, consumer demand for Black Pig rose again, and the figure recovered to 327,000 in 2001 (Table 8). In the case of Aguh, almost all native varieties of Aguh disappeared due to ground fighting in Okinawa at the end of the World War II and the donation and introduction of exotic breeds having high reproductive capacity after the war. Given these circumstances, the collection and conservation of a few barely surviving individuals having a shape similar to the native Aguh was carried out. As a result, the population increased to 100, and the F₁ is now being marketed as a brand pig. Ohmini is being preserved by private businesses and the F₁ of Ohmini is being marketed as a laboratory animal.

Chickens: The cutting off of Japan from outside contact in the Edo era (from 17th to the mid-19th century) had a significant impact on the establishment of the Japanese Chicken as birds either for pets or cockfighting. The Japanese Chicken as a chicken for practical use came about under the influence of exotic breeds introduced in the Meiji period. Since the liberalization of imports for breeding chickens in 1960, native chickens for practical use have fallen into a disastrous condition. Some native chickens are now being used to breed brand chickens. However, many of these brand chickens are being bred using special breeding technologies, such as special feeds and housing condition, without using native chickens. Brand chickens using native chickens are referred to as Jidori (Japanese old style native), a name that helps consumers to differentiate this breed from the others on offer. Chickens permitted to use the Jidori label are limited to breeds containing at least 50% of the genes of 41 breeds and native chickens designated by the Japan Chicken Association (Table 9) (38 native breeds according to JAS). The major native chicken breeds contributing in these Jidori production are Rhode Island Red (44.8%), Nagoya (3.8%), Shamo, Hinaidori, Barred

Plymouth Rock, and Satsumadori. These 6 breeds account for 58% of all native breeds and all breeds except Nagoya are used as hybrids. It is estimated that Jidori production has recently exceeded 1% of total edible bird production. The major use of native chickens is for chicken meat production, with egg production playing a more minor role.

Horses (Table 10): After World War II, along with the recovery and growth of the Japanese economy, cultivation and conveyance became mechanized in the agricultural sector. As a result, farm horses that had been actively raised till then and native horses used for conveyance lost their roles, resulting in a corresponding decline in their numbers. In the Tohoku region, which was the largest breeding center from the Edo era to the Showa era, the Nanbukoma existed, but it became extinct over a short period because of interbreeding with exotic breeds for the production of military horses. In regions other than Tohoku, only a few breeds uninfluenced at all by exotic breeds still exist. In spite of this, 8 native groups comprising Hokkaido Horse, Kiso Horse, Noma Horse, Tsushima Horse, Misaki Horse, Tokara Horse, Miyako Horse, and Yonaguni Horse are left and all are protected by conservation groups. Of these, the breeding place of the Misaki Horse has been designated as a natural monument. Seven groups except Hokkaido Horse are in a 'critical' or 'critical-maintained' state.

Goats (Table 11): In Japan, goats were bred to provide a degree of food self-sufficiency during food shortages in the post World War Two period. The population reached 700,000 in 1957, and then began to decline, falling to 28,000 in 1997. The number of Japanese Saanen has been increasing in recent years. As native goats, there are Tokara Goat and Shiba Goat. The Japanese Saanen breed has been produced by crossbreeding between a native goat and a Saanen and by successive crossbreeding with the Saanen. The Shiba Goat is bred as a laboratory animal in universities and research institutes. Its present status is 'endangered-maintained'. With regard to Tokara Goat, 35 purebred individuals exist at Kagoshima University and Hirakawa Zoo. Toshima village, the birthplace of Tokara Goat, have opened a goat farm. However, even here, there are only a few purebred individuals. The present status of Tokara Goat is 'critical-maintained'.

With regard to goat breeding in Japan, a national goat network was organized in 1999, and the network is engaging in activities with the goal of promoting goats, and utilizing goats to produce local special products or health foods.

Quail: Quail are the only indigenous species that have been domesticated in Japan. There are about 7.71 million quail being bred focusing on the use of eggs (2000). Seventy percent of production comes from Aichi Prefecture centering on the area around Toyohashi city.

Although this species has not undergone differentiation into several breeds, improvement is being undertaken at the Poultry Research Institute, Aichi-ken Agricultural Research Center (several tens of mutant strains are being bred as laboratory animals).

- **Systems for conservation of genetic resources**

MAFF gene bank project

Studies and projects focusing on genetic resources, which had hitherto been conducted by each research institute independently, were integrated into the MAFF gene bank project using nationwide networks in 1985, with programs being initiated at this time. With regard to animal genetic resource programs, the National Institute of Animal Industry, which had been focusing on these programs, was replaced by the National Institute of Agrobiological Resources that integrated animal, plant, and microorganisms center banks in 1988. In 1993, the DNA sector, which collects, collates, and provides DNA and the information on DNA necessary for Genome research, started its operations. From 2001, accompanying the conversion of national research institutes into independent administrative institutes (but without any changes in the fundamental frameworks of the programs), the National Institute of Agrobiological Sciences (independent administrative institute) began operating their projects as the main executive body responsible for implementation.

The Agrobiological Genetic Resources Genebank conducts surveys and collects genetic resources domestically and internationally and then classifies and identifies these resources, while at the same time conducting characterization of and taking steps to conserve these resources. In the field of genetic resource research, exchange and cooperation are being actively promoted between Japan and international organizations and research institutes. The International Workshop on Genetic Resources is held each year and looks at issues affecting genetic resources of plants, animals and microorganisms (one genetic resource is discussed each year). With regard to the animal genetic resource field, workshops have been held three times: “Animal Genetic Resources: Efficient Conservation and Effective Use” (1995); “Genetic Diversity and Conservation of Animal Genetic Resources” (1998); and “Present Status and Genetic Variability of Animal Genetic Resources in the Asian Region” (2002).

The conservation of livestock and poultry is practiced at the National Institute of Agrobiological Sciences, the center bank, and independent administrative institutes such

as two institute of the National Agricultural Research Organization, the National Institute of Livestock and Grassland Sciences, and the National Institute of Animal Health, and the National Livestock Breeding Center, as sub-banks. The center bank is involved with cryogenic preservation, mainly focusing on frozen semen. The sub-banks are concentrating more on maintaining live animals of endangered breeds, in combination with cryogenic preservation. Collection and conservation are being carried out focusing on breeds and strains that have been developed in Japan, and approximately 200 accessions including native ones on the verge of extinction have been conserved (Figure 5 and Table 12, 13).

Gene bank projects for Japanese fauna have conserved insects in addition to livestock and poultry. Silkworms in the central bank, and honeybees and stingless bees in the National Institute of Livestock and Grassland Sciences are being conserved respectively. In the National Institute of Agro-Environmental Sciences (independent administrative institute), insects that are natural enemies to harmful farm insects are tested to establish their susceptibility to pesticides and other chemicals, and these insects are then maintained and conserved as living specimens. The results of the gene bank projects have been compiled into genetic resource catalogs, management manuals, trait research manuals, trait research reports (2 volumes for the central bank, and 3 volumes for the Animal Research Center), annual achievement reports, and research reports within Japan and overseas (in 13 volumes). In addition, the records of the MAFF International Workshop on Genetic Resources have been published as a report in English (Table 14).

The budget for animal genetic resource projects amounts to 63.37million yen, and the budget for all the projects including plant and microorganism genetic resources amounts to 905.57 million yen.

Projects for conserving native horses in Japan (Table 10 and 15)

Of native horses, the Misaki Horse from the Toi Cape area has been designated as a natural treasure. A liaison meeting for the project to conserve 8 native horse groups including Misaki Horse hosted by the JEAA has been held every year since 1977. The number of native horses in Japan sharply declined around the 1970s (1,500 around 1975), and then rebounded to level off or increase further, doubling to 3000 in 1991. The Dosanko and Tsushima Horses have dramatically declined in number over the past five years, while the population of other horse groups is leveling off or slightly increasing.

In 1989, Imabari city in Ehime Prefecture opened the Noma Horse Highlands to conserve

the breed, and this third sector facility has become a highlight of sightseeing in Imabari city. Approximately 20,000 people visit these facilities annually to enjoy horse riding or take horse therapy. The number of Noma Horses has increased from 30 at the opening of the facilities to 74 in 2001.

Although facilities, such as those for sightseeing and pastures, appear to be secure for the horse groups increasing at present, it is difficult to increase horse populations beyond a certain level. Since the state of the Japanese economy has also had an impact on the conservation of native horses, any increase in budget allocations for conservation seems unlikely. However, it is expected that increased awareness of horse riding and horse therapy among the general public will ensure that the pony, especially the native pony, will continue to play a useful role.

Natural treasures (Table 16)

Nineteen varieties of livestock and poultry native to Japan have been designated as natural treasure. All of these are chickens except for Mishima Cattle and the Misaki Horse. Of these, only Onagadori in Tosa has been conserved as a special natural treasure.

These chicken breeds (the Misaki Horse and the Kurokashiwa chicken were designated after the World War II) were designated between 1928 and 1943. Conservation measures include ordinary grants (around 1.50 million yen) as a special local allocation taken from tax revenues and given to municipalities affected by the measures, and one-half grants for the preservation programs in which municipalities have been participant (a grant for feed expenses and surveys in Nangoku city and a grant for conservation facilities for Toumaru in Niigata Prefecture). (Gaining a clear picture of the current status of chickens depends on the involvement of municipalities.)

Conservation of livestock and poultry as animals for study (Table 17)

Financial assistance to support measures for strain conservation was provided targeting Hokkaido University (Dosanko), Nagoya University (4 chicken strains), and Hiroshima University (10 strains for MHC chicken research), totaling 3 universities, 2 animal species and 15 strains; a total of approximately 1.75 million yen for 3 universities.

- **Breeding technologies utilized for animal production in Japan**

Artificial insemination, transplantation of fertilized eggs, (*in vivo* fertilized eggs (frozen, fresh), *in vitro* fertilized eggs (frozen, fresh), and cloned cows (fertilized eggs, somatic cells) are being used.

Artificial insemination (Table 18, 19): According to 1998 statistics, the rate of artificial insemination for dairy cows is 99.4%, with frozen semen being used exclusively. For beef cattle the percentage for AI is 97.8%, and again only frozen semen is used in this procedure. Contrast this with pigs, where the corresponding figures are 7.6% and 10.5% respectively. The diffusion of AI and the utilization of frozen semen are both increasing. For horses, the rate of artificial insemination using fresh semen is 4.5%, while artificial insemination is not being employed for goats and sheep for any other purpose except genetic improvement. For chickens, artificial insemination using fresh semen is being conducted for genetic improvement, but no concrete statistics are available.

Transplantation of fertilized eggs (Table 20): For cattle, *in vivo* fertilized egg transplantation was conducted for 52,147 cows in 1999. As a result, 16,433 live offspring were obtained (conception rate is approximately 50%), while *in vitro* fertilized egg transfer was conducted for 9,726 cows and 2,110 living offspring were obtained (conception rate is approximately 35%). Frozen fertilized eggs account for approximately 75% of this. Three-quarters of the transplantations of embryos are being used for beef cattle. The conception rate for fresh egg transplantation is from several to ten percentage points higher than that for frozen egg transplantation. The number of transplantations of fertilized eggs is equivalent to 2.5% of the total number of artificial inseminations in cattle, 2.48 million head (2000). For the Japanese Black, the embryo transfer rate is equivalent to 6.3% of the total number of artificial inseminations, approximately 740,000 head.

For pigs, experimental transplantation of fertilized eggs has been successfully conducted.

Cloned livestock (May, 2002): Although cloning technologies are still in the experimental phase, with regard to cattle, 629 fertilized egg clones have been produced in 40 institutes and 293 somatic cell clones has been produced in 38 institutes; for pigs, 5 clones at one institute; for goats, 2 clones at one institute.

- **Technology applicable to rare livestock and poultry**

Pig's unfertilized egg and sperm microinjection

Live offspring were obtained as follows: After an unfertilized egg was taken from an ovary collected from a slaughtered animal and matured *in vitro*, the head of a sperm was implanted into the ovum and then returned to the uterus. This technique is expected to have applications in not only the propagation of pigs but also of rare livestock.

Formation of chicken PGC (primordial germ cell) and chimera germline

PGC is introduced into a chicken embryo to form a chimera germline, and then artificial insemination is carried out using frozen semen to propagate a pure breed. The production of Kurenkadori, a native breed, has been achieved by introducing the primordial germ cell from a Kurenkadori into a White Leghorn embryo, using artificial insemination of frozen Kurenkadori semen. Up until now, several domestic institutes have carried out this procedure with successful results.

- **State of trait characterization and evaluation (fundamental, production-related, quantitative, molecular genetic assessment)**

For livestock and poultry within Japan, data has been accumulated on fundamental and production-related traits from all the studies ever conducted, while agrobiological genetic resources genebank projects are also promoting trait characterization and evaluation of animal genetic resources held at the genebank. A trait characterization and evaluation manual was prepared for compile databases in 1991 and the manual was revised in 2001. Before the preparation of the 1991 edition, reports on trait research into the animal genetic resources were published using the results of biological research and literature research for genetic resources carried out in the genebank projects. At present, the genebank is promoting the computerization of databases to facilitate more ready access to the results of trait evaluation of animal genetic resources from the homepage of the National Institute of Agrobiological Sciences. Although the trait research items are different from the FAO questionnaires, they have been selected to accommodate the differences existing among a diverse range of animal species (Table 21). The items cover cattle, horses, pigs, sheep, goats, chickens, and rabbits for livestock and poultry; mice, rats and general rodents as laboratory animals; honeybees, silkworms and useful insects such as those that are natural enemies to insect pests.

Trait research items consist of the following:

- Primary trait: A fundamental trait (typically of appearance) that differentiates a species or strain and can be surveyed directly through observation or by simple measurement.
- Secondary trait: A trait that consists of weight, type, and physiological traits that represent important genetic resources. In addition, the items include those requiring sophisticated techniques for analysis such as those required for the analysis of blood groups and chromosomes.
- Tertiary trait: A trait that is related to economic importance including reproductive characteristics.

Furthermore, each trait is sub-classified into essential items and selective items. Essential items cover traits that should be collected and preserved in the current genetic resource projects. Selective traits cover traits that are expected to become important in the future. In beef cattle for example, 28 essential items and 16 selective items (a total of 44 items) are being surveyed. There are 53 items for dairy cattle, 44 items for horses, 56 items for pigs, and 43 items for layer type chickens and 52 items for meat type chickens that are subject to the present survey.

Many of the traits of native breeds too have already been clarified. Currently, native breeds are being utilized for brand meat and egg production. Trait information relating taste, texture, flavor, trace elements, and human health are also important.

In addition, information on the genetic relationships among both improved breeds and native breeds is important if conservation of native breeds is to be effective. Up until now, genetic relationships have been reviewed using molecular information (protein polymorphisms, blood groups, etc.). Systematized studies on native livestock focusing on Asian breeds (including Japanese ones) are being conducted by the Society for Research on Native Livestock centering on the universities, and the results of the studies have been published in the Report of the Society for Research on Native Livestock and other scientific journals. Recent reviews on genetic relationships using mitochondria DNA polymorphisms and other DNA markers are also being promoted, with these reviews being mainly undertaken by national research institutes and universities. It is necessary to accumulate information, such as that on protein polymorphisms, under the joint initiative with FAO. The National Institute of Agrobiological Sciences has developed the microsatellite DNA markers for pigs, chickens, ducks, and dogs that are necessary for the analysis of genetic relationships and the analysis of QTL. This institute is also involved in collaborations with other groups in the joint development of microsatellite DNA markers for quail, Guinea Fowl, aquatic animals, and other animals. Research into genetic relationships is being carried out for Japanese native

breeds of livestock and poultry, such as Mishima cattle and Kuchinoshima feral cattle, utilizing microsatellite DNA and mitochondria DNA.

In addition, it appears promising that the progress of future genome research will lead to the discovery of QTLs related to production traits, which will be applied in actual genetic improvement of domesticated animals. In Japan, genome research is being promoted with the main focus on cattle and pigs, but analyses are also being conducted for chickens and horses. With regard to native livestock and poultry, the first stage of gene mapping and the analysis of QTL has been completed using resource families derived from the Japanese Black at the Animal Genetics Research Institute and Shamo and White Leghorn from Hiroshima University and the National Institute of Agrobiological Sciences.

The Livestock Improvement Association of Japan is conducting DNA tests as part of an investigation into genetic diseases. The following tests are being conducted:

- Five genes of cattle, for dairy cattle, BLAD (Bovine leukocyte adhesion deficiency), CVM (Bovine complex vertebral malformations);
- for beef cattle, B3 (Bovine erythrocyte membrane protein band 3 deficiency), F13 (Factor XIII deficiency), CL16 (Claudin 16 deficiency); and
- one gene of pigs, RYR (Ryanodine receptor).

Moreover, individual identification and parentage tests that have conventionally been conducted using blood groups and protein polymorphisms is shifting after a trial period to tests using microsatellite DNA polymorphisms.

None of the assessments have encountered technological problems. The main issue is where the survey on native livestock should be focused more effectively in order to conserve the diversity of animal genetic resources.

- **Information systems in Japan**

Over recent years, Internet network systems in Japan have been improving rapidly, with personal computers becoming increasingly popular nationwide including use at the general household level. Policies and statistics released by the Japanese government are published as printed material. This includes all kinds of White Papers and national census reports, while the most fundamental information about Japan can be accessed through the Internet. From the homepage of the Bureau of Statistics and the Statistics Center of the Ministry of Public

Management, Home Affairs, Posts and Telecommunications, statistics obtained through the national census (carried out every 5 years), demographic estimates, labor force statistics, the consumer price index, and family budget inquiries can be accessed directly. From the homepage of the Cabinet Office, economic and financial policies, comprehensive technological and scientific policies and other policies, and information on expert committees relating to these policies are provided.

In the Ministry of Agriculture, Forestry, and Fisheries, the Agricultural White Paper based on annual reports to the Diet is published every year and statistics related to agriculture are published. The major statistics related to animal production include; 1) fundamental research on animal production: “Animal production statistics”, 2) preliminary research on animal production: “Feeding trends in dairy cows” “Feeding trends in beef cattle”, “The number of chicks hatched”, 3) research on livestock production: “Statistics for milk and dairy products”, 4) research on meat distribution: “Statistics on livestock product distribution” “Statistics on meat distribution”, 5) statistics on egg distribution: “Statistics on egg distribution”, 6) research on edible bird distribution statistics: “An outline of the results of research into edible birds slaughterhouses”, 7) “Research on production costs for livestock products”. With regard to feed production, “Data related to self-sufficiency in feedstock”, and “Harvesting feed products” are published annually.

In addition, information on agricultural management, food supply and demand, trade, and agriculture-related industries can be obtained from statistics other than animal production statistics. Local agricultural administrations in individual regions make independent reports and prefectures publish numerous reports and statistics, with most of these reports and statistics being made freely available to the public through the Internet. Moreover, the budget, accounting, bills and laws promulgated by the Ministry of Agriculture, Forestry, and Fisheries are also made public from its homepage, and the information can be retrieved freely by anyone.

Public broadcasting (television, and radio) transmits information nationwide. Newspapers also have nationwide delivery systems and there is the Agriculture Newspaper, the Keimeishi Newspaper and agricultural daily and weekly newspapers. There are also several monthly magazines, each of which addresses livestock farming in general, dairy farming, beef cattle, pig breeding, poultry breeding, animal production and processing, and livestock product distribution. For statistics, a monthly magazine (preliminary research reports in MAFF), quarterly and annual statistic reports are published regularly.

The utilization status of personal computers and the Internet in farming households (Nov.

2001) is 53.1% for PCs, and 32.3% for the Internet. Both have sharply increased. The objective of using personal computers in the farming community is 73.5% for agricultural management. By sector, the equivalent figure is 94.1% for beef cattle, and 89.5% for dairy farming. Other animal production sectors are close to the average rate. Most printed information can be downloaded free of charge through the Internet. Consultation through the Internet has also become active.

Independent information from municipalities and agricultural cooperatives is also being provided through various kinds of media.

For consumers, a significant amount of information from consumer organizations, women's organizations, consumer's cooperative societies, and other organizations is being sent through a variety of media. The Ministry of Agriculture, Forestry, and Fisheries is striving to gain an understanding of consumer opinion through various meetings, IAI Center for Food Quality, Labeling and Consumer Services, and the Room for Consumers.

1.3 Livestock utilization status

- **The utilization of breeds by animal species (data related to livestock improvement 2000)**

Beef cattle (Table 22): Seven breeds such as Japanese Black, Japanese Brown, Japanese Polled, Japanese Shorthorn, Angus, Hereford, and Charolais have been included in the statistics for beef. In 1999, the population, excluding cattle for fattening, totaled 669,000, 93% of which are Japanese Black. With regard to other breeds, Japanese Brown constitute 4.8%, Japanese Shorthorn 1.2%, and other breeds constitute less than 1% in total. Cattle being fattened for beef production totaled 1.84 million head. Holstein is also included in the statistics, accounting for 26.4% of the total. Hybrid populations produced from Holstein account for 31.3% and Japanese Black accounts for 39.8%, with these three breeds accounting for 97.5% of the total.

Dairy cattle (Table 23): Seven comprising Holstein, British Friesian, Jersey, Guernsey, Ayrshire, Brown Swiss, and Red Danish, have been included in the statistics. In 1999, Holstein totaled 1.73 million head, accounting for almost 100%, while the second most common breed was Jersey with only 9,202 head, and breeds other than Holstein totaled 10,287 head, accounting for less than 1%. Breeds other than Holstein are mainly bred at recreational farms or dairy farms where cheese, yogurt, and other dairy products are produced

and sold on the premises.

Pigs (Table 24): Pig production in Japan is characterized by the high popularity of the Kagoshima Black Pig. In addition to this breed, there are hybrids from triple crossbreeding Large White, Landrace, and Duroc, and hybrids from triple crossbreeding Large White, Landrace, Berkshire (in place of Duroc), or commercial pigs, which have been produced utilizing pigs imported from foreign breeding companies.

Eight breeds comprising Middle White, Berkshire, Landrace, Large White, Hampshire, Duroc, Spot, and Chester White have been included in the statistics. In 1999, Duroc, which is used as a terminal sire in a triple cross, accounted for by far the highest percentage at 52.9% of the total of 77,000 breeding boars; Berkshire, Landrace, Large White accounted for 6.1%, 5.3%, and 6.6% respectively. Other than these breeds, exotic hybrid pigs and crossbreds for triple cross account for 13.9%, and 13.4% respectively, making up more than 99% of the pigs in this category. On the other hand, of the total 886,000 breeding sows, Berkshire, Landrace, and Large White account for, 3.7%, 4.2%, and 3.1% respectively, with Duroc at 1.8%. Exotic hybrid pigs and crossbreds for triple cross account for 14.0% and 72.5% respectively. Purely bred female account for only 13.5% of the total. Pigs used for meat production total 5.97 million, only 6.6% of which are used as pure breeds. Berkshire at 2.8%, Duroc at 1.3%, Landrace at 1.1%, and Large White at 0.8% are used for this purpose. Berkshire, which is extremely popular in Japan under the name Black Pig, accounts for about 50%. Kagoshima Black Pig accounts for only 2% (327,000 animals) of the annual total number of slaughtered pigs (16 million, FY 2001).

Chickens (Table 25): For chicken production, meat production using broilers produced from imported exotic breeding chickens accounts for 89.4%. Adding waste chickens (9.0%) to this figure takes the percentage to 98.4% (meat production using other native breeds and other poultry breeds accounts for 1.6%). For eggs, White Leghorn and other laying breeding chicken breeds account for 7.21 million fowls, while native chickens and other breeding chickens for meat and eggs account for 340,000 fowls in total (probably used mainly for meat). These exotic breeding chicken breeds produce more than 95% of the eggs sold annually across the country. The statistics reveal that by examining the number of breeding chickens by breed, chickens can be classified into 12 breeds comprising White Leghorn (1.14 million fowls), Barred Plymouth Rock (104,000 fowls), Rhode Island Red (267,000 fowls), New Hampshire (589 fowls), Nagoya (40,000 fowls), White Plymouth Rock (963,000 fowls), White Cornish (181,000 fowls), Shamo (8,000 fowls), Hinaidori (3,000 fowls), Satsumadori (305 fowls), other laying breeds (2.60 million fowls), and breeds for meat production (7.40 million fowls), with a total of 12.62 million fowls counted in 662 facilities.

Horses (Table 26): The major purposes of horse production in Japan are horse racing (light horse, “*Banei*”*), horse riding and meat production. In Japan, 27,500 horses are being bred annually. For these purposes, light horses such as Thoroughbred and Arab, heavy horses such as Percheron and Breton, and crossbred horses are mainly utilized. There are 12,200 horses for riding use (1999), 2,600 native horses (2000), 9,200 light horses registered as thoroughbreds (2000), and 19,000 horses slaughtered (1999). For meat production, 3,700 horses were imported (1999, the volume fluctuates depending on the year). The consumption of horsemeat is declining as is clear from the imported volume of 27,800 tons in 1999, significantly reduced from the 1979 figure of 103,000 tons. Due to an upward trend in domestic production, the level of self-sufficiency has increased from 4.2% in 1979 to over 25% in 1997 (*a horse race unique to Japan where horses compete to be the first to reach the finish line while pulling a sleigh with a weight of 500 kg -1 ton).

For horses other than the 8,299 Thoroughbreds and 684 Arabs used for horse riding, according to the classification of horses for fattening and the other types, Percheron (1,594 head), Breton (1,115 head), other farm horses (1,978 head), light horses (1,939 head), and other horses (1,522 horses), a total of 8,138 horses, are being bred. There are 12,189 riding horses being bred in 833 facilities in Japan, and 1.47 million people are utilizing them.

Goats (Table 27): Only Japanese Saanen has been included in the statistics. This breed accounts for 30.4% of the total 14,000 goats. Most of them seem to be crossbred goats.

Sheep (Table 28): Japanese Corriedale and Suffolk have been included in the statistics. Suffolk account for 81.1%, and Japanese Corriedale account for 15.0% of the total 11,000 sheep. The Japan Sheep Association has registered several sheep and goat breeds; for sheep, Japanese Corriedale, Suffolk, Southdown, Romney Marsh, Border Leicester, and for goats, Japanese Saanen. Although the number of sheep totaled 945,000 head in 1957, it declined sharply because of the liberalization of imports for sheep meat (1959) and wool (1961), along with the proliferation of synthetic fibers, down to 11,000 head in 2000. No native sheep has ever existed in Japan. Sheep were imported after the Meiji era to produce meat and wool. In the early period, Corriedale was the main breed for wool production but in recent years, Suffolk is the main breed being utilized for meat production.

Other medium to small-sized animal resources (Table 29, 30): The breakdown is 305,541 ducks and Aigamo; 3,193 turkeys; 7.28 million Japanese quail; 1,527 geese; 24,000 Helmet Guinea Fowl; 111,000 Japanese Green Pheasants; 6,074 rabbits (for fur and for meat; 34,231 mink; 2,183 Inobuta; 6,383 wild boars; and a group of 4,948 deer (1,946 Japanese Deer; 808

Red Deer; 5 Chinese Water Deer; 251 Fallow Deer; 428 Formosan Sika Deer; and 1,510 other deer).

Farm animals for the use as laboratory animals (Table 31): There are 83,000 rabbits, 63 miniature pigs, 74 pigs and 706 goats.

• **1.4 The primary vision for conservation and utilization of livestock and important related fields**

Currently, domestic animal genetic resources for use are clearly divided into the major livestock and poultry species and/or breeds important for the production of livestock products and others. Native breeds (which were established before the Second World War) are not included in the major livestock breeds except for the Japanese Black.

Native livestock and poultry have been used for the production of brand meat and eggs. Kagoshima Black Pig and some breeds of Japanese Chicken including, Nagoya, Shamo, Hinaidori, Tosa Jidori, and Gifu Jidori, are being utilized for the production of brand meat and eggs. Although some brand chickens have not been established and disappeared, the native breeds occupying the top ranks have a low risk of extinction at this time provided their popularity can be maintained and populations are not invaded by infectious diseases.

Except for breeds used for the production of Jidori, native chicken breeds are being conserved on a small scale by people who are native chicken enthusiasts. The fact is that it is difficult to gain a clear picture of the actual status of these breeds.

Most native livestock other than chickens are also in locations other than production worksites, and are mainly being conserved by conservation groups and native chicken enthusiasts. In Japan today, the chicken breeds that exist most abundantly along with other native livestock have gained little recognition for the contribution they make to the maintenance of Japan's natural landscape and environment. They have not acquired the position emphasized by FAO that domesticated plants and animals are as an important contributor to biological diversity.

Part 2.

2.1 Recent trends in livestock production

- **Establishment of Japanese-style animal production**

As already mentioned, in the conventional Japanese agricultural system, livestock were mainly used as draft animals and it was only after these animals had outlived their usefulness or were surplus to requirements that they would be used as food. It was the animal production industry that responded to this situation. Since Japanese agriculture focused on paddy field rice farming, livestock were used almost exclusively as draft animals, and the Japanese animal production industry was regarded as an industry not based on land but was rather tending to adopt intensive feeding systems based mainly on imported feed. For these reasons, even though animal production for food has been part of the agricultural scene since the Meiji era, and production has sharply increased, the industry has not been a limiting factor on agricultural production in general or on horticulture centering on rice cropping, the mainstream of Japan's agriculture (Mizuma, 2001). The feed bond system (a system where no tariff is imposed on imported grains for feed) introduced in 1928 and the factory approval system introduced in 1963 encouraged the animal production industry to depend on imported feed. As a result, the production of pigs and chickens that do not need a large land area for breeding has dramatically increased.

The Law for Improvement and Increased Production of Livestock enacted in 1950 is a law that stipulates conditions for securing breeding livestock relating to registration, artificial insemination, and other items in an attempt to promote the animal production industry. The law stipulated that the government was required to establish the goal of improving and propagating livestock, stating, "The minister of Agriculture, Forestry, and Fisheries shall set specific goals by species concerning the improvement and propagation of livestock including cattle, horses, sheep, goats, pigs, and other livestock stipulated according to ordinances, and publicize each goal". In addition, the enforcement ordinance stated, "The goals shall be formulated for each period as set forth by the minister of Agriculture, Forestry, and Fisheries (within 5 years), for the next 10 years". In the first plan formulated in 1962 for accomplishment by 1971, in the case of pigs, the only targeted breeds were Yorkshire and Berkshire. In the seventh plan to be realized by 2010, Berkshire, Landrace, Large White, and Duroc were targeted. The two breeds common to the second and seventh plans are Landrace and Berkshire. Regarding the goal for weight increase per day set in the second plan, this is from 640g to 850g for Landrace, and from 570g to 750g for Berkshire. As part of the sixth plan (1996), the goal of using new technologies including DNA analysis has been

described. Holstein and Jersey have been included from among dairy cows, and their target volumes for milk are 4,800kg and 3,300kg in 1985, and 8,800kg and 6,500kg in 2010, respectively (Table 32).

The law concerning Dairy and Beef Production (1954) was enacted with the objective of promoting the sound development of dairy and beef cattle production and the stability of agricultural management, along with contributing to the stable supply of milk, dairy products, and beef. The law stipulates “The minister of Agriculture, Forestry, and Fisheries shall set fundamental guidelines to promote the modernization of dairy and beef cattle production according to ordinances”. In 2000, fundamental guidelines for development up until 2010 were established.

In addition, Chapter 1, Article 2, Item (3) of the Agricultural Basic Law enacted in 1961 states “Endeavors shall be made to expand the scale of agricultural management, and to address grouping of agricultural land, introduction of livestock, mechanization and rationalization of farmland holding and modernization of agricultural management”.

In the animal production industry, along with a decline in the need for draft animals due to mechanization, the era in which each farming household fed a small number of draft animal has ended. With the rapid growth of the Japanese economy, the need for animal products has increased. Accordingly, in compliance with the laws mentioned above and policies based on these laws, the continuing expansion of the industry based on financing systems and specialization has been promoted (Table 33). Most of the ex-farmhouse animal production based on small and medium sized livestock operations has disappeared. This is now carried on by only a small number of people and constitutes a minor part of animal production systems as they now exist in Japan, having little impact on overall production statistics.

- **Change in meat distribution**

The changes in meat distribution can be characterized in the following ways: due to an increase in the share taken by supermarkets and other merchandisers at the retailing stage and the increase of purchasing in the food service industry, the form of furnishing meat supplies has shifted from whole meat to processed and packed meat. The setting of transaction prices has also shifted from daily trading prices to long-term trading prices. In addition, the lower price that has resulted from the import liberalization of beef in 1991 has given rise to the phenomenon where the value of sales has decreased in spite of an increase in sales volumes. To address this phenomenon, there is now a clear trend to secure sales and profits through product differentiation rather than simply through low-priced products. Differentiated

products may be found under such catchphrases as “domestic products and delicious brand meat” and “safe meat whose place of production and breeding method can be identified”, although some mass merchandisers are still promoting the sale of low-priced products.

With the entry of mass merchandisers into the industry, the number of retailers declined by 35% between 1988 and 1994. Regarding the purchase of household meat supplies, there has been a significant shift from specialty retailers to supermarkets. Resulting from beef import liberalization, the commission sale of imported beef from the Agriculture and Livestock Industries Corporation has disappeared, while distribution outside the market by meat processing manufacturers, meat wholesalers, and imported trading companies (but not through meat wholesaler markets) has been expanded. In responding to this, distributors have had to provide a wide selection of products to meet consumers’ needs, especially for high-volume customers. In order to meet these demands, the following is required: meat treatment facilities with processing functions capable of adaptation to a variety of breeds and qualities; cold storage preservation that allows a prompt response to orders; and distribution for a variety of breeds within the specified time. In addition, due to increased term transactions, the capability to collect and analyze information in order to cover the risk of fluctuations in market prices is required (Abe 1999).

On the other hand, there is a movement between consumers and producers to deal directly with each other, with fresh meat being the key word (Farm Fresh movement), however, this trend is not yet so widespread.

- **Recent change in Japan’s livestock breeds and the rate of self-sufficiency (Table 22, 23, 24, 52, 34)**

This section deals with cattle, pigs, and chickens that account for the majority of current livestock production.

The average number of beef cattle being fed per farmhouse was 1.2 head in 1960, and this steadily increased, reaching 25.5 head in 2001. On the other hand, the number of households raising cattle has declined from 2.03 million to 110,000. The total number of cattle was at its peak in 1994 at 2.97 million head, with this number declining to 2.80 million head. Among cattle, beef breeds constitute approximately 60%, and the number of beef cattle as a proportion of the total cattle population has been decreasing from the 1970s. Import liberalization of beef started in 1991. The Japanese livestock industry is responding to import liberalization by taking measures to produce beef of higher meat quality than imported beef and that is suited to Japanese taste. As a result, the proportion of Japanese

Black among beef breeds, which accounted for approximately 85% from around 1970 to 1991, rose to 93% in 1999, resulting in the sharp decrease in cattle of other breeds to 50% or even lower. In 2000, beef production amounted to 3.64 million tons and of which derived from beef breeds accounted for 1.67 million tons, with national self-sufficiency for beef being 33.5%.

With regard to dairy cattle, Holstein is the dominant breed. The average milk yield has doubled from 4,250kg in 1965 to 8,794kg in 2000. The content of milk constituents has also steadily increased. The volume of concentrated feed given has increased 1.7 times (milk yield increased by 1.5 times during this period) from 1,889kg in 1975 to 3,205kg. This indicates that the rise in milk yield has largely depended not only on the genetic improvements leading to higher milk producing ability but also on the provision of concentrated feed that enables cows to realize their full productive potential. Native cattle breeds have not contributed to milk production at all, even though Japanese beef cattle breeds have been taken into consideration. Milk production amounted to 8.41 million tons in 2000, with the imported volume in the form of dairy products amounting to 4.00 million tons on a raw milk basis, 70% of which is cheese.

Milk consumption in Japan is characterized by the high rate of milk used for drinking. The use of liquid milk was formerly 40kg per capita, but the figure decreased to 38.6kg in 1999. Although milk for dairy products is tending to increase, the use of milk, especially the use of dairy products, is one-fourth to one-tenth of the corresponding figures for the EU or the USA. Among dairy products, the use of cream and cheese has soared; 28,855 tons of cheese was consumed in 1996, 84,058 tons in 1990 and 124,805 tons in 2000 (including processed cheese that is produced from imported natural cheese); cream has increased from 25,849 tons in 1985, 44,718 tons in 1990 and to 78,226 tons in 2000.

With regard to pigs, keeping pace with the postwar Japanese economic recovery, pig breeding has expanded, with an increase in the number of farming households up to 1.02 million in 1962 with a total of 4.03 million pigs (3.9 pigs per household). After this, the pig industry was also caught up in import liberalization (chicken meat in 1962 and pork in 1971) and international competition, and the industry has consequently had to strive to improve productivity by expanding the scale of operations just in order to survive. As a result, the number of pigs per household has increased 246 times (up to 961 per household between 1962 and 2002). Farming households with more than 1,000 pigs account for 21.3% of the total number of households and are breeding 70% of the population. Consumption of pork produced in Japan (parts) is currently 8.78 million tons and consumption of the imported pork amounts to 6.51 million tons, with a 57.4% rate of self-sufficiency.

Till around 1970, Middle White had been the breed most utilized, but was displaced from the top rank by the sharp increase in the utilization of the Landrace breed around 1975. Hampshire also increased from around 1975 (used as a terminal sire in triple-crossed hybrids), but due to an increase in the popularity and number of Duroc in the 1980s, the number of Hampshire has decreased since then. The Large White breed accounted for more than 10% of the total from 1970 to around 1990 and from that time the percentage has ranged from 5 to 10%. In 2000, Duroc reached 70%, while Berkshire, Landrace, and the Large White breeds have accounted for 3.5 to 4.5% of the pig population.

For breeding sows, Middle White began to be replaced by Landrace, and Large White around 1970 and the trend has continued up until now. Currently, the rate of hybrid breeding female pig accounts for more than 70% because pork pigs are mostly produced through three-way crossing. Imported hybrid pigs account for approximately 14% for both breeding male and female pigs. Strain development by closed herd breeding system for Large White, Landrace, Duroc and Berkshire breeds has been conducted in prefectures, agricultural cooperatives and other sectors. This has resulted in the certification of 62 strains so far; 39 strains have been maintained up until now. New strains, more than 10 strains are still being developed. The strains of pigs established in these projects are being provided to pig breeding households within Japan by public organizations and agricultural cooperatives.

For chickens, import liberalization of breeding chicks for broilers in 1960 had a significant impact on poultry industry in Japan. In 1966, the volume of broiler meat exceeded that of culled chicken meat, the major meat up until then. At the same time, for laying chickens, chickens derived from imported chicken breeds began to exceed 50%. At present, approximately 80% (approximately 21% for layer and 59% for broiler) of all breeding chicken are derived from imported. Poultry industry is being conducted by trading companies and food and fisheries companies on a large scale. Among edible chicken, 89% are broilers, 9% are culled chickens, and others are 1.3%. Although breakdowns concerning the origin of eggs do not exist, it is estimated that eggs from laying chickens derived from White Leghorn and imported chickens account for nearly 95%, while in the numbers of breeding chickens, White Leghorn and the other laying breeds account for 30%, and breeding chickens of dual purpose breeds for egg and meat account for only 2.5%. Production of chickens and eggs in Japan and the self-sufficiency rate (2000) amount to 1.19 million tons (67.6%) and 2.54 million tons (95.5%) respectively.

- **Sharing the benefits between farmers and consumers**

Although the growth in livestock production in Japan was interrupted and hindered by World

War II, production rapidly increased in the period of Japan's postwar economic recovery. The driving forces are the introduction of high-yielding breeds, improvements within Japan, and the development of a form of animal production characterized by the supply of large amounts of concentrated feed supported by importation. It is clear that the increase in the consumption of livestock products has made a significant contribution to the expansion of the average lifespan and the improvement of physique of Japanese people. It is also clear that the relatively modest increase in the cost of livestock products in relation to the growth of the gross national product has led to the enhanced consumption of livestock products.

On the other hand, the number of farming households including animal production households dramatically declined from 5.34 million households in 1970 to 2.34 million households in 2000, and the total income for agricultural production for the entire country has been tending to decline from around 1994. However, looking at the ratio of income to the GNP, farming household income has not fluctuated to any great extent for these 20 years, ranging 0.9-1.43 given that income in 1970 is 1 (Table 35). In response to the need for labor in industries outside agriculture, there has been a population flow to urban areas from rural areas, resulting in a decline in the rural population and the number of farming households. This has been underlined by the sharp rise in GNP that accompanied the trend toward urbanization. There are two reasons why it was possible for farming household incomes to be maintained at the ratio to GDP stated above. The first is improved production efficiency arising from the expanded scale of farming introduced as a countermeasure to the import liberalization of agricultural products. The second is the large-scale production practiced by farm households promoted by the government. However, it is clear that these measures have had the effect of lowering the food self-sufficiency rate despite increases in the efficiency of domestic agriculture.

In the animal production industry, the active workforce and the number of farming households have decreased, but it has still been possible to successfully expand production even though there is a smaller labor force. Production levels have been maintained, although there has been a slight tendency toward a decrease. This achievement has been made possible by initiatives taken in feeding management and genetic improvements, supported by improvements and propagation goals (cheap imported feed has contributed to this).

- **Relationship to biodiversity**

In Japan, pasture-based animal production is being conducted in Hokkaido and a part of the Tohoku region, while animal production in other regions is not generally based on pastoral farming. Therefore, the destruction of vegetation (the environment) directly caused by livestock has not become a great problem except in some islands where goats have reverted to

the wild. The adverse effect of livestock wastes (excretions) on the environment is a concern due to the increased environmental load this imposes. To avoid this, measures such as proper management of animal wastes from livestock and other living things and their effective utilization are being promoted.

2.2 Analyzing future demands and trends

The consumption of livestock products in Japan has increased eight times, from 3.4kg in 1960 to 28.2kg in 2000. Compared to 1970, there has been a 2.5-fold increase. Although this figure is one-third that of the USA and a half that of EU countries, Japanese people also consume around 35kg of fish and shellfish, 4-10 times the consumption of seafood in western countries. Therefore, the ingestion of animal foods compares favorably with developed western countries. In terms of the demand for livestock products, dairy products such as cheese are expected to increase, but raw milk, meat and eggs are unlikely to increase due to a leveling off or downward trend in the population. However, in terms of quality and in response consumer needs, there are increasing efforts to expand production and consumption through product differentiation. The trend among consumers is to purchase fresh, safe, delicious and healthy livestock products rather than just focusing on the price. Accordingly, livestock producers are endeavoring to meet consumers' needs by developing brand livestock and products.

Brand products are being produced from beef, pork, chicken and eggs, with 141, 178, 158 and 636 brands known respectively. Most of the branded pork, chicken and egg products are being produced from the same breeds as products being distributed through general markets. However, most of these have been differentiated with added value based on special feed, additives or different breeding methods. There are a few brands that use native breeds as a point of difference. Native breeds such as Mishima Cattle, Kagoshima Berkshire, Agoh, Hinaidori, Tosa Jidori, Nagoya, Gifu Jidori and Shamo are being utilized to produce brand products, a situation which is greatly contributing to the conservation of these breeds at the present time.

Uses for other than food production (fur, draft animal, property) are or will be of little importance.

Recently in Japan, there have been a series of scandals where a lot of imported beef, pork, and chicken have been disguised as domestic meat or domestic brand meat, or domestic dairy cattle's meat or hybrid meat has been passed off as Japanese Black's meat. These incidents have lowered consumer confidence in livestock products. It is necessary set up systems that

ensure 'traceability', i.e., the ability to trace the origin of products from the livestock production stage to distribution. For pigs, the way Black Pig is to be labeled has been defined and methods for differentiating products even after processed have been developed using DNA.

2.3 New trends and issues

- **Environmental issues**

As feed for livestock, crude feed including 2.35 million tons of hay, rice straw, hay cubes, and other roughages was imported in 1998, and 19.09 million tons of raw materials for concentrated feed, mainly grains, were imported. In 1960, raw materials for human food were more than double those for livestock. After this, raw materials for food have risen by 1.8 times but raw materials for animal feed have increased by 3.6 times, coming close to the imported volume of materials for human food. Such imported feed is excreted as feces and urine by livestock, most of which is then applied to farmland. The average level of the nitrogen load returned to field crop production within Japan is high at 151kg/ha. Although this average value itself is high, it is not evenly distributed across all prefectures and there are 2 prefectures where the value exceeds 300kg/ha, and 3 prefectures where the value is 250-300kg/ha. The value for Hokkaido as a whole is 100kg/ha but there are some areas where it is 300kg/ha. These areas have already reached an extremely high level compared to the standard of 170kg/ha that is to be implemented by the EU in December 2002. In 1992, the volume of nitrogen acceptable for field crop production within Japan was estimated to be 713,000 tons at the maximum. Estimated nitrogen contained in excretions that year was 803,000 tons, a barely acceptable value, taking the loss caused by the emission of ammonia and other substances into consideration. In 1998, however, the volume of nitrogen amounted to 743,000. This appears to have exceeded the acceptance capacity in spite of an expected loss, arising from an estimated 15% (approx.) decrease in nitrogen levels due to decline in areas under cultivation (Nishio 2002). Points to be noted in relation to the return of animal wastes to farmland are 1) lowered acceptance capacity due to a decrease in cultivated areas; 2) inability to obtain accurate figures on the volume of wastes returned to crop fields; 3) accumulation of wastes on fields and digging; 4) no restrictions on the application of manure and other things; and 5) application of wastes exceeding the acceptable levels for vegetable, flowers and fruit trees.

- **Stock feed self-sufficiency rate (Table 36)**

The stock feed self-sufficiency rate in 1998 was 22% in N terms and 25.1% on a TDN basis. If limited to concentrated feed, feed produced within Japan provides only 10% (2.00 million tons) of the total demand of 20 million tons. Approximately half of the 33.71 million tons of

grain consumed (including human use) is for domestic livestock. This is one of the factors contributing to the reduction in the level of self-sufficiency for agricultural products used as food.

One problem caused by the decline in the stock feed self-sufficiency rate is the reduction in the size of farm fields where feed (mainly crude feed) has always been produced, resulting in a decrease in the acceptance capacity for returned livestock wastes. This is not only a problem for feed production. The area under cultivation for other products has also been declining. Although not all rice paddies have been left fallow, more than 35% of rice paddies are subject to reduced cultivation arising from production adjustments for this crop.

2.4 Outline of future national policies

The Basic Law on Food, Agriculture, and Rural Areas was enacted in 1999, based on the changes in the situation regarding food, agriculture, and farming villages in Japan since the enactment of the Agricultural Basic Law in 1961. This law aims at responding to a marked decline in food self-sufficiency, the rise in the age of persons engaged in agriculture, and the decline in the vigor of farming villages due to a decrease in the total agricultural land area during this period. In accordance with the Basic Law, the Basic Plan for Food, Agriculture, and Rural Areas in 2000 was established. The fundamental pillar of this law is to take measures to ensure the stable supply of food including “the improvement of food self-sufficiency”, “sustainable development” and “response to emergencies”. Japan’s food self-sufficiency (1999) has declined to 41% in terms of supplied calories and 28% for grains. The Plan sets up production goals that take into consideration the nutrient balance of food to increase self-sufficiency to more than 50% in terms of supplied calories, in addition to ensuring a basic food supply. The plan promotes the maintenance and development of natural recycling functions to aid sustainable agricultural development, and also promotes effective integration of animal production and crop cultivation in harmony with the environment. Goals for 2010 are 9.93 million tons of raw milk, 630,000 tons of beef, 1.35 million tons of pork, 1.25 million tons of chicken meat, 2.47 million tons of egg (production in 1998 was 8.55 million, 530,000, 1.29 million, 1.21 million tons, 2.53 million tons respectively). The Plan promotes the proper use of compost and pesticides, the proper management and effective utilization of livestock wastes, and other things. In addition, the Basic Plan indicates directions for research and technological development over the next 10 years (Table 37).

In line with the Basic Plan, detailed plans and goals have been provided in “The guidelines for promoting the modernization of dairy farms and beef cattle production”, “Goals for the

improvement and propagation of livestock”, “Goals for the improvement and propagation of poultry” and “Plans for promoting a boost in feed production”. In addition, “reports of the feed chicken issue symposium” and “reports of the feed pig issue symposium” have also been made public. Along with the Basic Law, the “Law concerning appropriate management and the promotion of use of livestock excretion” became effect in November, 1999. Budgets for these policies and laws have been developed and programs aiming at the achievement of such goals are being implemented. Furthermore, manuals for emergencies are being publicly released in 2002.

Increasing domestic agricultural production and becoming more self-sufficient in animal feed are important issues in promoting the enhancement of food self-sufficiency and, in 2000, “plans for the promotion of increasing feed” were released. For the 2010 harvest, the Basic Plan set the goal of 5.08 million tons (TDN) (4,461kg/10a for a single-year harvest), with cultivated areas totaling 1.10 million ha. Promotion policies include 1) promoting the consolidation of land used by animal production households and a shift to apartment complex living; 2) the utilization of cultivated land such as a rice paddy and cooperation with crop farming households ; 3) the strengthening of the feed infrastructure in mountainous-hilly; 4) the steady promotion of grassland improvement; 5) promoting the dissemination of high quality grass breed and plant species, and the establishment of technologies at a high level; 6) promoting the systematization and outsourcing of feed production; 7) the promotion of Japanese-type pasture practices and introduction of public pastures; 8) promoting the use of every available local resource for animal production; and 9) dissemination and awareness of types of livestock products derived from animals that were fed much roughage. The figure of 5.08 million tons is equivalent to an increase of about 30% over the average current feed production level, and exceeds the peak of 4.48 million tons achieved in 1990. Through all of these means, the goal is to enhance the animal feed self-sufficiency rate by 2%, from 25% to 27%.

In 1999, the “Law concerning appropriate management and the promotion of use of livestock excretion” was enacted. The purpose of the law is the proper management and use of livestock wastes. Although wastes have been utilized effectively for crop production as a source of fertilizer, the rapid expansion of the scale of animal production and the reduction in the farming labor force caused by an aging rural population have created difficulties in using animal wastes as a resource. Since the transfer to a resource-recycling society is desired, it is necessary to manage animal wastes properly and promote their use as an effective agricultural resource. The law was therefore enacted so measures could be taken to promote appropriate management of livestock wastes and support measures whereby such wastes can be used to develop annual production. This law includes measures for storage facilities,

management standards for treatment facilities, measures for guidance, advice, recommendations, and orders by local governments, measures to promote consumption, formulation of fundamental guidance by the government, formulation of plans by prefectures, and financial assistance measures. Management standards are not applied to small animal production households (less than 10 cattle, 100 pigs, 2,000 chickens and 10 horses). Five-year interim measures have been established.

The “livestock individual identification system” started full operation from FY 2002. This system is able to provide both producers and consumers with a variety of information on individual animal. Underlying the falsification of livestock products are problems associated with Japan’s distribution system. In distribution, meat cannot be monitored directly at the distribution stage, making it difficult to detect falsified products. In order to prevent such incidents from occurring, it is necessary to create a system that makes it possible to trace products from the production stage for fresh food before processing right through to final consumption. This system ensures that individual identification and traceability of products is possible, a controversial topic in light of the BSE problem. The 2002 budget allocation for BSE is 206.5 billion yen including existing systems.

- **Domestic cooperation and cooperation with neighboring nations**

In order to conserve animal genetic resources in Asian regions, the “Conservation and utilization of animal genetic resources in Asia-Pacific regions” project was implemented (with Japanese financial assistance) as a four-year-plan from December 1993, targeting 12 Asian nations (Bhutan, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Pakistan, the Philippines, Thailand, Vietnam). The project activities comprised 1) assessment of the current status of breeds and populations of individual livestock species; 2) preparation of plans to conserve and increase the productivity of indigenous livestock and poultry breeds; 3) implementation of programs to train experts of each government; 4) publication and dissemination of the results of the projects; and 5) establishment of regional networks. The FAO Regional Office for Asia and the Pacific in Bangkok in Thailand acted as the base for this project was responsible for overall implementation. Japanese experts were also dispatched from December 1993 to June 1995 and in March 1996 interim assessments were conducted in Bangkok, which included Japanese experts. Dispatch of experts, reception of trainees and the supply of equipment and materials were conducted through the Japan International Cooperation Agency (JICA).

According to a research reports on Asian region conducted by the Society for Research on Native Livestock, it is clear that livestock breeds native to Japan are genetically positioned in the Asian cluster and introduced into Japan through the islands that extend northwards from

Taiwan or by way of the Korean Peninsula. Currently, the exchange of animal genetic resources between Japan and Asian countries is not being actively pursued for the following two reasons: 1) There are not many livestock with high productivity and favorable characteristics suited to Japanese conditions or possessing desirable features that are currently absent from Japanese livestock; and 2) Even though some breeds have attractive qualities for both countries, they cannot be taken out of their native countries in consideration of the national interest. This hurdle may become higher in the future.

In addition to these, there is Foot-and-Mouth disease and other diseases, which pose great problems in terms of the prevention of infectious diseases, and as a result genetic resources are not being actively exchanged.

The future exchange of genetic resources will aim at not the introduction of entire breeds but the effective introduction of a specific trait from one breed (gene) into a breed already having high productivity. Examples already known include the fecundity of the Meishia Pig and the trypanosoma-tolerance of N'Dama Cattle. In addition, due to diversification in distribution, it is necessary to secure a range of materials to meet the many and varied needs of consumers. Accordingly, Tokyo Metropolitan Livestock Experiment Station has developed a synthetic strain named "Tokyo X", from crossing three breeds Berkshire, Duroc, and Peking Black Pig. As mentioned before, hundreds of brand animal products already exist and differentiation needs to be expanded still more, provided that significant quantities of product can be obtained using high yielding livestock.

There are many native chickens in Japan. By crossbreeding, more than fifty brand chickens have already been produced. The total production in 2000 increased by 60% compared with that in 1995. Based on the Law Concerning Standardization And Proper Labeling Of Agricultural And Forestry Products (JAS Law), the Japanese Agricultural Standard (specific JAS) was enacted in 1999, and this standard officially defines production methods of 'Jidori' brand. Japan depends mostly on breeding chickens from overseas, so it is desirable to develop and disseminate breeding chicken suited to Japanese conditions.

Part 3.

3.1 Assessing national capacity

- **Institutions related to animal production**

The Ministry of Agriculture, Forestry, Fisheries comprises the Minister's Secretariat, Agricultural Production Bureau, General Food Policy Bureau, Management Improvement Bureau, Rural Development Bureau, Agriculture, Forestry, and the Fisheries Research Council Office. With regard to animal production, the Livestock Industry Department is mainly responsible for promoting projects. The Livestock Industry Department is made up of the Livestock Development Planning Division (Management Improvement Bureau (Livestock Planning and Coordination Office, Livestock Environment Office)), Livestock Technology Production Division (livestock improvement, (Technology Office)), Milk and Dairy Products Division, Meat and Egg Division, Feed Division (Feed Supply and Demand Planning Office, Grassland Improvement Office), Animal Health Division (infectious disease prevention, veterinary science, (International Agricultural Hygiene Office, Veterinary Drug Administration Office)) Horse racing Supervising Division, Animal Quarantine Service, and the National Veterinary Assay Laboratory. In addition, local agricultural administration bureaus are present in 7 regions including Tohoku, Kanto, Hokuriku, Tokai, Kinki, Chugoku and Shikoku, and Kyushu. The Agriculture, Forestry, and Fisheries Research Council is in charge of the following: 1) the planning and formulation of fundamental plans for research; 2) the comprehensive coordination of research-related activities; 3) liaison and coordination between research and administrative departments and bureaus; 4) research on the results and state of research; and 5) assistance for research conducted by prefectures and private businesses. MAFF is promoting the administration of agriculture, forestry, and fisheries in the areas of sanitation, trade, international economic cooperation agreements, in cooperation with other ministries and agencies.

Local governments have similar organizations and are responsible for administrative issues peculiar to individual local governments. Representative institutions of local government are: research institutes, Livestock Hygiene Service Center, local offices, Agricultural Improvement Extension Center, Animal Production Promotion Association, Livestock Artificial Insemination Association of Japan, Livestock Registry Association, Livestock Promotion Association, Milk Promotion Association, Meat Distribution Association, and Affiliate Mutual Insurance Federation of Agriculture (including livestock clinic), and Agricultural Cooperatives (animal production and dairy farming, etc.).

- **Research institutes and universities**

Research institutes under the jurisdiction of MAFF including 6 institute of the National Agricultural Research Organization, the National Institute of Livestock and Grassland Science, the National Institute of Animal Health, and the Livestock and Grassland Department (in 4 regional centers of the National Agricultural Research Center), the National Institute of Agrobiological Sciences, and the Japan International Research Center for Agricultural Sciences, are conducting basic research and development on animal production. In local municipalities, there are animal production research institutes and research centers, where research and development into technologies immediately applicable to agricultural production in the region is carried out.

Universities that have animal production-related departments (universities inside the parentheses are those that have veterinary science departments): national universities, 34 (10); public universities, 6 (1); and private universities, 11(5).

Corporations, private sector enterprises, and agricultural cooperatives are conducting research independently and the role of these research sectors is becoming more significant in relation to livestock product processing and feed, in particular.

- **Livestock improvement projects**

Projects to improve livestock and poultry in Japan have been promoted independently by prefectures, which have been setting their own improvement goals. In the government, centering on the National Livestock Breeding Center, the National Institute of Livestock and Grassland Science, the Livestock Improvement Association of Japan, and the Livestock Registry Association of agricultural cooperatives are jointly conducting improvement projects.

The major activities of the National Livestock Breeding Center are 1) improvement and propagation of livestock and the distribution of breeding livestock; 2) production and distribution of seed and seedling necessary for the propagation of forage crops; 3) tests for seed and seedling of forage crops; 4) research on genetic improvement, reproduction, feeding and management-related technologies; and 5) training/guidance. With regard to 1), evaluations on genetic ability of dairy cattle, beef cattle, pigs, chickens, horses, goats, sheep and rabbits are carried out along with production and supply of superior livestock.

Preservation of the genetic resources of livestock (as a sub-bank of the National Institute of Agro-biological Sciences) and individual identification projects are also carried out. With regard to 4), analysis of genes related to production traits, embryo transfer and the improvement of clone technology, and the improvement of artificial insemination technologies for livestock other than cattle are carried out. With regard to 5), technology training within Japan, short-term training courses for groups from developing countries commissioned through the Japan International Cooperation Agency; and dispatch of experts overseas are being conducted.

Projects of the Livestock Improvement Association of Japan include 1) production of young bulls by planned mating in order to select excellent proven sires ; 2) operating AI bull centers for provision of frozen proven bull semen ; 3) the provision of animal medicines for improvement and reproduction of livestock; 4) operate bio technology center for provision of embryo; 5) test for cattle blood types; and 6) operating computing center for dispatching processed data from cattle production records. In these projects, parentage and individual identification using blood type tests are being conducted only at institutions within Japan. At present, there is an ongoing shift away from blood groups and blood protein polymorphisms to parentage tests and individual identification by DNA. In addition, tests for inherited diseases that can be identified using DNA are being conducted.

- **Animal Health**

In the government, the Animal Health Division of Livestock Industry Department, Agricultural Production Bureau of MAFF, the National Institute of Animal Health and the Animal Quarantine Service Center are collaborated with local government and with 200 local livestock hygiene service centers for preventing epidemics of livestock.

For the purpose of protecting the health of all living beings, the National Institute of Animal Health is conducting, 1)Research on the survey, analysis, prediction, prevention and economical evaluation of animal diseases by epidemiological methods, together with field research on animal diseases and dissemination of epidemiological information, 2) Characterize pathogens such as parasites, bacteria, viruses, and prions, clarify mechanisms of their transmission and pathogenesis, and implement research into the diagnosis, treatment, and prevention of infectious diseases, 3)Animals' immune mechanisms at the genetic, molecular, and cellular levels and carry out clinical research to develop immunological methods for diagnosis, treatment, and prevention of infectious diseases, 4) Study ways to prevent the invasion and spread of infectious animal diseases not normally found in Japan, that could be destructive to livestock, 5) Study patho-physiology and the mechanisms of metabolic, reproductive and lacteal disorders that occur when the demand for production exceeds the animal's physiological capacity, 6)

Research relating to the safety of animal products and feeds. This includes developing methods of detecting poisonous materials, technologies to control toxicity, and techniques for evaluating the safety of animal products and feeds, 7) Manufacture diagnostic reagents for use in the diagnosis of disease and vaccines for disease prevention, 8) Offer a range of animal health related courses, training sessions and other programs and also accept trainees and researchers from overseas, and cooperate.

- **Livestock artificial insemination technicians, transplantation of fertilized eggs, and facilities**

Cattle: qualified artificial insemination technicians, 47,975 people; employees, 6,310 people. Horses: 958 people; 33 people. Sheep: 1,740 people; 38 people. Pigs: 11,824 people; 383 people. Veterinarians: full-time, 190 people; part-time, 2,664 people. Of these, people engaged in transplantation of internally fertilized egg total 2,402 and people engaged in transplantation of *in vitro* fertilized egg total 211.

There are 2,212 facilities that are performing artificial insemination of cattle; 421 facilities are performing artificial insemination plus transplantation of internally fertilized egg; 129 facilities are performing artificial insemination plus both *in vivo* and *in vitro* fertilization; 14 facilities are performing transplantation of externally fertilized egg in addition to artificial insemination; 108 facilities are performing only transplantation of internally fertilized egg; 28 facilities are performing *in vivo* and *in vitro* fertilization; and 4 facilities are performing only transplantation of externally fertilized egg. The number of facilities that perform only artificial insemination is declining, while facilities that perform transplantation of fertilized eggs are increasing in number.

In the 2002 edition of the national list of livestock-related bodies, the following organizations, groups and companies are listed: 108 central livestock organizations; 11 registered livestock organizations; 7 agricultural cooperative corporations; 16 cooperative corporations; 22 voluntary organizations; and 37 academic societies and study groups. In terms of companies involved in animal production there are 18 trading companies; 22 breeding companies; 15 milk companies; 16 animal production/meat processing companies; 49 feed/seedling companies; 90 chemical companies; 94 equipment and facilities companies; and 33 information and advertising companies.

- **Production**

JA groups in which the national agricultural cooperative central meeting and liaison meetings play a pivotal role are engaged in activities that represent the interests of farmers. Among JA groups, 1,310 groups and organizations including agricultural cooperatives and the Economic Federation are active in individual prefectures and areas, and the level of participation of organized farmers in agricultural cooperatives is nearly 100%. Turnover in 2000 amounted to 4.65 trillion yen and that for the animal production sector amounted to 1.16 trillion yen.

In accordance with the “Principles concerning the strengthening of animal production guideline systems” decided upon by the Ministry of Agriculture, Forestry, and Fisheries, the Japan Livestock Industry Association was established in 1955 as a guide organization. Its objectives are to enhance the technological competence of animal production managers and stabilize animal production management. In addition, as a supplemental organization to provide help and guidance for animal production operations in prefectures, prefectural livestock industry associations were established successively. The Japan Livestock Industry Association is engaged in a broad range of activities with affiliated organizations such as prefectural livestock industry associations, Agricultural Cooperatives and organizations supervising member animal production businesses. Activities include management guidance, supply of funds, provision of information, research on animal production, and publishing. As part of liberalization of animal products and internationalization in recent years, the Japan Livestock Industry Association is providing information through publications and the Internet in its role as a comprehensive, central organization, and is running a nationwide livestock production information network (LIN).

The Japan Dairy Council was established by national organizations related to dairy farming in accordance with a notification from the administrative vice minister of MAFF in August 1962. This council is a dairy farming guidance organization (public interest corporation in accordance with the Civil Law Article 34), which consists of designated raw milk producer organizations (designated organizations) established by the inauguration of “The law for subsidizing dairy farmers” (“Deficiency payment law”) in 1966 and all organizations related to dairy farming (the Central Union of Agricultural Co-operatives, the National Federation of Agricultural Co-operatives, the National Federation of Dairy Co-operative Associations, the National Federation of Exploitative Agricultural Co-operatives, the Norinchukin Bank, and the National Mutual Insurance Federation of Agricultural Co-operatives).

The Civil Law Article 34 states “This council shall aim to contribute to the sound

development of dairy farming in Japan through promoting raw milk commission sales through cooperative organizations of milk producers, stabilizing the supply of raw milk and rationalizing distribution and improving quality”. This council is engaged in the following activities; liaison and coordination of supply and demand for milk between designated raw milk producer organizations and the National Federation of Agricultural Co-operatives taking geographical regions of the country as the unit of the organization; formulation of demand and supply prospects for milk; treatment of raw milk by raw milk producer organizations; storage, sales and production of dairy products; guidance on storage and sales; promoting consumption of milk and dairy products; and collection and provision of data and information on the projects mentioned above.

In addition, through the joint efforts of the following organizations, stable production and supply of livestock products and rationalization of distribution are being worked towards jointly by organizations including production related organizations by animal species (e.g., Japan Chicken Association, National Pig Association, National Beef Association), registry organizations, processing and distribution organizations by products, and facilities, equipment and materials-related organizations.

- **Required human resources and types**

Considering the current state of Japanese-type animal production, the field that will assume vital importance in the future is the environment for animal production. In addition, in order to enhance the animal feed self-sufficiency rate, contractors are necessary to compensate for the shortage of labor due to aging and to accomplish expansion in the scale of operations. The training and development of contractors is a current requirement.

- **Infrastructure**

As mentioned in Chapter 2, the key words for animal production in Japan are the environment, increased animal feed self-sufficiency, safety and security. Emergency measures to address the BSE problem are being taken with a large budget allocated as already mentioned. Promoting proper use of livestock wastes leads to not only a better environment, but also strengthening of the agricultural infrastructure, an increase in the animal feed self-sufficiency rate and sustainable agriculture. The improvement of animal waste treatment facilities and the preparation of systems to promote the utilization of these facilities are required.

- **IT systems**

Nationwide the Livestock-Industry Information Network (LIN) has been established. Through this network, animal production-related organizations are connected with each other and can access homepages related to animal production worldwide. Since the quality of homepages in individual organizations varies, further improvement is required.

Currently, cellular phones are popular, and through this device access to the Internet has become easier. However, the dissemination of the cellular phones is lagging behind in agricultural areas where many elderly persons live. It is necessary to increase the utilization of the Internet in agricultural areas, not by expanding hardware but through software.

- **Improvement of laws and regulations covering animal genetic resources**

Although there have been no legal protection and conservation systems that target farm animal genetic resources exclusively, the following laws concerning wild animals and pets exist.

In 1992, “the Convention on Biological Diversity” was adopted. The convention became effective in December 1993. Japan concluded the treaty as the 18th member nation in that year. In accordance with the Convention on Biological Diversity Article 6, the governments of member nations are required to formulate national strategies aiming at the conservation and sustainable utilization of biological diversity. In response to the convention, the government formulated National Strategies on Biodiversity in October 1995, and revised the strategies in 2002. Regarding the protection of wildlife, “the Convention Concerning the Protection of the World Cultural and National Heritage”, “the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (hereafter Ramsar Convention)”, and as domestic laws, “the Wildlife Protection and Hunting Law”, “the Endangered Species Preservation Law” and other laws and treaties have been enacted.

“The Law for the Protection of Cultural Properties” (1950) designates animals including livestock (including habitats, breeding places, and migratory sites) that have high scientific value for Japan as natural treasures. Article 77 Item 1 of this law can order or recommend to the management organization or the owner of the special natural treasure to do whatever is necessary to carry out restoration of these areas when special historic relics, places with natural beauty, and other natural treasure are damaged or have deteriorated, and if it is acknowledged that these places are in need of restoration. As historic relics and places with

natural beauty other than the special ones mentioned above, Item 2 of the same article can recommend to the management organization or the owner of the special natural treasures to do whatever is necessary for restoration.

“The Law Concerning the Protection and Control of Animals” has been in force since 1973, but excludes animals related to animal production and agriculture, and animals that are bred or kept for laboratory or experimental use.

- **Assessment of international cooperation, trading, activities, and deficiencies**

Japanese experts participated in the Informal Panel of Experts on the Development of the Global Strategy for AnGR and in the Intergovernmental Technological Working Group on Animal Genetic Resources set up by FAO. Concerning the conservation of animal genetic resources in African areas, ILRI (the International Livestock Research Institute, headquartered in Ethiopia) affiliated with CGIAR (the Consultative Group on International Agricultural Research), which is an international agriculture research organization, is implementing action in a number of study areas. Japanese experts are dispatched to ILRI and Japanese specialists sit on the board of directors.

Breeding sires such as Holstein from western countries have continued to be imported for use in Japan. Since the imported potential breeding bulls are occupied more than half in progeny testing projects and the quantities of semen imported are still tending to increase, the National Livestock Breeding Center and the Livestock Improvement Association of Japan are working towards joining INTERBULL (International Bull Evaluation Service) in 2003. This service carries out international comparisons of evaluations of bulls for the dairy industry.

The Livestock Improvement Association of Japan is participating in international comparative studies in the area of bovine blood group tests, which are conducted in alternate years. In addition, this organization is taking part in multicenter coordinated tests, a joint study for the standardization of DNA markers and preliminary work for test organizations on a global basis to select the markers as internationally acceptable standard markers.

Border measures were introduced in response to the changes in rice tariffs in April 1999 after prolonged negotiations extending over half a century since the accession to GATT in 1955. Current tariff levels have been reduced as a result of these negotiations. In this process, import liberalization of livestock products has been proceeding steadily. To address the challenges accompanying import liberalization, there has been an expansion of the scale of animal production households, livestock breeds demonstrating high productivity have been

introduced, and improvement and propagation have been promoted. As a result, the diversity of animal genetic resources, general breeds and indigenous populations has decreased.

In addition, Japan ratified “the Convention on Biological Diversity”, “the Ramsar Convention” and other treaties addressing wildlife diversity, and based on these treaties, Japan is establishing international protection areas and National Strategies on Biological Diversity, in cooperation with neighboring countries.

Part 4.

Policies to develop current animal production have been reviewed in previous chapters. In this chapter therefore, issues concerning the conservation of native breeds are taken up.

4.1 Cross-cutting priorities

- **Institutional development and capacity building**

The National Institute of Agrobiological Sciences has researched, collected and conserved the genetic resources of agriculturally significant species and organisms and has conducted projects on animal genetic resources in its role as the central genebank in Japan. In 2000, this institute was designated as a National Focal Point of FAO. Currently, 7 people including one National Coordinator are engaged in working on animal genetic resources. The Society for Research on Native Livestock (with more than 100 members) has promoted research since 1960, focusing on research into the genetic relationship among Asian livestock including Japanese varieties. Since research into other livestock by veterinarians and zoologists is broadly based, it is important to increase the number of personnel that have an interest in these areas and are involved in genetic resource studies and projects, rather than mere capacity building.

- **Dissemination and awareness of animal genetic resources**

In realizing the preservation and conservation of animal genetic resources and with the introduction of sustainable use, it is important to have the understanding, cooperation and participation of the general public. It is crucial to promote the awareness of animal genetic resources and to ensure that this information is disseminated. To achieve this, it is convenient and useful to utilize IT (information technologies) resources such as the Internet, which has rapidly advanced and been gaining in popularity in recent years. By utilizing these IT resources, it is possible to provide information and enhance awareness concerning the conservation and sustainable development of genetic resources across a broad cross-section of the public. The National Institute of Agrobiological Sciences is providing information on genetic resources conserved in genebank on the homepage of the Ministry of Agriculture, Forestry, and Fisheries genebank (plant genetic resources sector, microorganism genetic resource sector, and animal genetic resource sector). However further improvements are required.

In addition, it is necessary to link homepages providing information on genetic resources, whether this is sourced from organizations or individuals, and send information to both producers and consumers in order to enhance awareness. At the same time, it is also important, to receive information on genetic resources so that it can be widely shared by all interested parties.

Since native breeds and varieties other than chickens are small in number, it is relatively easy to establish their location and conservation status. Information on a considerable number of species can be accessed through the Internet. However, it is difficult to get a clear picture of the chicken situation at present because there are many different breeds that are often bred on a small scale. It is necessary to provide detailed location information on other breeds wherever possible in addition to Japanese native chicken breeds. This can be provided through the homepages that are providing investigating locations and conservation status. These informations will be resultant from a series of researches. It is also necessary to create systems capable of sending information on strains and inbreeding depression to promote the exchange of populations between small-scale owners.

- **Traditional knowledge**

There are many traditional events related to a variety of livestock that are still held, particularly in relation to cattle and horses. These include “*hatsuuma*”, “*ageuma*”, “*yabusame*”, “*ushioni*” at the Warei shrine, the cattle festival at Uzumasa, and sacred rites relating to field work (Tsuda 2001) in rural Japan. At these events, living farm animals play a leading role, but indigenous breed rarely appear. New breeds are now being utilized at these traditional events and festivals.

The production of livestock now takes place on a large scale and the presence and awareness of farm animals has gradually been fading from ordinary life. Only a few livestock have been bred for specific purposes, such as cattle for bullfights, and Onagadori and Naganakidori as fighting cocks and pet animals. Dishes using goat and pig meat in Okinawa Prefecture and “*kiritanpo-nabe*” using Hinaidori in Akita Prefecture can be said to be forms of traditional cuisine utilizing traditional Japanese breeds. Most non-native breeds have already become familiar in ordinary Japanese life. With the exception of chickens, the handing down of these traditional recipes and breeds does not seem to have led to the protection of native animals.

- **Reinforcing conservation efforts**

Most native livestock are presently categorized as ‘critical’ or ‘critical-maintained’. Currently, the conservation of genetic resources in Japan is being conducted mainly through the *ex situ* conservation of frozen embryos and semen and small populations of live animal, as a supplementary conservation measure of *in situ* conservation of live animal population. The conservation of frozen embryos and semen is not necessarily satisfactory because the number of collected individuals is limited and freezing technologies have not been well established for some species. Somatic cell cloning technology was first introduced in 1996 but has not yet become fully established. The technique of freezing somatic cells could be used to conserve species where it is difficult to freeze germ cells. Collecting somatic cells and conducting conservation through freezing should be used in preference until cloning technology for somatic cells has been reached a more mature stage. By doing this, somatic cells can be conserved as genetic resources regardless of sex.

For avian species, the somatic cell cloning technology has not succeeded. However, chicken with chimeric germ cell lines has already produced successfully using frozen primordial germ cells (PGC). The main drawback of this technique is that it takes time, but it can conserve the cells of both sexes.

Collection and conservation of somatic cells has already started for Mishima Cattle. There are plans to collect the cells from most individuals of the breed. It is necessary to start collecting PGC of native chickens in Japan as soon as possible.

The Japanese Chicken Conservation Group holds shows in various regions, where chicken enthusiasts exchange information and their fowls. The organizations related native breed conservation are also playing an important role on behalf of other livestock. Policies need to be prepared to provide further incentives to the Conservation Group to continue its efforts.

- **National policies, laws, regulations, and measures**

The Ministry of the Environment released the New National Strategy of Japan on Biodiversity in March 2002. The Ministry of Education, Culture, Sports, Science and Technology released the “National bio-resource projects” that aims at the improvement of bio-resource systems such as those for laboratory animals and plants (including laboratory mouse and *Arabidopsis thaliana*), ES cells, other stem cells and genetic materials derived from various living organisms. These projects assume the viewpoint of the comprehensive promotion of

life science. Agrobiological resources genebank projects are required to review how effective measures to conserve genetic resources have been, utilizing the characteristics of individual projects and linking these projects and systems effectively to take the entire nation into consideration.

4.2 Characteristics of animal species and breeds in regions and village communities

Dominant breeds utilized throughout Japan do not have local characteristics. Native breeds are connected with specific regions due to their background and history.

Japanese Brown in Kumamoto and Japanese Shorthorn in the Tohoku region have superior grazing traits compared to Japanese Black and are bred and grazed in grasslands located on mountainous-hilly areas. In 2000, direct payment systems to the mountainous-hilly areas started in accordance with the Basic Law on Food, Agriculture, and Rural Areas. In Aso, this grant is used to promote animal production focusing on the maintenance and management of grasslands and the Japanese Brown of cattle.

- **Emergency protection requirements**

Among native breeds, Japanese Polled is a breed that has suffered the greatest reduction in its population. It does not face the threat of immediate extinction because of the existence of the Japanese Polled Corporation established and financed by Yamaguchi Prefecture, and other sectors. However, its genetic material (germ cells, body cells) as genetic resources must be secured in as large a quantity as possible.

- **Activities with high potential effects in the short/medium-term**

It is necessary to research the actual conditions of the Japanese Chicken and Japanese Chicken enthusiast groups throughout Japan, and to ascertain the actual population of individual breeds in the process of the research. It is important to formulate effective policies for conservation in the future, based on the situation of individual breeds revealed in the course of the research.

- **Necessity for long-term and sustainable use, MoDAD (the measurement of domestic animal diversity), sustainable breeding programs, and breeding techniques**

As a move towards long-term and sustainable use, “Plans for the promotion of increased production of animal feed” and the “Law concerning appropriate management and the promotion of use of livestock excretion” have been enacted. Native breeds represented by only small populations must be designated as breeds for conservation rather than sustainable use, and measures taken (including germ cell preservation) to protect these breeds from extinction. In addition, it is necessary to monitor not only the population size of the breed but also to keep and maintain pedigree and to analyze genetic relationship, and to monitor the genetic diversity and variability of the targeted breed or population using high-sensitivity analytic methods such as DNA polymorphism. Breeding programs should be prepared using this information.

Part 5.

5.1 Recommendations

- **Fundamental research and technology transfer**

Japan is providing ODA (Official Development Assistance) based on the philosophy of supporting the independent efforts of developing countries. JICA (the Japan International Cooperation Agency) is an organization that is in charge of projects that focus on technological cooperation. JICA is supporting the development of personnel from developing countries who are playing a significant role in the creation of their nations. The projects JICA is supporting are 1) dispatch of experts; 2) accepting trainees; 3) providing equipment and materials; and 4) technological cooperation through projects (including projects 1) and 3) above). The National Livestock Breeding Center is the main body that supports the animal production field. The center is extending the range of fields eligible to receive its support in the livestock hygiene and livestock production areas to include livestock propagation, research and education. In recent years, livestock processing has been gaining greater prominence, so sophisticated technologies such as transplantation of fertilized eggs and other biotechnologies have shown rapid development in response to this increasing need. The main target was dairy cows, but in recent years, for example, beef cattle, pigs, and poultry, dairy products, grassland farming, and feed crops have also been targeted. The National Livestock Breeding Center is accepting approximately 30 trainees from developing countries to participate in the following 5 training courses.

- Beef cattle breeding and artificial insemination technology (not more than 8 people, less than 3 months)
- Bovine transplantation of fertilized eggs (not more than 8 people, 3 months)
- Pig breeding and production technology (not more than 6 people, 3 months)
- Chicken breeding and production technology (not more than 9 people, 3 months)
- Feed crop production and utilization technology (not more than 6 people, 4 months)

The National Institute of Animal Health is the main body that supports the animal health related field and accepting approximately 5 trainees from developing countries to participate in the veterinary medicine technology course (6 months).

The both institutions have also conducted training on an individual basis, and aims at enhancing the effectiveness of technology transfer through accepting local engineers (counterparts) for a certain period. Japanese trainers are dispatched to developing countries to conduct technological guidance and train their counterparts in their specialty. The training period and curricula are decided based on the needs and wishes of the trainers. The training content varies and the training period ranges from several days to several months.

Universities and national research institutes provide opportunities to researchers from developing countries (who are visiting Japan through various fellowship programs) to participate in joint-research in a number of fields including MoDAD (assessment of livestock diversity).

- **IT system networks**

The National Institute of Agro-biological Sciences has constructed systems for genetic resource management centering on plant genetic resources and is making part of the systems public. The exchange of information with sub-banks and the inputting data is being performed through this system. With regard to international networks, the institute transmits information in cooperation with the Domestic Animal Information System (DAD-IS) under the FAO.

- **Principles and modalities for safe exchange and conservation of animal genetic resources**

The National Institute of Animal Health in the National Agricultural Research Organization is mainly responsible for carrying out research on livestock diseases. This institute is dispatching researchers to ILRI and accepting researchers and trainees from developing countries.

- **Mobilization of systems to support co-operative activities for individual animal genetic resources**

A variety of ODA projects are receiving assistance from JICA. Assistance for the establishment of plant genetic resources gene banks is included in these projects. In the livestock area, there a lot of projects relating to animal genetic resources such as artificial insemination and livestock improvement. Most of the projects have plans to improve and

increase production using exotic breed. If guidelines for the conservation of animal genetic resources in individual countries are formulated, and indigenous breeds is positioned in the center of sustainable agriculture system (with a view to increasing production), these projects seemed to be able to receive ODA. Activities linked to biodiversity conservation projects are also important.

- **Co-operation for conservation and other activities, and the equitable sharing of burdens and benefits**

It is also important to assist conservation activities initiated by the private sector. For example, in March 1998, the Cattle Museum in Maesawa town in Iwate Prefecture organized a Cooperation Committee to restore and support Tongkonan. This is a building connected with the raising of traditional water buffalos peculiar to Toraja. The buildings in this complex are clearly decaying, resulting in a negative change in the landscape in this traditional community. The Cattle Museum and Toraja and Mamasa Culture Reservation Group have contacted the people in Toraja publicly and privately, and the committee was established mainly by members of the museum but also with volunteers from among the general public. Through selling telephone cards and books and fund-raising, the secretariat of this committee researched and selected buildings in Tongkonan and Aran. The selection was made based on how urgently the buildings required restoration, their historical and rarity values and their uniqueness. Support was received to restore a total of 10 buildings through negotiations with local families.

Part 6.

6.1 The editing process

The second Intergovernmental Technical Working Group on Animal Genetic Resources adopted the recommendation on development of the First Report on the State of World's Animal Genetic Resources for Food and Agriculture, through a country-driven process, and the submission of the country report from an individual country (September 2000). This task force had to select the Focal Point and the National Coordinator for individual countries. In response to this, Japan designated the National Institute of Agrobiological Sciences as the Focal Point, and Dr. Taro Obata from the institute as the National Coordinator, notifying this to FAO. In addition, the Gene Bank for Animal Genetic Research of the Ministry of Agriculture, Forestry, and Fisheries in FY 2000, that made up the task force (February 2001), and its working group meetings (October 2000), decided the content of the national report and selected the editorial members, making Dr. Obata (NC) the chief editor. The task force decided to start collecting relevant material adhering to the same working schedule as the FAO.

Dr. Yoshiaki Izaike from the National Institute of Animal Industry (at that time) participated in the Global Training of the Trainer's Workshop held in Rome in March 2000 and participated in the formulation of guidelines for the national report. Moreover, Mitsuru Minezawa, from the Editorial Committee Office of the National Institute of Agro-biological Sciences, participated in the Asia-Pacific Training Workshop held in Bangkok in November 2001, when the schedule for the submission of the national report (by August 2002) was released.

Editorial work was conducted mainly by Minezawa and Obata but with cooperation from the editorial staff and the other interested parties. In June 2002, the Japanese version of the report (a draft) was delivered to editorial staff and relevant departments and a review of the content was requested. During this period, from the SoW news of DAD-IS, it became clear that the work on compiling the report would be put off till August 2002 or thereafter.

The Japanese version was compiled in October 2002, and translated into English, and then submitted to the FAO after being reviewed by the relevant departments.

6.2 Executive Summary

Japan is located between longitudes 123° and 149° east and latitudes 24° and 46° north. Situated in East Asia, the country is made up of a group of islands surrounded by the Pacific Ocean to the east and the Japan Sea to the west, extending far longer in the south-north direction than in the east-west direction. It has a natural land area of 378,000 km² occupied by 127 million people (2000). The climate differs greatly between the southern and northern regions; some regions belong to the subarctic zone while others are subtropical. Due to mountainous regions extending down through central of Honshu, seasonal winds have different influences on the eastern and western seaboard. The regions facing the Pacific Ocean receive a high summer rainfall while regions facing the Sea of Japan have heavy snowfalls in winter. Rice cropping is mainstream in Japanese agriculture though the form of cultivation varies from region to region.

Agricultural production in Japan is valued at 9.12 trillion yen, 72.3% of which is accounted for by field husbandry. That is to say, 26.9% (2.45 trillion yen) of the value of total production is generated by livestock farming, which exceeds the figure for rice production (25.5%), Japan's major crop. The population of Japan is 127 million, with 47.06 million dwellings. Of these, the farming population totals 13.46 million people with 3.12 million dwellings, while households involved in livestock farming account for 160,000 dwellings.

1

1.1 Diversity of domestic species and breeds

Breeds covered in livestock-related statistics and other native breeds and populations include 9 beef cattle breeds; 7 dairy cattle breeds; 12 pig breeds (including wild boars and counting Kagoshima Black Pig and Berkshire separately); 12 horse breeds and populations; 3 goats breeds and populations; 2 sheep breeds; one breed of rabbit; and 6 other mammal species. There are 38 chicken breeds and 6 other bird species, of which quail is the only animal species that has been domesticated in Japan.

Lots of species and breeds of livestock and poultry have been introduced into Japan, but breeds other than major breeds of cattle, pigs and chickens have decreased in number and have not played an important role in animal production. There are some breeds included in the statistics that cannot be said to have become well established in Japan, and their introduction at this point would have to be regarded as tentative.

Status of native cattle and poultry in Japan

Cattle: Since the Meiji era, exotic cattle breeds have been introduced and crossbreeding between Japanese cattle and exotic breeds has been promoted in most regions nationwide. As a result, there are only two cattle groups that escaped hybridization with exotic breeds---Mishima Cattle, which have survived in Mishima Island off the coast of Hagi city in Yamaguchi Prefecture and Kuchinoshima Cattle living on Kuchinoshima of the Tokara Islands in Kagoshima Prefecture. Cattle other than in above-mentioned region are roughly categorized into 4 types depending on the types of exotic cattle used for crossbreeding with native cattle; Japanese Black, Japanese Brown, Japanese Shorthorn, and Japanese Polled have been produced. Their characteristics differ within the same breeds and among breeds greatly depending on the characteristics of the cattle within the region and/or of hybridized exotic cattle.

Pigs: Before Japanese people began to eat pigs nationwide, a native pig called Shima Pig or Aguh existed in Kagoshima and Okinawa. At present Black Pig (it is thought to be of Berkshire origin) has gained popularity as a special brand product in Kagoshima Prefecture. In the case of Aguh, almost all native breeds disappeared after World War II. Under such conditions, the collection and conservation of the population with characteristics similar to the few surviving native Aguh has been carried out.

Ohmini is being preserved by private businesses and the F1 of Ohmini is being marketed as a laboratory animal.

Chickens: The cutting off of Japan from outside contact in the Edo era (from 17th to the mid-19th century) had a significant impact on the establishment of the Japanese Chicken as birds either for pets or cockfighting. The Japanese Chicken as a chicken for practical use came about under the influence of exotic breed introduced in the Meiji period. Since the liberalization of imports for breeding chickens in 1960, native chickens for practical use have fallen into a disastrous condition. Some native chickens are now being used to breed brand chickens. Brand chickens using native breeds are distinguishable from other brands and are referred to as Jidori. Jidori are defined as chickens that contain at least 50% of genes from among 41 breeds and native breeds designated by the Japan Chicken Association (38 native breeds according to JAS). The major native chicken breeds including these Japanese old-style natives are Rhode Island Red (44.8%), Nagoya (3.8%), Shamo, Hinaidori, Barred Plymouth Rock, and Satsumadori. These 6 breeds account for 58% of all native breeds.

Horses: After World War II, along with the recovery and growth of the Japanese economy, cultivation and conveyance became mechanized in the agricultural sector. As a result, farm

horses that had been actively raised till then and native horses used for conveyance lost their roles, resulting in a corresponding decline in their numbers. In spite of this, 8 native populations comprising Hokkaido Horse, Kiso Horse, Noma Horse, Tsushima Horse, Misaki Horse, Tokara Horse, Miyako Horse, and Yonaguni Horse are left and all are protected by conservation groups.

Goats: As native goats, there are Tokara Goat and Shiba Goat. The Japanese Saanen breed has been produced by crossbreeding between a native goat and a Saanen and successive crossbreeding with the Saanen. The Shiba Goat is bred as a laboratory animal in universities and research institutes. With regard to Tokara Goat, 35 purebred individuals exist at Kagoshima University and Hirakawa Zoo. Toshima village, the birthplace of Tokara Goat, have opened a goat farm. However, even here, there are only a few purebred individuals.

Quail: Quail are the only indigenous species that have been domesticated in Japan. There are about 7.71 million quail being bred focusing on the use of eggs (2000). This species has not undergone differentiation into several breeds.

1.2 Conservation systems for genetic resources

- **MAFF gene bank projects**

The MAFF gene bank project started in 1985 as a nationwide network. From 2001, the National Institute of Agrobiological Sciences has been the main body conducting research, collection, classification and identification of genetic resources domestically and internationally, along with implementing characterization and conservation of resources.

The conservation of domestic animals is practiced at the National Institute of Agrobiological Sciences, the center bank, and independent administrative institutes such as two institutes of the National Agricultural Research Organization, the National Institute of Livestock and Grassland Sciences, and the National Institute of Animal Health, and the National Livestock Breeding Center, as sub-banks. The center bank is involved with cryogenic preservation, mainly focusing on frozen semen. The sub-banks are concentrating more on maintaining live animals of endangered breeds, in combination with cryogenic preservation. Collection and conservation are being carried out focusing on breeds and strains that have been bred in Japan, and approximately 200 accessions including native breeds on the verge of extinction have been conserved.

- **Conservation projects for livestock and poultry**

Of native horses, the Misaki Horse from the Toi Cape area has been designated as a natural treasure. A liaison meeting for the project to conserve 8 native horse groups including Misaki Horse hosted by the JEAA has been held every year since 1977. Nineteen varieties of livestock and poultry native to Japan have been designated as natural treasures. All of these are chickens except for Mishima Cattle and the Misaki Horse. Of these, only Onagadori in Tosa has been conserved as a special natural treasures. In addition, financial measures for strain conservation are being undertaken targeting Dokanko and 14 chicken strains of 3 universities an.

1.3 Breeding technologies utilized for livestock production in Japan

Artificial insemination: According to the statistics in 1998, the rate of implementation for artificial insemination in cattle is 99%, of which frozen semen comprises 100%; for pigs, the implementation rate is 7.6%, of which frozen semen comprises 10.5%. Both implementation of AI and the utilization of frozen semen are increasing. For horses, the rate of artificial insemination using fresh semen is 4.5%.

Transplantation of fertilized eggs: For cattle, transplantation of fertilized eggs has been performed corresponding 2.5% of the total number of artificial inseminations in cattle, 2.48 million head (2000). For Japanese Black, the transplantation of fertilized eggs makes up 6.3% of the total number of artificial inseminations, approximately 740,000 head. For pigs, experimental transplantation of fertilized eggs has been successfully conducted.

Cloned livestock (May, 2002): Although cloning technologies are still in the experimental phase, with regard to cattle, 629 individuals from fertilized egg clone have been produced in 40 institutes and 293 from somatic cell clone has been produced in 38 institutes; for pigs, 5 somatic clones at one institute; for goats, 2 somatic clones at one institute.

- **Technology applicable to rare livestock and poultry**

After pig's unfertilized eggs being matured *in vitro*, the head of a sperm is implanted into the ovum under a microscope. After this, the egg is returned to the uterus. In this way, offspring can be obtained. It is expected that this technique will be applied to not only the propagation of pigs but also of rare livestock. PGC is introduced into a chicken's embryo to form a chimera germline and then artificial insemination using frozen semen to propagate a pure

breed is carried out.

1.4 Status of trait characterization and evaluation (fundamental, production-related, quantitative and molecular genetics)

For livestock and poultry within Japan, data has been accumulated on fundamental and production-related traits from all the studies ever conducted, while agrobiological genebank projects are also promoting trait characterization and evaluation of animal genetic resources held at the genebank. Trait information relating taste, texture, flavor, trace elements, and human health will become more necessary in the future.

Studies on genetic relationships have been conducted using molecular information (protein polymorphisms, blood groups, mitochondria DNA polymorphisms, and other DNA markers). In addition, genome research on livestock and poultry has been conducted. With regard to native livestock and poultry, Japanese Black, Shamo and other livestock have been used to produce resource families for gene mapping and the analysis of QTL. With regard to individual identification and parentage tests, there is likely to be a shift away from conventional methods using blood groups and protein polymorphisms to microsatellite DNA polymorphisms after the completion of a trial test period. Five genes of cattle causing genetic diseases, and one pig gene have already been the subjects of DNA testing.

1.5 State of use by species (data related to the improvement of livestock (2000))

Beef cattle: In 1999, the population, excluding cattle for fattening, totaled 669,000, 93% of which are Japanese Black. With regard to other breeds, Japanese Brown constitute 4.8%, Japanese Shorthorn 1.2%, and other breeds constitute less than 1% in total. Cattle being fattened for beef production totaled 1.84 million head. Holstein is also included in the statistics, accounting for 26.4% of the total. Hybrid populations produced from Holstein account for 31.3% and Japanese Black accounts for 39.8%, with these three breeds accounting for 97.5% of the total.

Dairy cattle: In 1999, Holstein totaled 1.732 million head, accounting for almost 100%, while the second most common breed was Jersey with only 9,202 head, and breeds other than Holstein totaled 10,287 head, accounting for less than 1%. Breeds other than Holstein are mainly bred at recreational farms or dairy farms where cheese, yogurt, and other dairy products are produced and sold on the premises.

Pigs: Pig production in Japan is characterized by the high popularity of the Kagoshima Black

Pig. In addition to this breed, there are hybrids from triple crossbreeding Large White, Landrace, and Duroc, and hybrids from triple crossbreeding Large White, Landrace, Berkshire (in place of Duroc), or commercial pigs, which have been produced utilizing pigs imported from foreign breeding pig companies.

Chickens: For chicken production, meat production using broilers produced from imported exotic breeding chickens accounts for 89.4%. Adding waste chickens (9.0%) to this figure takes the percentage to 98.4%. For eggs, White Leghorn and other breeding chicken of layer breeds account for 7.21 million fowls, while native chickens and other breeding chickens of dual purpose for meat and eggs account for 340,000 fowls in total (probably used mainly for meat).

Horses: The major purposes of horse production in Japan are horse racing, horse riding and meat production. In Japan, 27,500 horses are being bred annually. For these purposes, light horses such as Thoroughbred and Arab, heavy horses such as Percheron and Bretonne, and crossbred horses are mainly utilized.

Goats : Only Japanese Saanen has been included in the statistics. This breed accounts for 30.4% of the total 14,000 goats. Most of them seem to be crossbred goats.

2

2.1 Recent trends in livestock production

In the conventional Japanese agricultural system, livestock were mainly used as draft animals and it was only after these animals had outlived their usefulness or were surplus to requirements that they would be used as food. It was the animal production industry that responded to this situation. Along with a decline in the need for draft animals due to mechanization, the era in which each farming household fed a small number of draft animal has ended.

With the rapid growth of the Japanese economy, the need for higher livestock production has increased, and in accordance with laws such as the Law for Improvement and Increased Production of Livestock, the Agricultural Basic Law and policies based on these laws and financial systems, continuing expansion and specialization have been promoted. Most ex-household animal production based on small and medium sized livestock operations has disappeared. This change has had little impact animal production systems as they now exist in Japan.

- **Recent change in Japan's livestock breeds and its self-sufficiency rate**

The average number of beef cattle being fed per farmhouse was 1.2 head in 1960, and this steadily increased, reaching 25.5 head in 2001. On the other hand, the number of households raising cattle has declined from 2.03 million to 110,000. The total number of cattle was at its peak in 1994 at 2.97 million head, with this number declining to 2.80 million head. Import liberalization of beef started in 1991. The number of Japanese Black as a proportion of the entire cattle population has increased. This is because this breed is perceived as having higher meat quality more suited to Japanese tastes than imported beef. The breed represented around 85% of the cattle population in 1970, but this figure grew to 93% by 1999, resulting in a sharp decline in the numbers of other breeds to 50% or even lower. In 2000, beef production amounted to 3.64 million tons and of which derived from beef breeds accounted for 1.67 million tons, with national self-sufficiency for beef being 33.5%.

With regard to dairy cattle, Holstein is the dominant breed. The average milk yield has doubled from 4,250kg in 1965 to 8,794kg in 2000. The content of milk constituents has also steadily increased. The volume of concentrated feed given has increased 1.7 times (milk yield increased by 1.5 times during this period) from 1,889kg in 1975 to 3,205kg. Milk production amounted to 8.41 million tons in 2000, with the imported volume in the form of dairy products amounting to 4.00 million tons on a raw milk basis, 70% of which is cheese.

For pigs, the number of pigs per household has increased 246 times (from 3.9 in 1962 to 961 in 2002). Farming households with more than 1,000 pigs account for 21.3% of the total number of households and are breeding 70% of the population.

Consumption of pork produced in Japan (parts) is currently 8.78 million tons and consumption of the imported pork amounts to 6.51 million tons, with a 57.4% rate of self-sufficiency.

Currently, the rate of hybrid breeding male pig accounts for more than 70% because pork pigs are mostly produced through triple crossing. Imported hybrid pigs account for approximately 14% for both breeding male and female pigs.

For chickens, import liberalization of chicks for broilers in 1960 has led to a shift away from the use of culled chickens to broiler meat. In the case of layer breeds there was also a shift away to chickens produced from imported breeding chickens. At present, approximately 80% (approximately 21% for laying breeds and 59% for broilers) of all breeding chickens are derived from imported grandparental stocks. For edible chicken, 89% are broilers, and for eggs, it is estimated that White Leghorn and eggs derived from laying chickens from imported

breeding chickens account for nearly 95%. Production of chicken and eggs in Japan and the self-sufficiency rate (2000) are 1.19 million tons (67.6%), and 2.54 million tons (95.5%), respectively.

- **Sharing the benefits between farmers and consumers**

Although the growth in livestock production in Japan was interrupted and hindered by World War II, production rapidly increased in the period of Japan's postwar economic recovery. It is clear that the increase in the consumption of livestock products has made a significant contribution to the expansion of the average lifespan and the improvement of physique of Japanese people.

On the other hand, the number of farming households including animal production households dramatically declined from 5.34 million households in 1970 to 2.34 million households in 2000, and the total income for agricultural production for the entire country has been tending to decline from around 1994. However, looking at the ratio of income to the GNP, farming household income has not fluctuated to any great extent for these 20 years.

2.2 Demand and trends for livestock products

The consumption of livestock products in Japan is one-third of the USA, and half that of the EU. However, the Japanese people eat a lot of fish and shellfish, so the intake of animal food compares favorably with developed western countries.

In terms of the demand for livestock products, dairy products such as cheese are expected to increase, but raw milk, meat and eggs are unlikely to increase due to a leveling off or downward trend in the population. However, the trend among consumers is to purchase fresh, safe, tasty, and healthy livestock products, rather than just focusing on the price. Accordingly, livestock producers are endeavoring making efforts to meet consumers' needs by developing brand livestock and products.

Brand products are being produced from beef, pork, chicken and eggs, with 141, 178, 158 and 636 brands known respectively. There are a few brands that use native breeds as a point of difference. Native breeds such as Mishima Cattle, Kagoshima Berkshire, Agou, Hinadori, Tosa Jidori, Nagoya, Gifu Jidori and Shamo are being utilized to produce brand products, a situation which is greatly contributing to the conservation of these breeds at the present time.

Uses for other than food production (fur, draft animal, property) are or will be of little

importance.

2.3 New trends and issues

- **Animal feed self-sufficiency rate and environmental issues**

The stock feed self-sufficiency rate in 1998 was 22% in N terms and 25.1% on a TDN basis. If limited to concentrated feed, feed produced within Japan provides only 10% (2 million tons) of the total demand of 20 million tons. Approximately half of the 33.71 million tons of grain consumed (including human use) is for domestic livestock. This is one of the factors contributing to the reduction in the level of self-sufficiency for agricultural products used as food. Most of excreted feces and urine are applied to farmland. The volume of nitrogen has exceeded the acceptance capacity due to decline in areas under cultivation.

2.4 Outline of future national policies

“The Basic Law on Food, Agriculture, and Rural Areas” was enacted in 1999. In accordance with the Law, the Basic Plan for Food, Agriculture, and Rural Areas in 2000 was established. The fundamental pillar of this law is to take measures to ensure the stable supply of food including “the improvement of food self-sufficiency”, “sustainable development”, and “response to emergencies”. Japan’s food self-sufficiency (1999) has declined to 41% in terms of supplied calories and 28% for grains. The Plan sets up production goals that take into consideration the nutrient balance of food to increase self-sufficiency to more than 50% in terms of supplied calories, in addition to ensuring a basic food supply. The plan promotes the maintenance and development of natural recycling functions to aid sustainable agricultural development, and also promotes effective integration of animal production and crop cultivation in harmony with the environment. Goals for 2010 are 9.93 million tons of raw milk, 630,000 tons of beef, 1.35 million tons of pork, 1.25 million tons of chicken meat, and 2.47 million tons of egg. For forage crops, the Law has set a goal of 5.08 million tons (TDN), (a rate of 4,461 kg/10a per year), with the cultivated area totaling 1.10 million ha.

In 1999, “the Law concerning appropriate management and the promotion of use of livestock excretion” was enacted and Livestock Population Identification Systems came into full operation in FY 2002.

- **Domestic cooperation and cooperation with neighboring nations**

Japan has supported the Asia-Pacific Area Office in Bangkok by providing funds to the FAO in order to conserve animal genetic resources in Asian regions. In addition, Japan has assisted in the creation of infrastructure including human development in Asian nations through ODA and a variety of fellowships. Currently, the exchange of animal genetic resources between Japan and Asian countries is not being actively pursued for the following two reasons: 1) There are not many livestock with high productivity and favorable characteristics suited to Japanese conditions or possessing desirable features that are currently absent from Japanese livestock; and 2) Even though some breeds have attractive qualities for both countries, they cannot be taken out of their native countries in consideration of the national interest. This hurdle may become higher in the future.

The future exchange of genetic resources will aim at not the introduction of entire breeds but the effective introduction of a specific trait (gene) from one breed into a breed already having high productivity.

3.

3.1 Assessing national capacities

- **Institutions involved in animal production**

The Ministry of Agriculture, Forestry, Fisheries comprises the Minister's Secretariat, Agricultural Production Bureau, General Food Policy Bureau, Management Improvement Bureau, Rural Development Bureau, Agriculture, Forestry, and the Fisheries Research Council Office. With regard to animal production, the Livestock Industry Department is mainly responsible for promoting projects. Local governments have similar organizations and are responsible for administrative issues peculiar to individual local governments.

- **Research and education**

Research and development across a broad range from pure research to practical use are being conducted in research institutes under the jurisdiction of MAFF. Such institutes include the National Agricultural Research Organization and the National Institute of Agrobiological Sciences, and animal production-related research institutes in municipalities.

There are fifty-one universities that have animal production-related departments, and 16 universities that have departments involved in the veterinary sciences. Private research institutes are playing a greater role in research, particularly in research on animal product

processing and feed.

- **Livestock improvement projects**

Projects to improve livestock and poultry in Japan have been promoted independently by prefectures, which have been setting their own improvement goals. In the government, centering on the National Livestock Breeding Center, the National Institute of Livestock and Grassland Science, the Livestock Improvement Association of Japan, the Livestock Registry Association, and Agricultural Cooperatives are jointly conducting improvement projects.

- **Animal Health**

In the government, the Animal Health Division of Livestock Industry Department, Agricultural Production Bureau of MAFF, the National Institute of Animal Health and the Animal Quarantine Service Center are collaborated with local government and with 200 local livestock hygiene service centers for preventing epidemics of livestock.

- **Livestock artificial insemination technicians, transplantation of fertilized eggs and facilities**

The number of qualified artificial insemination technicians and related veterinarians total 65,000 people with 9,500 employees. Of these, there are 2,402 persons engaged in transplantation of *in vivo* fertilized eggs; and 211 people engaged in transplantation of *in vitro* fertilized eggs. There are 2,200 facilities that are conducting animal artificial insemination, of which 670 facilities are also conducting transplantation of fertilized eggs.

- **Required human resources and types/infrastructure**

The key words for animal production in Japan are the environment, increased self-sufficiency of animal feed, and safety and security. Emergency measures to address the BSE problem are being taken with a large budget allocated. Promoting proper use of livestock wastes leads to not only a better environment, but also strengthening of the agricultural infrastructure, an increase in the animal feed self-sufficiency rate and sustainability of agriculture. The improvement of animal waste treatment facilities and the preparation of systems to promote the utilization of these facilities are required.

- **IT systems**

In recent years, the Internet system has been rapidly developed and integrated into normal work activities. The level of utilization of personal computers and the Internet in farming households is 53.1% for PCs, and 32.3% for the Internet (November 2001). Policies, reports, and statistics released by the Japanese Government, municipalities, producer organizations, and consumer groups can be accessed through the Internet. Nationwide LIN (Livestock Information Net) has been developed. The Net is linking homepages related to animal production within Japan and to those overseas. It should be noted however, that individual organizations need to improve their homepages to facilitate use.

- **Improvement of laws and regulations affecting animal genetic resources**

Although there are international laws affecting animals including “the Convention on Biological Diversity”, in terms of domestic laws, “the Wildlife Protection and Hunting Law”, “the Endangered Species Protection Law”, “the Law for the Protection of Cultural Properties” and “the Law Concerning the Protection and Control of Animals”, there are no legal systems or measures that target farm animals exclusively in order to protect and conserve these genetic resources.

The Ministry of the Environment released New National Strategies on Biological Diversity in March 2002. The Ministry of Education, Culture, Sports, Science and Technology initiated the National Bio-resource Project, highlighting the importance of genetic resources as part of the infrastructure for research. In the projects, the agrobiological genebank project should be connected with these projects and systems effectively, and the future direction of conservation of agricultural genetic resources should be reviewed from a national perspective.

- **Assessment of international cooperation, trading, activities and deficiencies**

Japanese experts are being dispatched to the Informal Panel of Experts on the Development of the Global Strategy for AnGR and in the Intergovernmental Technological Working Group on Animal Genetic Resources under the auspices of the FAO. There is also Japanese specialists who sit on the board of directors of the International Agricultural Research Institutes affiliated with the CGIAR (the Consultative Group on International Agricultural Research). Japan is participating in international comparative studies in the area of bovine blood group tests, multicenter coordinated tests, a joint study for the standardization of DNA markers and

preliminary work for test organizations on a global basis to select the markers as internationally acceptable standard markers. Japan will participate in INTERBULL (International Bull Evaluation Service) in 2003. This service conducts international comparisons of assessments of bulls for the dairy industry.

In addition, Japan ratified “the Convention on Biological Diversity”, “the Ramsar Convention” and other treaties addressing wildlife diversity, and based on these treaties, Japan is establishing international protection areas and National Strategies on Biological Diversity, in cooperation with neighboring countries.

4.

4.1 National cross-breeding characteristics

The National Institute of Agrobiological Sciences was designated as a National Focal Point of FAO. Currently, 7 people including one National Coordinator are engaged in working on animal genetic resources. The Society for Research on Native Livestock (with more than 100 members) has promoted research since 1960, focusing on research into the genetic relationship among Asian livestock including Japanese varieties. Since research into other livestock by veterinarians and zoologists is broadly based, it is important to increase the number of personnel that have an interest in these areas and are involved in genetic resource studies and projects, rather than mere capacity building. Currently, no technical problems have arisen concerning conservation and assessments.

In realizing the preservation and conservation of animal genetic resources and with the introduction of sustainable use, it is important to have the understanding, cooperation and participation of the general public. It is crucial to promote awareness of animal genetic resources through IT. In addition, it is necessary to provide detailed information on livestock location wherever possible, particularly for chickens, by ongoing research on the locations where these breeds can be found and their conservation status.

There are many traditional events related to a variety of livestock that are still held, particularly in relation to cattle and horses. The presence and awareness of farm animals is gradually fading from ordinary life. Some animals were bred for specific purposes: bulls for bullfighting, roosters for cockfights, the breeding of pet chickens such as Onagadori and Naganakidori, along with traditional cooking using goats, pigs, and chickens. If such traditions are deemed to be useful ways of conserving indigenous animals, it is necessary to actively disseminate these traditions.

- **Reinforcing conservation efforts**

Most native livestock are presently categorized as ‘critical’ or ‘critical-maintained’. Most native livestock are presently categorized as ‘critical’ or ‘critical-maintained’. Currently, the conservation of genetic resources in Japan is being conducted mainly through the *ex situ* conservation of frozen embryos and semen and small populations of live animal, as a supplementary conservation measure of *in situ* conservation of live animal population. The conservation of frozen embryos and semen is not necessarily satisfactory because the number of collected individuals is limited and freezing technologies have not been well established for some species. Somatic cell cloning technologies of mammals and technologies to produce chicken with chimeric germ cell lines using PGC (Primordial Germ Cell) are potent new technologies for *ex situ* and *in vitro* conservation. For *in situ* conservation, groups set up to protect native livestock and poultry are playing an important role and policies need to be prepared to provide further incentives to the Conservation Group to continue its efforts.

4.2 Priorities of animal species and breeds in regions and communities

Dominant breed utilized throughout Japan do not have local characteristics. Native breeds are connected with specific regions due to their background and history. It is necessary to promote native livestock using systems in accordance with the Basic Law on Food, Agriculture, and Rural Areas. It is necessary to give priority to breeds and varieties designated as ‘critical’ in order to gain a clear understanding of their actual state. It is important to formulate effective policies for conservation in the future, based on the situation of individual breeds revealed in the course of the research.

- **Long-term and sustainable conservation and plans for use**

As a move towards long-term and sustainable use, the “Plans for the promotion of increased production of animal feed” and the “Law concerning appropriate management and the promotion of use of livestock excretion” have been enacted. Activities using native breeds such as Japanese Brown and Japanese Shorthorn are presently ongoing in several regions. It is necessary to identify many breeds as objects for protection in order to prevent extinction. This has to begin before methods including such as germ cell preservation and other conservation measures are fully up and running. To do this, it is necessary to monitor not only the population size of the breed but also to keep and maintain pedigree and to analyze genetic relationship, and to monitor the genetic diversity and variability of the targeted breed or population.

5.

5.1 Recommendations

- **Basic research and technology transfer**

Japan's ODA is mainly being conducted through JICA, and assists developing countries to create infrastructures, which includes capacity building. There are many animal production projects that will have an impact on the future viability of animal populations such as artificial insemination and livestock improvement. If guidelines for the conservation of animal genetic resources in individual countries are formulated, and indigenous breeds is positioned in the center of sustainable agriculture system (with a view to increasing production), these projects seemed to be able to receive ODA.

Universities and national research institutes are dispatching researchers to international research organizations, conducting joint research with researchers visiting Japan through various kinds of fellowship programs, and accepting trainees studying animal production and livestock hygiene. These projects need to continue developing into the future.

It is necessary to improve the domestic IT networks set up to assist with conservation of animal genetic resources. Regarding international IT networks, it is necessary to reinforce the transmission of information in cooperation with the Domestic Animal Diversity Information System (DAD-IS) of FAO.

- **Co-operation in conservation and other activities and equitable sharing of burdens and benefits**

It is also important to assist conservation activities initiated by the private sector. One example is the Tongkonan Cooperation Committee dedicated to the restoration of sites of historical significance and the support of organizations such as the Cattle Museum of Maezawa city in Iwate Prefecture.

Annex 1 The history of animal production in Japan and the background to regional deficiencies

Current regional differences in animal production in Japan have arisen from geographical conditions and the historical background.

In Japan, the utilization of livestock as a food resource resumed after the Meiji era except in some regions, and became highly significant after World War II.

Before the Meiji era (until 1870)

In regions south of Kyushu, particularly in Okinawa, pigs and goats have been bred for food for centuries. Okinawa, on which the central government (Japan's feudal government in Edo era) had little influence, has used pigs and goats for special ritual events (“*hare*”) for food. A culture peculiar to Okinawa is partly maintained through these customs and rituals. From the Tohoku region to Hokkaido, hunting provided some animal meat for food.

Although it has been said that Japanese people were not accustomed to eating meat, this abstinence was confined to central regions. In peripheral regions where such influences did not extend, animals were used as food.

- **Outline of the diversity of livestock and poultry in Japan before the Meiji era**

Cattle: Cattle were widely bred in various regions as farm animals. There are cattle strains peculiar to the areas they were bred in. In 1310, there were 10 strains. In the late 1700s, centering on west Japan, cattle with superior characteristics began to be produced and several tens of strains were successfully bred, all derived from a cow named “*Tsuru*”. Such cattle are the origin of the current Japanese Black. Cattle were bred using closed methods focusing on such qualities as fertility and their capacity to provide labor.

In other regions, a lot of cattle were bred as farm animals though no accurate records have been left.

Pigs: It was forbidden to eat pigs in Honshu and they were neither a farm animal nor a pet, so they were only bred in a very limited number of regions such as in the suburbs of Nagasaki, which was the only place open to foreign countries, and Kagoshima, where the influence of the government did not penetrate, and Okinawa. The pigs were small and weighed less than 50kg. In the New Year and during festivals, they were slaughtered and eaten (they were bred in western Japan).

Chickens: Chickens were a species that people did not regard as taboo to eat, unlike four-footed animals, but most Japanese chicken breeds produced before the Meiji era were for pets or used for cockfighting. Chickens for practical use were small in number, and only a group of Kochin were used in this way. It was not until the Meiji era that Nagoya began to make practical use of chickens. On the other hand, ornamental chicken breeds such as Onagadori and Chabo and chicken breeds used in cockfighting like Shamo have been speciated.

Horses: Horses were used as farm animals and for military purposes. The 130 horses unearthed from ancient battlefields in the Kamakura era were small- to medium-size with a height of 109-140 centimeters. Major breeding centers for horses before the Meiji era were the Tohoku region and the southern part of Kyushu. It is thought that horses of mainly medium size were bred in Honshu, judging from the size of the indigenous breeds still surviving.

Goats: Goats were bred mainly in regions south of Kyushu. Small-sized goats were bred as livestock for meat. Native goats such as Shiba, Yaku, and Tokara in Nagasaki are well known. All of them were bred to provide a sustainable supply of meat.

No statistics for other animals survive although wild species were utilized through hunting. Accompanying the advent of meat eating, sheep, rabbits, quail and other animals have been bred; however, full utilization of such animals was not achieved until recent times.

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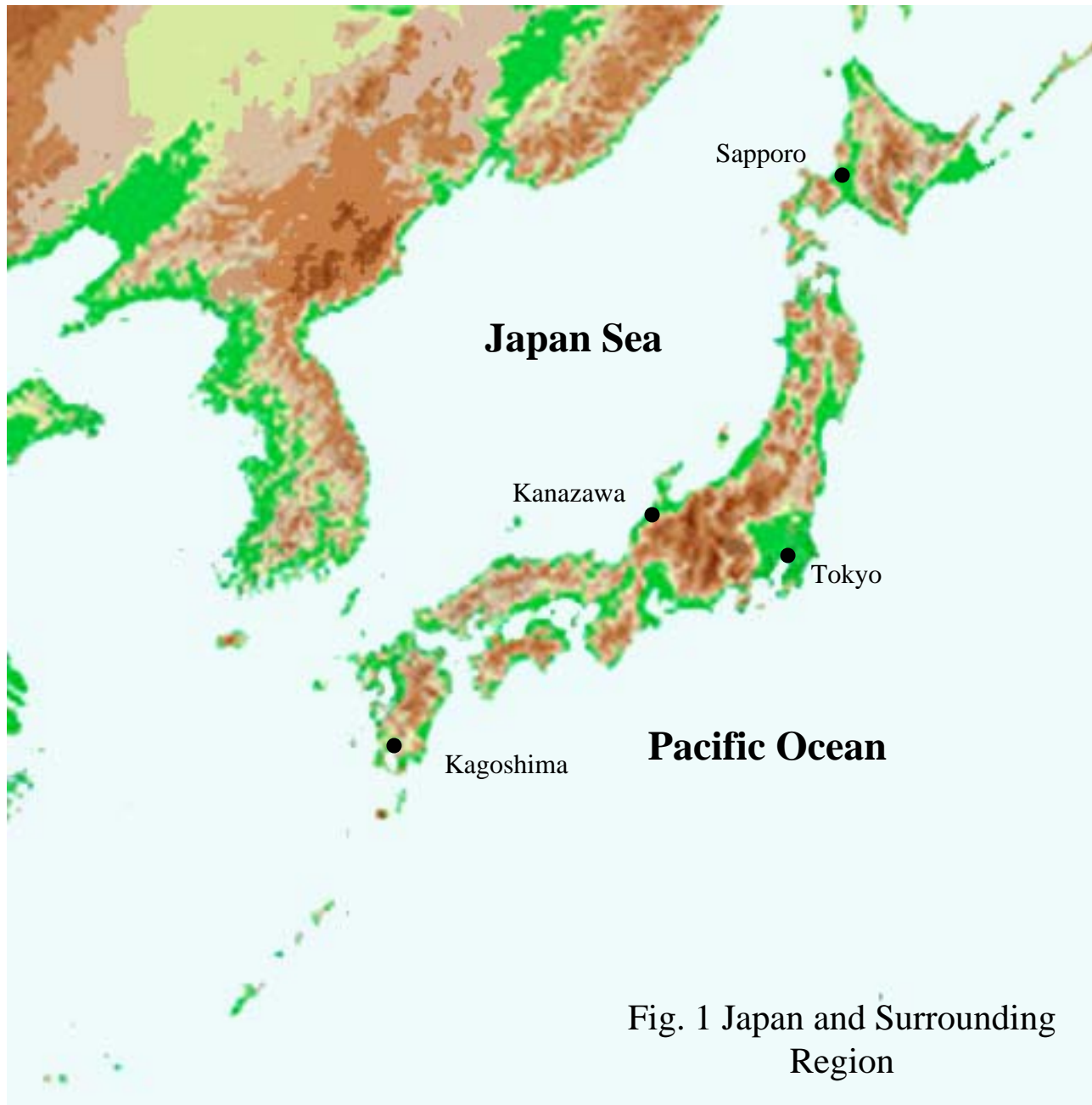


Fig. 1 Japan and Surrounding Region

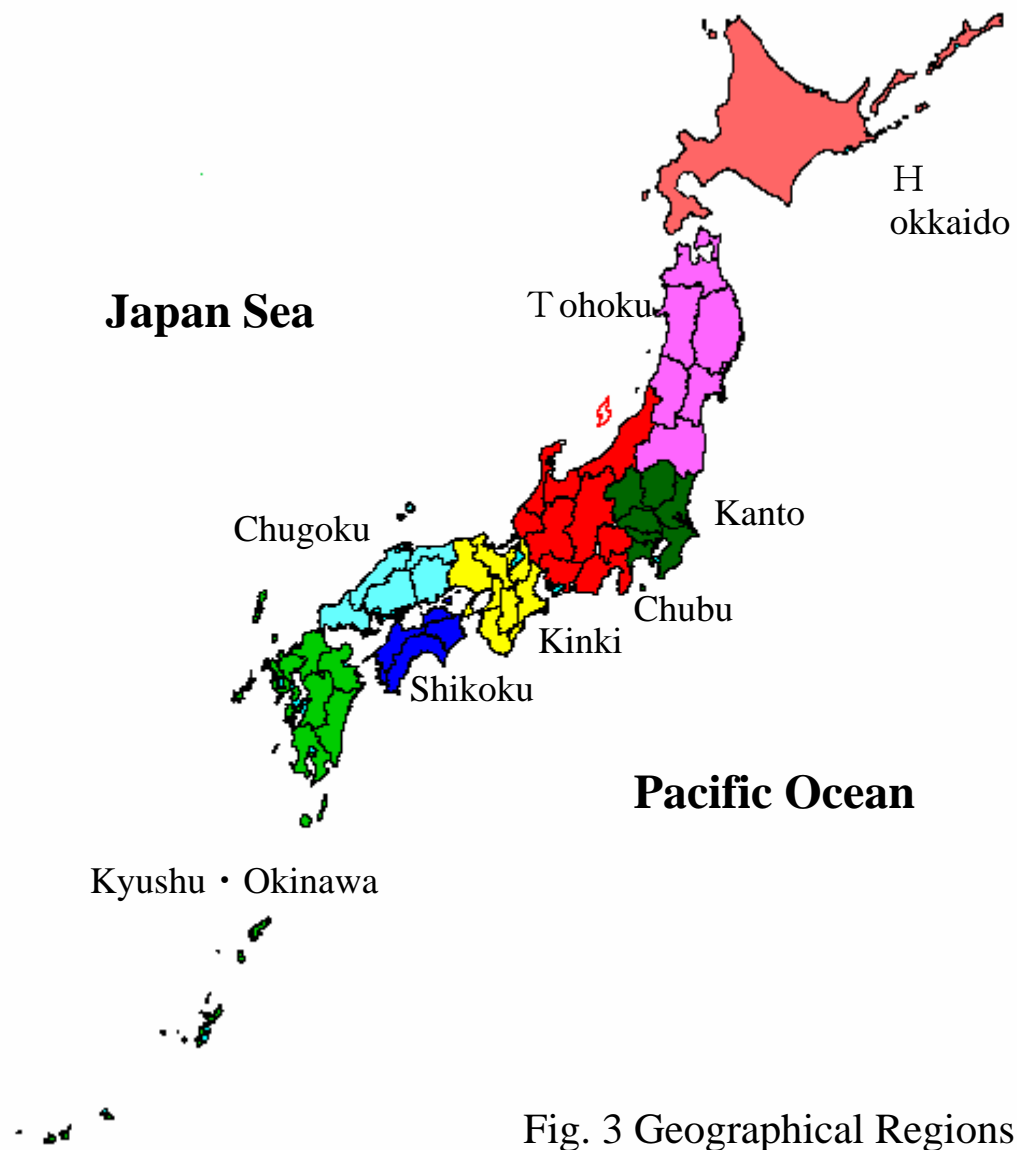
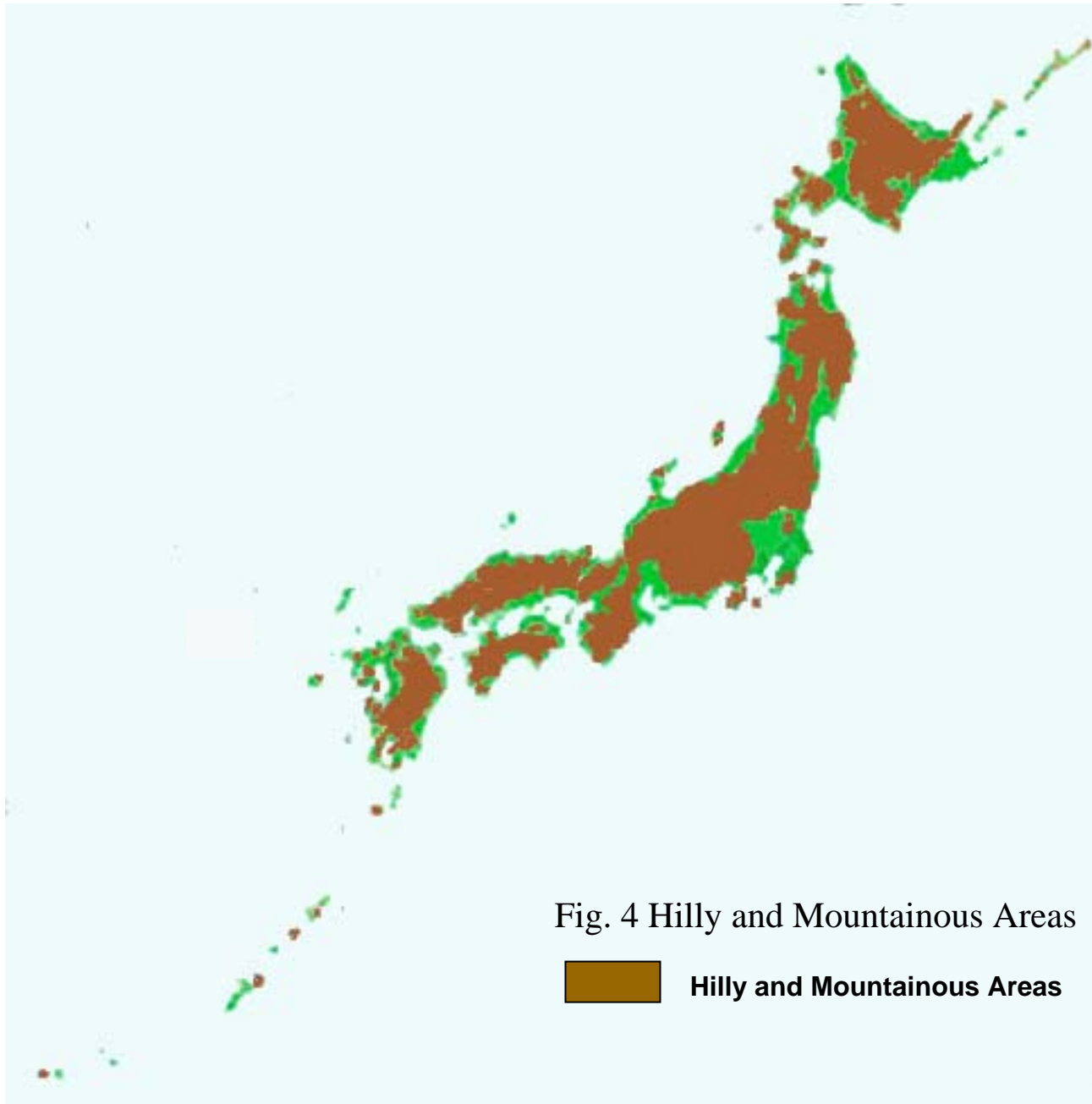
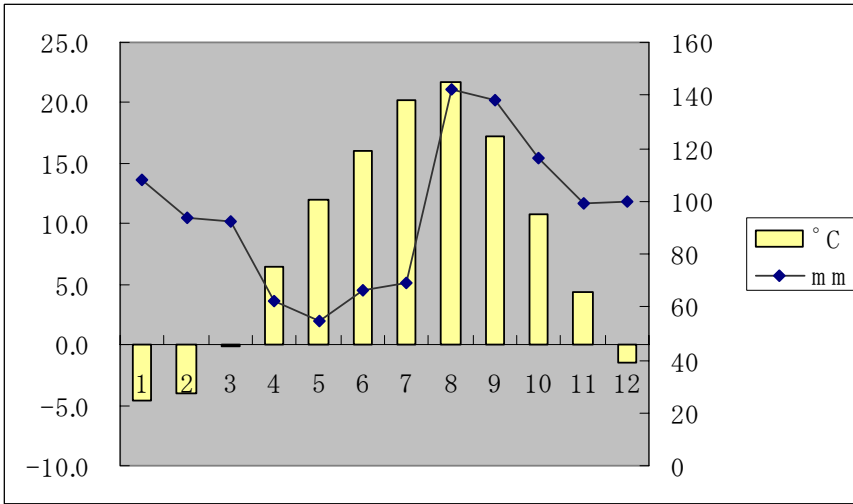
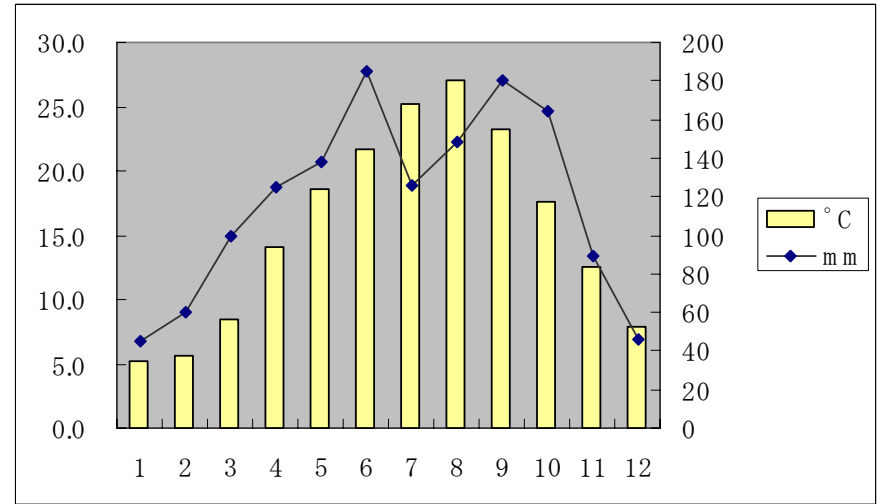


Fig. 3 Geographical Regions of Japan

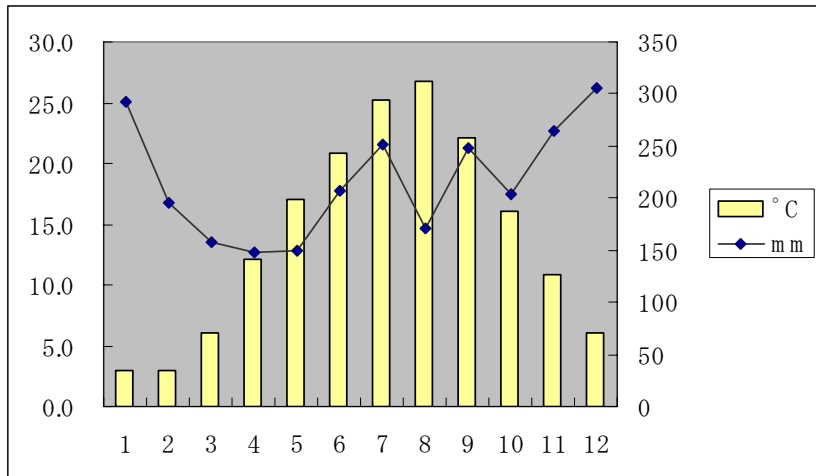




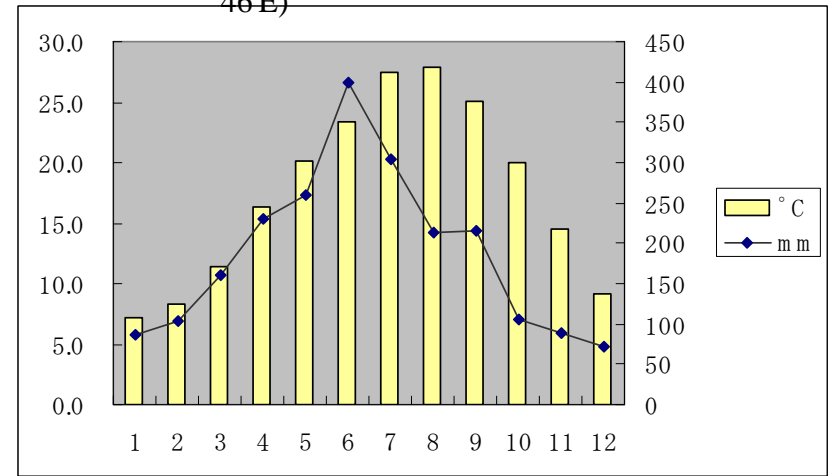
Sapporo(43° 03'N,141° 20'E)



Tokyo(35° 41'N,139° 46'E)



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Region	City	Latitude Longitude	Temperature		Precipitation												
			° C	mm	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.	Annual
Hokkaido	Sapporo	43° 03' N 141° 20' E	° C	mm	-4.6	-4.0	-0.1	6.4	12.0	16.1	20.2	21.7	17.2	10.8	4.3	-1.4	8.2
Hokuriku Japan Sea side	Kanazawa	36° 33' N 136° 39' E	° C	mm	2.9	2.9	6.0	12.1	17.0	20.8	25.2	26.8	22.1	16.1	10.8	6.0	14.1
Kanto Pacific Ocean side	Tokyo	35° 41' N 139° 46' E	° C	mm	5.2	5.6	8.5	14.1	18.6	21.7	25.2	27.1	23.2	17.6	12.6	7.9	15.6
Kyushu	Kagoshima	31° 34' N 130° 33' E	° C	mm	7.2	8.3	11.4	16.4	20.1	23.4	27.4	27.9	25.1	20.0	14.5	9.2	17.6
South-West Islands	Okinawa	26° 12' N 127° 41' E	° C	mm	16.0	16.3	18.1	21.1	23.8	26.2	28.3	28.1	27.2	24.5	21.4	18.0	22.4

(Average : 1961-1990)

(Rika Nenpyo, Chronological Scientific Tables, 2000, Maruzen)

Table 2 The Number of Species and Subspecies in The 4th National Survey on The Natural Environment (All-Species Survey) and in the Japanese Red List

Mammals	Number of Species	Number of Species and Subspecies in the Japanese Red Data Book							
		EX	EW	IA	IB	II	NT	DD	合計
Insectivora	18				1	2	9		12
Chiroptera	39	2		5	14	12		7	40
Primates	2						1		1
Lagomorpha	5				1				1
Rodentia	33			2	2		3		7
Carnivora	31	2		3	2	2	3	2	14
Artiodactyla	7								
Total	135								
including spp. a.	241	4		10	20	16	16	9	75

Birds	Number of Species	Number of Species and Subspecies in the Japanese Red Data Book							
		EX	EW	IA	IB	II	NT	DD	合計
Steganopodes	3								
Anseriformes	47	1			1	3	2	5	12
Galliformes	7					1	1	2	4
Columbae	9	2			2	1			5
others	472	10	1	17	22	43	13	8	114
Total	538								
including spp. a.	70	13	1	17	25	48	16	15	135

*Exotic species are included in the list of All-species survey.

Japan Integrated Biodiversity Information System (<http://www.biodic.go.jp/english/J-IBIS.html>)

An outline of definitions of the categories based on IUCN Red Data Book Categories

●Extinct (EX)

:species thought to be extinct in Japan

●Extinct in the Wild (EW)

:species found only in captivity or cultivation

<Threatened >

●Threatened I (CR+EN)

:species facing a risk of extinction

○IA Critically Endangered (CR)

○IB Endangered (EN)

●Threatened II (VU)

: species facing a very high risk of extinction

●Near Threatened (NT)

: species facing a difficulty in maintaining the viable population

●Data Deficient (DD)

Old categories

Extinct (Ex)

—

Endangered (E)

Vulnerable (V)

Rare (R)

—

Table 3 Major Indexes of Hilly and Mountainous Area

Item	Nationwide	Hilly and mountainous area	Hilly agricultural area		Mountainous agricultural area	
			area	agricultural area	area	agricultural area
Total area(1999) (1,000 ha)	37,179 (100.0)	25,277	11,904		13,373	
Cultivated area(1999) (1,000 ha)	4,866 (100.0)	2,013 (41.4)	1,500 (30.8)		513 (10.5)	
Paddy fields(1999) (1,000 ha)	2,659 (100.0)	1,016 (38.2)	766 (28.8)		250 (9.4)	
Total number of households(1995) (1,000 households)	44,108 (100.0)	5,479 (12.4)	3,990 (9.0)		1,489 (3.4)	
Total population(1995) (1,000 persons)	125,570 (100.0)	17,465 (13.9)	12,860 (10.2)		4,605 (3.7)	
Total number of households(2000) (1,000 households)	3,120 (100.0)	1,318 (42.2)	915 (29.3)		403 (12.9)	
Change in number from 1995 (1,000 household)	▲ 324	▲ 142	▲ 94		▲ 48	
Farming households population(2000) (1,000 persons)	13,458 (100.0)	5,355 (39.8)	3,775 (28.1)		1,580 (11.7)	
Change in number from 1995 (1,000 persons)	▲ 1,626	▲ 662	▲ 451		▲ 212	
Farming engagement population(2000) (1,000 persons)	3,891 (100.0)	1,493 (38.4)	1,094 (28.1)		399 (10.2)	
Proportion of population over 65 years old	52.9	56.5	55.4		59.4	
Agricultural gross production amount(1999) (100 million yen)	94,718 (100.0)	34,661 (36.6)	27,026 (28.5)		7,635 (8.1)	
Rice cropping	23,650 (100.0)	8,434 (35.7)	6,524 (27.6)		1,910 (8.1)	
Vegetables	22,492 (100.0)	6,143 (27.3)	4,588 (20.4)		1,555 (6.9)	
Fruits	8,071 (100.0)	3,485 (43.2)	3,027 (37.5)		458 (5.7)	
Ornamental plants	4,636 (100.0)	1,240 (26.7)	981 (21.2)		259 (5.6)	
Livestock	25,566 (27.0)	11,759 (33.9)	8,958 (33.1)		2,801 (36.7)	

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Table 4 Trend of Agricultural Production

(100 million yen, (%))

	1975	1985	1995	1997	1998	1999	2000 Ratio (estimated)	Ratio
Total agricultural production	90,514	116,295	104,498	99,113	99,264	93,638	91,224	(100.0)
Total cultivated breeding	65,012	82,996	78,513	72,492	73,891	68,209	65,990	(72.3)
Rice cropping	34,658	38,299	31,861	27,792	25,148	23,761	23,246	(25.5)
Vegetables	14,673	21,104	23,978	23,090	25,953	22,395	21,124	(23.2)
Total livestock	23,404	31,686	25,125	25,784	24,653	24,647	24,541	(26.9)
Dairy cattle	5,655	8,876	7,917	7,942	7,850	7,707	7,725	(8.5)
Milk production	4,468	7,596	7,014	7,043	7,012	6,879	6,856	(7.5)
Meat cattle	2,467	4,727	4,494	4,533	4,464	4,400	4,514	(4.9)
Pig	7,333	7,910	5,059	5,249	4,929	4,802	4,662	(5.1)
Chicken	7,471	9,342	7,011	7,443	6,728	7,050	6,972	(7.6)
Egg production	4,776	5,099	4,096	4,638	3,996	4,237	4,208	(4.6)
Other Livestock	478	830	645	617	683	688	668	(0.7)
Other Agriculture	2,098	1,613	860	837	720	782	693	(0.8)

Monthly Trends of Livestock Production (May, 2002)

Table 5-1 Animal Genetic Resources Species and Breeds Found in Japan

	Species	Breeds	Present Main Uses	Native or Exotic	Risk Status	Conservation Effort or Program	Conservation			
							Live	Frozen Semen	Frozen Embryo	Frozen Somatic Cell
Mammals	Cattle	Japanese Black	Meat Production	Native	Not at Risk	—	—	—	—	—
		Japanese Brown	Meat Production	Native	Not at Risk	—	—	—	—	—
		Japanese Poll	Meat Production	Native	Critical	Yamaguchi Prefecture	○	○	—	—
		Japanese Shorthorn	Meat Production	Native	Not at Risk	—	—	—	—	—
		Aberdeen-Angus	Meat Production	Exotic	—	—	—	—	—	—
		Hereford	Meat Production	Exotic	—	—	—	—	—	—
		Charolais	Meat Production	Exotic	—	—	—	—	—	—
		Holstein	Milk Production	Exotic	—	—	—	—	—	—
		British-Friesian	Milk Production	Exotic	—	—	—	—	—	—
		Jersey	Milk Production	Exotic	—	—	—	—	—	—
		Guernsey	Milk Production	Exotic	—	—	—	—	—	—
		Airshire	Milk Production	Exotic	—	—	—	—	—	—
		Brown Swiss	Milk Production	Exotic	—	—	—	—	—	—
		Red Danish	Milk Production	Exotic	—	—	—	—	—	—
	Mishima Cattle	Meat Production	Native	Critical-Maintained	Natural monument.	○	○	○	○	
	Kuchinoshima Feral Cattle	Meat Production	Native	Critical-Maintained	University	○	—	—	—	
	Pig	Middle White	Meat Production	Exotic	—	—	—	—	—	—
		Berkshire	Meat Production	Exotic	—	—	—	—	—	—
		Landrace	Meat Production	Exotic	—	—	—	—	—	—
		Large White	Meat Production	Exotic	—	—	—	—	—	—
		Hampshire	Meat Production	Exotic	—	—	—	—	—	—
		Duroc	Meat Production	Exotic	—	—	—	—	—	—
		Spotted	Meat Production	Exotic	—	—	—	—	—	—
		Chester White	Meat Production	Exotic	—	—	—	—	—	—
		Kagoshima Berkshire	Meat Production	Native*	Not at Risk	—	—	—	—	—
		Aghu (Shimabuta)	Meat Production	Native	Critical-Maintained	Okinawa (Kagoshima)	○	—	—	—
		Ohmini	Laboratory Animal	Native	Critical-Maintained	Laboratory Animal Supply	○	—	—	—
	Wild Pig/Hybrid	Meat Production	Wild, Hybrid	—	—	—	—	—	—	
	Horse	Percheron and Its Cross	Meat and Banei**	Exotic	—	—	—	—	—	—
		Breton and Its Cross	Meat and Banei	Exotic	—	—	—	—	—	—
		Thoroughbred and Its Cross	Horse Race	Exotic	—	—	—	—	—	—
		Arab and Its Cross	Horse Race	Exotic	—	—	—	—	—	—
		Dosanko	Horse Riding	Native	Not at Risk	Conservation Association	○	○	—	—
Kiso		Horse Riding	Native	Endangered-Maintained	Conservation Association	○	○	—	—	
Noma		Horse Riding	Native	Critical-Maintained	Conservation Association	○	—	—	—	
Tsushima		Horse Riding	Native	Critical-Maintained	Conservation Association	○	○	—	—	
Misaki		Horse Riding	Native	Endangered-Maintained	Conservation Association	○	—	—	—	
Tokara		Horse Riding	Native	Endangered-Maintained	Conservation Association	○	○	—	—	
Miyako		Horse Riding	Native	Critical-Maintained	Conservation Association	○	○	—	—	
Yonaguni		Horse Riding	Native	Endangered-Maintained	Conservation Association	○	—	—	—	
Goat		Japanese Saanen	Milk Production	Native	Not at Risk	NLC	○	○	—	—
	Chubby	Laboratory Animal	Native	Endangered-Maintained	NLC, NIGLS, Other	○	—	—	—	
	Tokara	Meat Production	Native	Critical-Maintained	University, Zoo	○	—	—	—	
Sheep	Japanese Corriedale	Wool Production	Native	Not at Risk	—	○	—	—	—	
	Suffolk	Meat Production	Exotic	—	—	—	—	—	—	
Rabbit	Japanese White	Laboratory Animal	Native	Not at Risk	—	○	—	—		
Mink		Hide Production	Exotic	—	—	○	—	—		
Shika Deer		Meat, Velvet and Horn	Wild	Not at Risk	—	○	—	—		
Red Deer		Meat, Velvet and Horn	Wild, Exot	—	—	—	—	—		
Samber		Meat, Velvet and Horn	Wild, Exot	—	—	—	—	—		
Fallow Deer		Meat, Velvet and Horn	Wild, Exot	—	—	—	—	—		
Taiwanese Shika Deer		Meat, Velvet and Horn	Wild, Exot	—	—	—	—	—		

* Kagoshima Berkshire has 70 years history from the first breeding pair has been introduced.

** Draft Horse Race, limited in Hokkaido Region (<http://www.banei-keiba.or.jp/information/banei-race%20English.htm>)

Table 5-2 Animal Genetic Resources Species and Breeds Found in Japan

Bird	Species	Breeds	Present Main Use	Native or Exotic	Risk Status	Conservation Effort or Program	Conservation	
							Live	Frozen Semen
Bird	Chicken	White Leghorn	Egg Production	Exotic	Not at Risk	-	-	-
		Barred Plymouth Rock	Hybrid Production	Native	Not at Risk	-	-	-
		Rhode Island Red	Hybrid Production	Native	Not at Risk	-	-	-
		New Hampshire	Hybrid Production	Exotic	Not at Risk	-	-	-
		Nagoya	Meat, Egg, Hybrid Product	Native	Not at Risk	-	-	-
		White Plymouth Rock	Hybrid Production	Exotic	Not at Risk	-	-	-
		White Cornish	Hybrid Production	Exotic	Not at Risk	-	-	-
		Shamo	Cook Fighting, Fancy, Hybrid	Native	Not at Risk	Natural monument.	○	○
		0-shamo	Cook Fighting, Fancy, Hybrid	Native	DD	Natural monument.	-	○
		Ko-shamo	Fancy	Native	DD	Natural monument.	-	○
		Ygido	Fancy	Native	DD	Natural monument.	-	-
		Kinpa	Fancy	Native	DD	Natural monument, Akita Pref.	○	○
		Hinai-Dori	Fancy, Hybrid	Native	Not at Risk	Natural monument, Akita Pref.	○	○
		Satsuma-Dori	Cook Fighting, Fancy, Hybrid	Native	Not at Risk	Natural monument.	○	○
		Japanese Long-tailed Fowl	Fancy	Native	DD	Natural monument., Kochi Pref., Nankoku shi	○	-
		Totenko	Fancy	Native	DD	Natural monument.	○	○
		Japanese Rumples Bantam	Fancy	Native	DD	Natural monument.	○	-
		Japanese Long-Saddled Bantam	Fancy	Native	DD	Natural monument.	○	-
		Koeyoshi	Fancy	Native	DD	Natural monument.	○	○
		Tomaru	Fancy	Native	DD	Natural monument.	○	○
		Minohiki	Fancy	Native	DD	Natural monument.	○	-
		Jidori or Japanese-Old type	Fancy, Hybrid	Native	DD	Natural monument.	○	○
		Gifu-jidori	Fancy, Hybrid	Native	Not at Risk	Natural monument., Gifu Pref.	-	-
		Tosa-jidori	Fancy, Hybrid	Native	Not at Risk	Natural monument., Kochi Pref.	-	-
		Shokoku	Fancy	Native	DD	Natural monument.	○	-
		Japanese Bantam	Fancy	Native	DD	Natural monument.	○	○
		Katsura-chabo	Fancy	Native	DD	Natural monument.	-	-
		Shojo-chabo	Fancy	Native	DD	Natural monument.	-	-
		Ukokkei	Fancy	Native	DD	Natural monument.	○	○
		Kawachiyakko	Fancy	Native	DD	Natural monument.	○	-
		Jittoko	Fancy	Native	DD	Natural monument.	○	-
		Kurokasiwa	Fancy	Native	DD	Natural monument., Ymaguchi Pref.	○	-
		Tosa Cochin	Fancy	Native	DD	NLBC	○	○
		Kumamoto	Fancy	Native	DD	NLBC	○	-
		Kureko-Dori	Fancy	Native	DD	-	-	-
		Gankei	Fancy	Native	DD	-	-	-
		Utai-Chahn	Fancy	Native	DD	-	-	-
		Okinawa Hige-Jidori	Fancy	Native	DD	-	-	-
		Miyaji-Dori	Fancy	Native	DD	-	-	-
		Ingii	Fancy	Native	DD	-	-	-
		Mikawa	Fancy	Native	Not at Risk	Aichi Pref., NLBC	○	○
		Sado Hige-Jidori	Fancy	Native	DD	-	○	-
Duck/Hybrid		Meat, Hybrid Production				○		
	Osaka-Duck	Meat Production	Native	DD	Osaka Prefecture	-	-	
Turkey		Meat Production	Exotic	-	-	-	-	
Quail		Meat Production	Native	-	-	-	-	
Goose		Meat Production	Exotic	-	-	-	-	
Guinea Fowl		Meat Production	Exotic	-	-	-	-	
Pheasant		Meat Production	Wild	-	-	-	-	

DD : Data Deficient

Note: The species and breeds adopted in this table are Japanese native breeds and the breeds which was shown their statistics in the "Annual Animal Breeding Related References"

(-) : DD or popular breeds in case of native breeds or without special attention in case of exotic breeds

Table 6 Number of Native Cattle

	Total No of Cattle	Number of Breeding Cow	Year of data collected	Ratio to Previous Data	Previous Data	Ratio to Previous Data	Previous Data
Japanese Poll	156	56	2001	0.60	1995		
Japanese Brown		29387	2000	0.64	1995		
Japanese Shorthorn		7204	2000	0.33	1990		
Japanese Black	c. a. 1.6 million	1.0 million	2000				
Mishima Cattle	108	70	23/06/1905	0.22	1967	3.27	1975
Kuchinoshima Feral Cattle							
Kuchinoshima	44-66	nos in 1999					
Nagoya University	24		2001				
Kagoshima University	20		2001				

Table 7 Exotic Breeds Crossed with Indigenous Cattle for Establishment of Modern Japanese Native Breeds in Each Prefecture

Name of modern native breed	Prefecture	Crossed exotic breeds
Japanese Black	Kyoto	Brown Swiss
	Hyogo	Shorthorn, Devon, Brown Swiss
	Okayama	Shorthorn, Devon
	Hiroshima	Simmental, Brown Swiss, Shorthorn, Ayrshire
	Tottori	Brown Swiss, Shorthorn
	Shimane	Devon, Brown Swiss, Simmental, Ayrshire
	Yamaguchi	Devon, Ayrshire, Brown Swiss
	Ehime	Shorthorn
	Ohita	Brown Swiss, Simmental
	Kagoshima	Brown Swiss, Devon, Holstein
Japanese Brown	Kochi	Simmental, Korean Cattle
	Kumamoto	Simmental, Korean Cattle, Devon
Japanese Poll	Yamaguchi	Aberdeen-Angus
Japanese Shorthorn	Aomori	Shorthorn
	Iwate	Shorthorn
	Akita	Shorthorn, Devon, Ayrshire

Table 8 Pig and Kagoshima Berkshire Production in Kagoshima Prefecture

	1965	1970	1975	1980	1985	1990	1991	1992		
Total pig	256,903	367,780	790,330	1,351,331	1,748,763	2,203,863	2,194,882	2,233,749		
Kagoshima Berkshire	213,486	61,051	12,645	37,640	27,639	95,400	106,000	112,000		
Proportion of Kagoshima Berksh	83.1	16.6	1.6	2.8	1.6	4.3	4.8	5.0		
	1993	1994	1995	1996	1997	1998	1999	2000	2001	
Total pig	2,307,405	2,298,289	2,228,436	2,031,771	2,031,067	2,086,085	2,074,637	2,048,769		
Kagoshima Berkshire	112,500	112,700	124,800	137,300	177,800	218,800	256,000	278,500	327,000**	
Proportion of Kagoshima Berksh	4.9	4.9	5.6	6.8	8.8	10.5	12.3	13.6		

References: Production and Shipment Statistics of Livestock Products *Kagoshima Prefecture ** Estimate from Preliminary Report
 (From Kagoshima Berkshire Producer Conference Homepage)

*

eport

Table 9 Japanese Native Chicken Breed Defined by
Japan Chicken Association

Name of Breeds	Local Name
Aizu-Jidori	Aizu-Jidori
Ise-Jidori	Ise-Jidori
Iwate-Jidori	Iwate-Jidori
Ingii	Ingii-Dori
Ukokkei	Ukokkei
Utai-Chahn	Utai-Chahn
Ekoku	Ekoku
Barred Plymouth Rock	Ohan Plymouth Rock
O-Shamo	O-Shamo
Okinawa Hige-Jidori	Okinawa Hige-Jidori
Japanese Long-tailed Fow	Onagadori
Kawachiyakko	Kawachiyakko
Gankei	Gan-Dori
Kinpa	Kinpachi-Dori
Gifu-jidori	Gifu-jidori
Kumamoto	Kumamotoshu
Kureko-Dori	Kureko-Dori
Kurokashiwa	Kurokashiwa
Cochin	Cochin
Koeyoshi	Koeyoshi
Ko-Shamo	Ko-shamo
Sado Hige-Jidori	Sado Hige-Jidori
Satsuma-Dori	Satsuma-Dori
Shibatori	Shiba-Dori
Shokoku	Oguni-Dori
Jittoko	Jittoko
Japanese Bantam	Chabo
Tsushima-Jidori	Tsushima-Jidori
Totenko	Totenko-Dori
Tomaru	Tomaru
Tosa Cochin	Tosa-Kyukin
Tosa-jidori	Tosa-jidori
Nagoya	Nagoyashu
Nankin-Shamo	Nankin-Shamo
Hinai-Dori	Hinai-Dori
Mikawa	Mikawashu
Minohiki	Minohiki-Dori
Miyaji-Dori	Miyaji-Dori
Ygido	Hachikido
Yamato-Shamo	Yamato-Shamo
Rhode Island Red	Rhode Island Red

From The Definition of National Bland Chicken by
Japan Chicken Association (1997)

<http://village.infoweb.ne.jp/~takakis/meigara.htm>

Table10 Transition in Numbers of Japanese Native Horse in Each Breed
(head)

year	Dosanko	Kiso	Noma	Tsushima	Misaki	Tokara	Miyako	Yonaguni	Total
1965		510		1,182					
1966		470		1,029					
1967		350		969					
1968		190		808				210	
1969		120		726					
1970		90		654				170	
1971		55		580	60				130
1972		53	5	499	60				122
1973	1,180	46	5	409	53	44			1,816
1974	1,298	45	5	321	55				1,800
1975	1,337	33	5	287	60	45			1,825
1976	1,095	32	5	243	62	49			1,554
1977	1,093	38	5	243	63	54	15		1,559
1978	1,155	43	6	215	67	60	14		1,619
1979	1,286	40	7	181	75	61	14		1,723
1980	1,307	39	8	171	82	62			1,724
1981	1,478	56	10	123	80	68	13		1,885
1982	1,581	50	11	109	84	69	10		1,969
1983	1,681	56	13	92	90	69	7		2,068
1984	1,680	61	15	89	94	70	9		2,078
1985	1,666	64	17	75	91	75	8		2,056
1986	1,545	66	22	61	99	88	9		1,952
1987	1,731	66	25	59	102	89	10		2,147
1988	2,083	67	28	59	96	91	11		2,506
1989	2,245	69	30	65	97	92	14		2,701
1990	2,561	68	34	75	93	104	15	115	3,065
1991	2,925	68	35	89	84	118	19	112	3,450
1992	2,665	98	36	92	86	114	21	91	3,203
1993	2,834	86	38	92	82	110	25	94	3,361
1994	2,928	92	42	84	87	115	23	95	3,466
1995	2,614	87	47	79	88	113	21	108	3,157
1996	2,693	84	50	70	92	110	21	81	3,201
1997	2,419	76	63	40	92	108	16	81	2,895
1998	2,408	57	75	33	98	106	16	99	2,892
1999	2,174	64	72	32	112	103	17	103	2,677
2000	1,950	86	74	30	119	113	18	120	2,510
2001		127	77	34	117	121	19	106	

Summary of Annual Liaison Meeting for the Conserve and Utilization of Japanese Native Horses (2001)

Table 11 Number of Native Goat

	Institutions	Nos. head	Note
Tokara	Kagoshima University	20	include mongrels
	Hirakawa Zoo	15	
	Toshima-mura Municipal Goat Farm	c. a. 10	
Chubby	N I G L S	c. a. 10	without castrated individual
	N L B C	50	

NIGLS: National Institute of Grassland and Livestock Institute

NLBC: National Livestock Breeding Center

Table 12-1 Animal Genetic Resources Maintained by Project of MAFF
Japan(March 13, 2001)

Mammal	No. of Breed or Lines	Breed or Species Name	
Cattle	41	Mishima	
		Kuchinoshima Feral	
		Japanese Polled	
		Japanese Short Horn	
		Japanese Brown-Kochi	2 strains
		-Kumamoto	3 strains
		Japanese Black	28 lines
		Brahman	
		Santa Gertrudis	
Luxi Yellow			
Buffalo		Swamp (Okinawa)	
Horse	5	Tsushima	
		Kiso	
		Toakara	
		Hokkaido	
		Miyako	
Pig	30	Meishan	2 lines
		Middle White	2 lines
		Berkshire	1 line
		Landrace	10 lines
		Duroc	2 lines
		Dong Bei Min Zhu	
		Beijing Black	
		Large White	5 lines
		Jinhua	
Goettingen Miniature			
Hampshire			
Sheep	3	Manx Loaghtan	
		Finnish Landrace	
		Barbados Black Belly	
Goat	2	Chubby	
		Japanese Saanen	
Rabbit	4	Dutch	
		Japanese White Large	
		Japanese White Small	
		Japanese Angora	
Mouse	37	Laboratory Strains	35 strains
		Knockout Mouse line	2 lines
	123		

Table 12-2 Animal Genetic Resources Maintained by
Project of MAFF Japan (March 13, 2001)

Poultry	No. of Breeds or Lines	Breed or Species Name	
Chicken	68	Mikawa	
		Nagoya	4 lines
		Tosa Cochin	
		Hinai	2 lines
		Satsuma	3 lines
		Shamo	3 lines
		Shamo-Middle	
		Kumamoto	
		Rhode Island Red	2 lines
		Barred Plymouth Rock	2 lines
		Ukokkei	2 lines
		Totenko	
		Koeyoshi	
		Tomaru	2 lines
		Gifu-Jidori	2 lines
		Iwate-Jidori	2 lines
		Shokoku	2 lines
		Kinpa	
		Tsushima-Jidori	
		Tosa-Jidori	
		Fayomi	
		New Hampshire	2 lines
		White Plymouth Rock	2 lines
Buff Cochin			
Brahma			
Australorp			
Minorca			
Inbred Strain	10 strains		
Hamburgh			
Brabanter			
Araucana			
White Babcock	3 lines		
Japanese Quail	3	Domesticated Line	
		Wilde Caught Line	
		Mutant Line	
	71		

Table 13 Japanese Endangered Livestock Breeds

Breed	Status	Population size	MAFF Gene Bank	Introduction
Cattle				
Kuchinoshima	Critical	< 100 1995	Semen	Before 1988
Mishima	Critical	65 1991	Live, Embryo, Semen	Before 1988 and 1996
Goat				
Tokara	Critical	< 100 1995		
Chubby	Endangered	100 - 500 1995	Live	Before 1988
Horse				
Kiso	Critical	90 1991	Live, Semen	1990
Misaki	Critical	84 1991		
Miyako	Critical	19 1991	Live	1996
Noma	Critical	35 1991		
Taishu	Critical	89 1991	Live, Semen	1989
Taokara	Critical	100 -200 1991	Live, Semen	1991
Yonaguni	Critical	112 1991		
Pig			Using as Experimental	
Ohmini	Critical	100 1978	Animal	
Chicken				
Shiba-tori	Critical	< 100 1993		
Japanese creeper	Endangered	100 - 1000 1987		
Japanese long-tail	Endangered	100 - 1000 1991		
Kawachiyakko	Endangered	100 - 1000 1987		
Koeyoshi	Endangered	100 - 1000 1987	Semen	1991
Kurokashiwa	Endangered	100 - 1000 1987		
Minohiki	Endangered	100 - 1000 1987		
Okinawa native	Endangered	100 - 1000 1987		
Sadohige-Jidori	Endangered	100 - 1000 1987		
Tosa cochin	Endangered	100 - 1000 1987	Live	1999

World Watch List for Domestic Animal Diversity (3rd ed.) FAO (2000)

Table 14 List of Publications by MAFF Genebank Project

(Published from National Institute of Agrobiological Resources)

Management of Collection and Preservation

Catalogue of Animal Genetic Resources MAFF Gene Bank Project (First Edition) (1991)

Catalogue of Prefectural Animal Genetic Resources (unfinished manuscript) (1992)

Manual for Preservation and Management of Animal Genetic Resources (1993)

Manual for Passport Information of Animal Genetic Resources (1992)

Manual for Passport Information of Animal Genetic Resources (Edition) (1995)

Manual for Passport Information of Animal Genetic Resources (Revised Edition) (1996)

Characterization and Evaluation

The Descriptors for Characterization and Evaluation in Animal Genetic Resources (unfinished manuscript) (1991)

The Descriptors for Characterization and Evaluation in Animal Genetic Resources (Fascicule Edition) (2001)

The Descriptors for Characterization and Evaluation in Animal Genetic Resources (Supplement, Fascicule Edition) (2002)

Characteristics of Animal Genetic Resources MAFF Gene Bank Project (No. 1) (1992)

Characteristics of Animal Genetic Resources MAFF Gene Bank Project (No. 2) (1997)

Annual Report

Annual Report of The Animal Genetic Resources MAFF Gene Bank Project (No. 1 – No. 12) (1988 – 2000)

Survey Report

Survey Report for animal Genetic Resources (No. 1 – No. 12) (1990 – 2000)

MAFF International Workshop on Genetic Resources

"Animal Genetic Resources: Efficient Conservation and Effective Use"(1995)

"Genetic Diversity and Conservation of Animal Genetic Resources" (1998)

(Published from National Institute of Animal Industry)

Characterization and Evaluation

Manual for Characterization and Evaluation in Animal Genetic Resources (1988)

Characteristics of Animal Genetic Resources (1) (1989)

Characteristics of Animal Genetic Resources (2) (Characteristics of Meishan Pig) (1992)

Characteristics of Animal Genetic Resources (3) (1997)

Project Report

Three Years Report of The Animal Genetic Resources MAFF Gene Bank Project (1985 – 1987) (1988)

Survey Report

Survey Report Concerning Preservation and Utilization of Animal Genetic Resources in Malaysia and Thailand (1989)

Table 15 Budget for Conservation of Japanese Native Horse Breeds i (1000 yen)

	Total budget	Subsidy	Budget directly used for conservation of horse
Dosanko	3993	2755	1080
Kiso	4006	2979	3309
Noma	52047	1390	5900
Tsushima	3195	2978	1800
Misaki	4415	1021	3037
Tokara	1453	1453	1138
Miyako	1774	1689	1338
Yonaguni	2879	2299	2300
Total	73762	16564	19902

Summary of Annual Liaison Meeting for the Conserve Utilization of Japanese Native Horse(2001)

Table 16 Native Domesticated Animals Registered as Natural Monument

Prefecture	Registered Animals	Criterion	Locality	Year of Registration
Yamaguchi	Original Place of Mishima Cattle	A4	Mishima, Hagi-shi	1928
Miyazaki	Misaki Horse and Its Habitat	A4/A3	Ohno, Kushima-shi	1953
ND	Japanese Long-tailed Fowl of Tosa*	A4	Kochi-Prefecture	1923
ND	Totenko	A4	Kochi-Prefecture	1936
ND	Japanese Rumples Bantam	A4	Kochi-Prefecture	1937
ND	Japanese Long-Saddled Bantam	A4	Kochi-Prefecture	1937
ND	Koeyoshi	A4	Akita-, Aomori-, and Iwate- Prefectures	1937
ND	Tomaru	A4	Niigata-Prefecture	1939
ND	Minohiki	A4	Aichi- and Shizuoka-Prefectures	1940
ND	Jidori or Japanese-Old type	A4	Mie-, Gifu-, Kochi- and Iwate-Prefectures	1941
ND	Shokoku	A4	Kyoto-, Shiga- and Mie-Prefectures	1941
ND	Shamo	A4	Tokyo-, Ibaraki-, Chiba-, Aomori-, Akita- and Kochi-Prefectures	1941
ND	Japanese Bantam	A4	Tokyo-, Chiba-, Kanagawa-, Saitama, Gunma-, Shizuoka-, Osaka- and Kumamoto-Prefectures	1941
ND	Hinai-Dori	A4	Akita-Prefecture	1942
ND	Ukokkei	A4	Tokyo-, Mie-, Osaka-, Hiroshima-, Yamaguchi- and Kagawa-Prefectures	1942
ND	Kawachiyakko	A4	Mie-Prefecture	1943
ND	Satsuma-Dori	A4	Kagoshima-Prefecture	1943
ND	Jittoko	A4	Kagoshima-Prefecture	1943
ND	Kurokashiwa	A4	Shimane- and Yamaguchi-Prefectures	1951

* Special Natural Monument

ND : Not defined

A3: Animal population and its special natural habitat

A4: Animal breed or population indigenous especially in Japan

Table 17 Conservation of Farm Animal Genetic Resources in National University

University	Hokkaido University	Nagoya University	Hiroshima University
Section	The Field Science Center for Northern Biosphere	Bioagricultural Sciences	Faculty of Applied Biological Sciences
Animals	Dosanko	Domestic Fowl	Chicken Lines with Specific Blood Type
Representative Strain and No. of Strains	Dosanko 1 line	White Leghorn 2 lines Brown Leghorn 1 line PNP/DO 1 line	GVHR 4 lines IgG 2 lines HIG 2 lines HIM 2 lines
Annual Budget for Conservation	292,000 yen	317,000 yen	1,145,000 yen

The Ministry of Education, Culture, Sports, Science, and Technology

Table 18 The Number of Characters Examined in Each Species by Japanese Genebank Project

	Species	Use	Primary		Secondary		Tertiary		Characters examined		
			required	optional	required	optional	required	optional	Total	required	optional
Domestic Animals	Cattle	Common	10	5	9	6	6	5	41	25	16
		Meat					12		12	12	0
		Milk					3		3	3	0
	Horse	Meat	5		9	6	18	6	44	32	12
	Pig	Meat	7	6	10	6	22	5	56	39	17
	Sheep/Goat	Common	15	8	11	5	6	9	54	32	22
		Meat					6		6	6	0
		Hair					11		11	11	0
	Chicken	Milk					3		3	3	0
		Common	15		8	6	7		36	30	6
		Egg						7	7	0	7
	Rabbit	Meat						16	16	0	16
Common		9	8	6		7	5	35	22	13	
Meat						8		8	8	0	
Lab. Animal						13		13	13	0	
	Hair					3		3	3	0	

The Descriptors for Characterization and Evaluation in Animal Genetic Resources (2001)

Primary characters : mainly morphological characters with which breeds are distinguished from each other

Secondary character economically important characters including body weight, shape, physiological traits

and also including genetic characters, such as blood type chromosome, DNA polymorphisms.

Tertiary characters : yield and quality of products including reproductive characters

Essential characters : most important characters as animal genetic resources

Optional characters : characters of secondary importance as animal genetic resources

Table 19 Transition of Beef Cattle Breeds Composition

(%)

	1965	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Japanese Black	81.1	84.3	84.7	86.5	86.4	86.6	86.8	84.0	86.0	86.5	86.6	86.7	86.9	87.0	86.1
Japanese Brown	17.2	12.7	12.1	10.2	9.6	8.7	8.8	10.8	9.3	8.7	8.8	8.9	8.9	8.9	10.0
Japanese Poll	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
Japanese Shorthorn	1.2	1.9	2.1	2.3	2.6	2.8	2.8	3.9	3.6	3.7	3.3	3.1	3.0	3.0	2.8
Aberdeen-Angus		0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4
Hereford		0.1	0.1	0.2	0.4	0.5	0.5	0.6	0.4	0.4	0.6	0.6	0.5	0.5	0.5
Charolais										0.0	0.0	0.0	0.0	0.0	0.0
Hybrid															
Others	0.1	0.4	0.4	0.3	0.4	0.6	0.6	0.1	0.1	0.0		0.1	0.1	0.0	0.0

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Japanese Black	85.5	86.5	86.6	86.7	85.8	85.1	85.3	86.2	88.2	88.7	89.9	90.7	91.7	92.0	92.7	93.0
Japanese Brown	10.7	9.2	9.1	8.9	9.5	10.1	9.8	8.4	7.0	7.0	6.5	6.1	5.3	5.0	4.7	4.8
Japanese Poll	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese Shorthorn	2.7	3.0	3.2	3.1	3.2	3.0	2.8	2.8	2.4	2.1	1.8	1.7	1.5	1.5	1.3	1.2
Aberdeen-Angus	0.5	0.5	0.4	0.6	0.7	0.8	1.0	1.3	1.3	1.2	0.9	0.8	0.7	0.8	0.6	0.5
Hereford	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.4	0.3	0.2	0.2	0.2	0.1	0.1
Charolais	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hybrid						0.2	0.4	0.7	0.6	0.5	0.5	0.4	0.4	0.4	0.4	0.3
Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.0

Data Related to Livestock Improvement (2000)

Table 20 Transition of Dairy Cattle Breeds

1. Transition of Bulls in Each Breed

	(head)																	
	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	
Total (A)	1,602	1,597	1,486	1,440	1,524	1,640	1,569	1,356	1,114	1,232	1,294	1,456	1,394	1,237	1,154	1,215	1,140	
Holstein	1,523	1,523	1,413	1,377	1,469	1,588	1,525	1,325	1,082	1,203	1,265	1,431	1,372	1,207	1,124	1,195	1,120	
British-Friesian																		
Jersey	71	4	4	6	6	5	7	7	12	11	6	3	2	8	8	4	4	
Guernsey	1	61	61	48	41	42	32	19	14	12	15	16	15	16	14	9	10	
Airshire	6	2	2	3	3	3	3	3	4	2	3	2	2	3	4	4	4	
Brown Swiss	1	6	6	6	6	5	2	2	2	2	3	2	2	3	4	3	2	
Number of Cow(B)	1,288,950	1,309,970	1,376,100	1,439,000	1,663,360	1,804,000	1,856,000	1,819,000	1,778,000	#####	#####	#####	#####	#####	#####	2,091,000	2,073,399	
B/A	805	820	926	999	1,091	1,100	1,183	1,341	1,596	1,422	1,381	1,244	1,354	1,600	1,791	1,721	1,819	
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total (A)	1,060	1,059	1,057	939	941	969	899	873	1,000	1,129	1,137	1,190	1,176	1,087	1,152	1,134	1,196	1,233
Holstein	1,042	1,041	1,019	891	932	959	875	854	982	1,113	1,117	1,172	1,158	1,075	1,136	1,120	1,187	1,219
British-Friesian																		
Jersey	3	2	34	34				6										
Guernsey	9	10	4	7	7	6	20	9	11	14	18	17	17	11	14	14	9	12
Airshire	4	4		7	2		4	3	4	1	2				1			
Brown Swiss	2	2				1		1	1									
Number of Cow(B)	2,055,762	2,044,008	2,032,131	1,926,009	1,955,786	1,880,667	1,853,809	1,857,278	1,891,272	#####	#####	#####	#####	#####	#####	1,860,395	1,823,385	1,730,164
B/A	1,939	1,930	1,923	2,051	2,078	1,941	2,062	2,127	1,891	1,687	1,736	1,669	1,647	1,704	1,590	1,641	1,525	1,403

2. Transition of Cows in Each Breed

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	
Total Number of Cow	1,288,950	1,309,970	1,376,100	1,439,000	1,663,360	1,804,000	1,856,000	1,819,000	1,778,000	#####	#####	#####	#####	#####	#####	2,091,000	2,073,399	
Holstein	1,260,617	1,284,266	1,351,648	1,417,459	1,646,545	1,785,902	1,839,395	1,805,225	1,766,505	#####	#####	#####	#####	#####	#####	2,085,657	2,068,534	
British-Friesian																		
Jersey	28,263	25,636	24,384	21,432	16,680	17,979	16,455	13,650	11,360	9,836	8,942	6,874	6,312	5,236	5,423	5,089	4,697	
Guernsey	20	18	18	59	35	40	50	50	50	50	50	35	49	67	62	71	51	
Airshire	50	50	50	50	100	79	100	65	75	85	92	92	90	112	117	163	111	
Brown Swiss								10	10	10	19	20	24	14	4	17	6	
Red Danish																		
Other Breeds										15	15	13	9	6		3		
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total Number of Cow	2,055,762	2,044,008	2,032,131	1,926,009	1,955,786	1,880,667	1,853,809	1,857,278	1,891,272	#####	#####	#####	#####	#####	#####	1,860,395	1,823,385	1,740,257
Holstein	2,051,271	2,039,479	2,027,764	1,921,673	1,951,596	1,876,374	1,849,226	1,851,204	1,884,229	#####	#####	#####	#####	#####	#####	1,851,182	1,814,063	1,730,164
British-Friesian																		
Jersey	767	1,108	1,039	811	778	440	737	379	229	1,002	232	159	169	86	58	61	194	
Guernsey	4,301	4,345	4,066	4,016	3,858	3,998	4,138	5,872	6,781	6,964	7,791	7,791	7,749	8,234	8,792	8,652	8,550	9,202
Airshire	53	57	164	213	222	224	365	109	152	356	288	279	284	238	210	189	239	194
Brown Swiss	133	110	115	105	105	61	66	74	47	29	22	16	16	3	3	2	6	5
Red Danish	4	17	19	2	1	7	14	19	63	206	225	328	318	287	289	328	418	550
Other Breeds										3								

Data Related to Livestock Improvement (2000)

Table 21 Transition in Numbers of Breeding Hogs, Breeding Sows, and Pigs for Fattening

1. Breeding hogs		1,975	1,980	1,981	1,982	1,983	1,984	1,985	1,986	1,987	1,988	1,989	1,990	1,991	1,992	1,993	1,994	1,995	1,996	1,997	1,998	1,999
Middle White		368	72	155	51	58	148	55	79	66	62	76	63	57	43	61	55	62	366	30	39	75
Berkshire		316	310	408	572	788	894	879	910	916	936	1,517	1,685	2,280	2,518	2,380	2,352	2,236	2,721	3,200	3,622	4,717
Landrace		11,693	10,876	8,767	7,271	7,330	7,252	7,108	6,974	7,447	6,973	6,605	6,209	5,565	5,582	5,182	4,561	4,421	4,044	3,819	3,874	4,120
Large White		3,600	7,926	7,328	7,009	7,038	8,347	9,632	10,585	10,990	9,634	9,817	9,316	7,919	7,173	6,566	5,990	5,395	5,611	5,313	4,998	5,147
Hampshire		13,406	21,660	22,102	18,026	15,385	13,310	11,099	9,768	8,774	6,955	5,449	5,077	3,609	3,213	2,557	2,026	1,774	1,444	1,319	1,106	1,009
Duroc		3,052	12,775	17,399	21,417	27,708	31,562	38,672	41,979	45,963	44,941	48,042	48,391	46,674	47,649	43,615	45,621	42,962	42,859	41,807	41,686	40,934
Spotted		63	403	322	271	209	176	200	119	78	66	42	41	44	39	25	33	24	22	2	3	4
Chester White		12	40	68	46	32	1	52	3,737	14	11	63	67	9	18	22	21	20	22	10	74	19
Others		23	284	404	718	1,370	1,735	3,303	4,311	6,681	6,605	6,914	9,441	8,872	8,752	9,288	11,513	8,898	8,115	8,256	12,772	11,047
Hybrids						1,370	1,735	3,303	4,311	6,681	6,605	6,914	9,441	8,872	8,752	9,288	11,513	8,898	8,115	8,256	12,772	11,047
Cross		931	2,279	3,011	3,038	3,074	2,777	3,134	5,349	5,948	7,051	9,117	9,485	10,558	11,078	11,737	10,841	9,087	11,374	12,963	8,950	10,356
Total		33,464	56,625	59,964	58,419	62,992	66,202	74,134	83,811	86,877	83,234	87,642	89,775	85,587	86,065	81,433	83,013	74,879	76,578	76,719	77,124	77,428

2. Breeding sows		1,975	1,980	1,981	1,982	1,983	1,984	1,985	1,986	1,987	1,988	1,989	1,990	1,991	1,992	1,993	1,994	1,995	1,996	1,997	1,998	1,999
Middle White		8,754	1,803	604	410	327	391	327	414	290	252	324	215	253	197	746	207	115	224	118	73	172
Berkshire		11,551	6,551	6,381	5,894	5,926	7,152	5,509	4,677	6,117	6,215	9,779	9,861	12,348	14,208	14,521	14,855	15,490	20,004	23,798	27,767	32,950
Landrace		392,318	321,305	292,893	249,419	195,941	174,912	154,783	139,502	119,852	99,227	84,546	75,480	68,113	54,463	55,945	47,402	42,367	38,951	40,898	46,296	37,387
Large White		38,878	54,357	51,731	49,106	47,152	46,403	50,457	53,945	52,393	58,401	56,586	54,610	51,607	44,565	45,252	35,365	32,325	28,360	31,812	28,729	27,053
Hampshire		52,050	55,960	40,285	29,486	24,757	27,512	13,743	11,049	9,478	7,556	6,348	5,630	4,392	3,559	2,425	2,150	2,572	1,477	1,667	1,509	1,203
Duroc		9,754	41,246	37,761	39,951	48,706	41,450	41,034	35,834	30,911	29,957	26,606	26,259	26,069	26,440	15,528	14,254	14,320	18,268	19,163	11,907	15,977
Spotted		903	894	620	724	821	357	286	480	339	307	382	59	51	29	40	161	38	58	0	0	0
Chester White		75	176	466	96	96	62	1,313	21	63	67	142	220	51	25	57	66	40	41	210	193	105
Others		1,145	409	16,708	9,954	16,264	23,078	40,742	52,914	74,898	95,870	90,089	135,421	141,910	142,700	127,633	177,228	165,686	157,854	135,751	146,911	128,517
Hybrids						16,264	23,078	40,742	52,914	71,932	76,301	90,075	110,672	119,285	126,063	122,554	114,366	128,839	140,568	123,813	122,262	124,361
Cross		295,085	663,341	681,323	722,115	773,289	779,009	841,611	842,281	877,958	875,384	879,155	796,346	758,303	709,101	685,234	658,642	606,019	645,312	661,844	625,526	642,693
Total		810,513	1,146,042	1,128,772	1,107,155	1,113,279	1,100,326	1,149,805	1,141,117	1,172,299	1,173,236	1,153,957	#####	#####	995,287	947,381	950,330	878,972	910,549	915,261	888,911	886,057

3. Pigs for fattening		1,975	1,980	1,981	1,982	1,983	1,984	1,985	1,986	1,987	1,988	1,989	1,990	1,991	1,992	1,993	1,994	1,995	1,996	1,997	1,998	1,999
Middle White		20,586	4,240	1,900	1,624	1,061	1,200	1,368	881	514	384	707	617	939	571	285	66	323	383	114	34	130
Berkshire		5,294	9,183	7,766	15,647	17,769	16,778	28,124	6,623	20,310	18,835	32,413	33,118	44,547	38,906	26,077	40,997	68,055	95,826	98,247	131,627	169,384
Landrace		612,648	427,948	293,065	334,416	276,594	249,100	261,402	185,813	160,759	141,647	126,681	122,931	120,476	98,186	112,048	87,271	82,694	74,634	61,755	143,314	65,303
Large White		57,469	101,482	72,204	83,785	86,379	99,314	114,514	86,038	111,001	153,845	102,125	95,881	104,498	83,439	108,918	68,608	51,814	39,231	46,564	60,823	49,514
Hampshire		78,194	86,383	65,788	70,034	68,065	47,647	47,803	27,423	32,076	31,678	18,645	15,010	12,112	7,262	3,841	3,828	4,143	7,130	8,357	4,096	2,608
Duroc		18,957	67,158	62,331	115,220	123,492	97,455	121,972	99,714	90,901	93,642	79,182	80,557	90,742	83,972	65,749	34,557	57,227	59,993	63,909	56,233	80,406
Spotted		5,201	2,170	640	2,207	1,238	588	1,229	1,077	220	1,518	1,638	322	131	101	80	84	83	51	0	0	0
Chester White		70	130	60	77	65	60	7,696	2	0	0	0	1,740	328	205	15	40	20	29	1,000	1,000	1,000
Others		10,255	1,163	47,935	51,322	73,541	114,693	182,402	290,114	397,137	430,079	427,729	660,124	600,632	630,172	621,224	900,494	834,887	699,605	743,114	879,110	696,107
Hybrids						73,541	114,693	182,402	288,649	380,474	362,088	427,729	604,912	520,307	566,316	607,135	574,866	734,545	678,449	683,684	719,342	665,320
Cross		2,999,436	5,416,140	5,498,923	5,156,135	5,160,842	5,025,767	5,221,956	5,821,727	5,975,210	5,909,821	6,038,356	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####
Total		3,808,110	6,115,997	6,050,612	5,830,467	5,809,046	5,652,602	5,988,466	6,519,412	6,788,128	6,781,449	6,827,476	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####

Data Related to Livestock Improvement (2000)

Table 22 Transition in Numbers of Breeding Chicken in Each Breed

	(Head %)									
	1, 980	1, 981	1, 982	1, 983	1, 984	1, 985	1, 986	1, 987	1, 988	1, 989
White Leghorn	2, 076, 531	1, 831, 444	1, 665, 326	1, 550, 480	1507777	1, 622, 415	1, 709, 872	1, 625, 423	1, 544, 652	1, 450, 188
Raito Composition	23.3	21.7	18.7	16.7	16.8	17.8	16.9	15.5	13.3	13.3
Barred Plymouth Rock	6, 529	6, 635	2, 967	3, 979	17169	6, 335	12, 342	1, 645	7, 555	4, 308
Raito Composition	0.1	0.1	0.0	0.0	0.2	0.1	0.1	0.0	0.1	0.0
Rhode Island Red	62, 494	70, 007	84, 469	95, 040	87541	80, 678	121, 954	138, 332	117, 505	129, 984
Raito Composition	0.7	0.8	0.9	1.0	1.0	0.9	1.2	1.3	1.0	1.2
New Hampshire	48	445	325	736	93	75	386	409	2, 904	551
Raito Composition	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nagoya	918	1, 542	862	3, 880	3380	4, 155	1, 217	3, 631	4, 305	12, 444
Raito Composition	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
White Plymouth Rock	1, 423, 071	1, 052, 081	247, 993	1, 531, 515	1553769	1, 595, 583	1, 684, 063	1, 453, 877	232, 480	2, 599, 285
Raito Composition	15.9	12.5	2.8	16.5	17.3	17.5	16.6	13.9	2.0	23.8
White Cornish	134, 665	312, 953	558, 720	200, 434	192195	208, 844	327, 986	206, 818	1, 047, 286	329, 031
Raito Composition	1.5	3.7	6.3	2.2	2.1	2.3	3.2	2.0	9.0	3.0
Shamo										
Raito Composition	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hinai-Dori										
Raito Composition	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Satsuma-Dori										
Raito Composition	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other egg breeds and hybrid	1, 587, 324	1, 185, 659	1, 207, 842	1, 521, 453	1175889	1, 115, 135	1, 402, 600	1, 704, 346	1, 852, 048	1, 575, 171
Raito Composition	17.8	14.1	13.5	16.3	13.1	12.2	13.8	16.3	16.0	14.4
Other chicken breeds and hybrid	3, 638, 659	3, 964, 981	5, 157, 276	4, 398, 462	4421268	4, 492, 634	4, 873, 431	5, 342, 653	6, 775, 903	4, 808, 051
Raito Composition	40.7	47.1	57.8	47.3	49.3	49.2	48.1	51.0	58.5	44.1
Total	8, 930, 239	8, 425, 747	8, 925, 780	9, 305, 979	8, 959, 081	9, 125, 854	10, 133, 851	10, 477, 134	11, 584, 638	10, 909, 013
Raito Composition	100	100	100	100	100	100	100	100	100	100

	1, 990	1, 991	1, 992	1, 993	1, 994	1, 995	1, 996	1, 997	1, 998	1, 999
White Leghorn	1, 308, 436	1, 337, 004	978, 910	2, 924, 697	1, 265, 401	791, 816	1, 292, 366	1, 318, 947	1, 021, 600	1, 146, 832
Raito Composition	13.6	14.9	9.6	17.6	8.3	6.7	8.7	11.8	8.8	9.1
Barred Plymouth Rock	2, 908	2, 344	31, 493	10, 100	32, 345	7, 114	19, 676	24, 266	17, 354	10, 423
Raito Composition	0.0	0.0	0.3	0.1	0.2	0.1	0.1	0.2	0.1	0.1
Rhode Island Red	143, 111	131, 942	105, 847	82, 542	79, 671	94, 065	102, 188	118, 709	100, 944	267, 171
Raito Composition	1.5	1.5	1.0	0.5	0.5	0.8	0.7	1.1	0.9	2.1
New Hampshire	706	487	503	588	618	798	9, 708	9, 380	643	589
Raito Composition	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
Nagoya	15, 221	16, 634	4, 669	4, 887	10, 464	6, 116	7, 138	121, 498	12, 080	40, 183
Raito Composition	0.2	0.2	0.0	0.0	0.1	0.1	0.0	1.1	0.1	0.3
White Plymouth Rock	2, 064, 986	1, 030, 378	1, 365, 355	1, 373, 391	290, 977	216, 380	267, 238	316, 944	419, 307	963, 096
Raito Composition	21.5	11.5	13.3	8.2	1.9	1.8	1.8	2.8	3.6	7.6
White Cornish	263, 756	136, 176	196, 067	175, 802	40, 651	31, 822	39, 736	60, 014	57, 706	181, 483
Raito Composition	2.7	1.5	1.9	1.1	0.3	0.3	0.3	0.5	0.5	1.4
Shamo			1, 562	2, 045	11, 336	26, 465	11, 207	11, 133	6, 256	7, 921
Raito Composition	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.1
Hinai-Dori			254	209	230	1, 093	1, 495	465	1, 835	3, 284
Raito Composition	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Satsuma-Dori			741	724	80	83	113, 060	150	414	305
Raito Composition	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0
Other egg breeds and hybrid	1, 642, 779	1, 641, 283	2, 096, 167	3, 308, 269	4, 258, 337	2, 091, 439	2, 995, 711	2, 108, 021	2, 279, 116	2, 606, 385
Raito Composition	17.1	18.3	20.5	19.9	27.8	17.8	20.3	18.9	19.7	20.6
Other chicken breeds and hybrid	4, 177, 796	4, 696, 249	5, 465, 883	8, 771, 824	9, 331, 972	8, 513, 485	9, 914, 346	7, 082, 532	7, 659, 007	7, 397, 329
Raito Composition	43.4	52.2	53.3	52.7	60.9	72.3	67.1	63.4	66.2	58.6
Total	9, 619, 699	8, 992, 497	10, 247, 451	16, 655, 078	15, 322, 082	11, 780, 676	14, 773, 869	11, 172, 059	11, 576, 262	12, 625, 001
Raito Composition	100	100	100	100	100	100	100	100	100	100

Data Related to Livestock Improvement

Table 23 Number of Horse in Each Breed

Horse for Farming	Percheron and Its Cross	Female	436
		Castrated	555
		Male	50
		Total	1,594
	Breton and Its Cross	Female	497
		Castrated	346
		Male	43
		Total	1,115
	Others	Female	869
		Castrated	832
		Male	229
		Total	1,978
	Subtotal	Female	1,802
		Castrated	1,733
		Male	322
		Total	4,687
Light horse		Female	732
		Castrated	709
		Male	435
		Total	1,939
Others		Female	318
		Castrated	1,028
		Male	156
		Total	1,522
Total		Female	2,852
		Castrated	3,470
		Male	903
		Total	8,138
Horse for Riding		Total	12,189
		Pony	1,695

Data Related to Livestock Improvement

Table 24 Transition of Goat Breeds

(Head, %)

		1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Male	Japanese Saanen	787	796	782	816	920	648	560	554	474	479
	Other breeds	4,009	4,684	4,142	4,077	6,677	4,997	4,410	9,121	5,196	4,782
	Total	4,796	5,480	4,924	4,893	7,597	5,645	4,970	9,675	5,670	5,261
Female	Japanese Saanen	18,739	16,597	15,240	14,106	11,433	10,296	7,756	-	5,993	8,090
	Other breeds	15,916	18,019	17,232	16,738	19,605	16,398	14,366	13,526	15,725	12,415
	Total	34,655	34,616	32,472	30,844	31,038	26,694	22,122	13,526	21,718	20,505

		1991	1992	1993	1994	1995	1996	1997	1998	1999	Raito Compositior 1999
Male	Japanese Saanen	519	542	404	496	416	399	421	400	611	10.9
	Other breeds	5,218	5,221	4,881	4,539	4,643	4,394	4,754	5,030	4,991	89.1
	Total	5,737	5,763	5,285	5,035	5,059	4,793	5,175	5,430	5,602	100.0
Female	Japanese Saanen	4,988	4,277	3,852	4,426	3,713	3,525	3,516	3,620	3,761	26.1
	Other breeds	15,174	14,603	13,430	11,994	10,421	10,505	11,465	11,705	10,624	73.9
	Total	20,162	18,880	17,282	16,420	14,134	14,030	14,981	15,325	14,385	100.0

Data Related to Livestock Improvement

Table 25 Transition of Sheep Breeds

		(head)									
		1,980	1,981	1,982	1,983	1,984	1,985	1,986	1,987	1,988	1,989
Male	Japanese Corriedale	219	295	280	242	235	340	304	410	250	282
	Suffolk	502	645	750	1,039	983	985	1,024	1,100	1,137	1,364
	Other breeds	74	59	81	26	23	36	28	33	75	98
	Hybrids				87	55	77	133	121	75	193
	Total	795	999	1,111	1,394	1,296	1,438	1,489	1,664	1,537	1,937
Female	Japanese Corriedale	3,234	2,679	2,673	2,820	2,240	2,317	1,580	1,525	1,540	2,003
	Suffolk	5,765	6,039	9,908	11,264	12,240	12,106	13,737	14,235	14,955	15,507
	Other breeds	1,341	1,494	1,867	172	138	224	203	342	413	318
	Hybrids				1,344	1,094	2,549	2,024	2,236	1,746	1,828
	Total	10340	10,212	14,448	15,600	15,712	17,196	17,544	18,338	18,654	19,656
		1,990	1,991	1,992	1,993	1,994	1,995	1,996	1,997	1,998	1,999
Male	Japanese Corriedale	390	237	319	344	204	255	232	207	185	430
	Suffolk	1,652	1,393	1,645	1,421	1,363	1,121	1,206	1,101	1,027	1,168
	Other breeds	101	171	171	303	316	324	270	340	258	277
	Hybrids	185	219	201	297	299	271	299	350	226	327
	Total	2,328	2,020	2,336	2,365	2,182	1,971	2,007	1,998	1,696	2,202
Female	Japanese Corriedale	1,436	1,204	1,232	1,163	1,096	972	933	766	981	1,071
	Suffolk	16,591	15,991	15,560	15,405	13,248	11,505	9,635	8,408	6,937	6,951
	Other breeds	451	482	1,301	1,418	803	1,014	1,082	969	1,096	960
	Hybrids	1,301	1,133	1,247	882	800	815	678	862	826	1,029
	Total	19,779	18,810	19,340	18,868	15,947	14,306	12,328	11,005	9,840	10,011

Data Related to Livestock Improvement (2000)

Table 26 Numbers of Household and of Head
in Each Small Animal Species

Duck/Hybrid	No. of Household	869
	No. of Head	305,541
Turkey	No. of Household	156
	No. of Head	3,193
Quail	No. of Household	117
	No. of Head	7,281,688
Goose	No. of Household	58
	No. of Head	1,527
Guinea Fowl	No. of Household	55
	No. of Head	24,345
Pheasant	No. of Household	159
	No. of Head	111,323
Rabbit for meat and hair	No. of Household	268
	No. of Head	6,074
Mink	No. of Household	8
	No. of Head	34,231
Hybrid pig between wild and	No. of Household	66
	No. of Head	2,183
Wild pig	No. of Household	393
	No. of Head	6,383

Data Related to Livestock Improvement (2000)

Table 27 Number of Head in Each Deer Species

Shika Deer	Male	751
	Female	1,195
Red Deer	Male	266
	Female	542
Samber	Male	4
	Female	1
Fallow Deer	Male	100
	Female	151
Taiwanese Shika Deer	Male	184
	Female	244
Other Species	Male	693
	Female	817

Data Related to Livestock Improvement (2000)

Table 28 Numbers of Numbers of Household and of Head
in Each Laboratory Animal Species

Rabbit	No. of Household	503
	No. of Head	82,666
Miniature Pig	No. of Household	7
	No. of Head	63
Pig	No. of Household	7
	No. of Head	74
Goat	No. of Household	22
	No. of Head	706

Data Related to Livestock Improvement (2000)

Table 29 Prevalence of Artificial Insemination and Utilizing Frozen Seamen

	Dairy Cattle	Beef Cattle	Pig	Horse	Sheep	Goat
Accumulated Number of Female Inseminated	1,747,495	737,131	#####	7,190	2,289	1,018
Accumulated No. of Female Artificially Inseminate	1,736,773	721,252	98,069	324	0	0
Proportion of Artificial Insemination	99.4	97.8	7.6	4.5	0.0	0.0
Accumulated No. of Females Inseminated Frozen Sea	1,736,740	721,119	10,258	0	0	0
Proportion of Utilization Frozen Seamen	100.0	100.0	10.5	0.0	0.0	0.0

Data Related to Livestock Improvement (2000)

Table 30 Results of Insemination

Total Number of Females	Dairy Cattle	Beef Cattle	Horse	Pig
Copulated or Artificial insemination	1,415,008	584,466	6,243	1,232,335
No. of Females Become Pregnant	1,172,944	562,417	4,435	1,087,269
No. of Females not Become Pregnant	169,084	88,032	1,526	127,223
Conception Unknown	72,980	49,447	282	38,661
Conception Rate	87.4	105.1	74.4	91.1
No. of Calf produced	1,067,322	515,520	3,851	11,595,443
Number of Male Calf	553,988	263,970	1,937	4,684,142
Number of Female Calf	513,334	252,140	1,914	4,579,245
Production Rate	79.5	96.4	64.6	971.4

Data Related to Livestock Improvement (2000)

Table 31 Situation of Practicing Embryonic Transfer in Cattle

1. Transition of The Number of Calves Produced from Embryonic Transfer

	(head/FY)	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
in vivo fertilized egg transfer	No. of donor	2,724	3,589	4,078	5,207	6,899	7,704	9,099	10,853	11,618	11,922	11,079	13,231	13,438	14,172
	No. of recipient	5,034	6,850	8,559	12,253	15,788	19,865	26,613	32,811	36,876	37,744	40,742	44,657	46,925	49,206
	No of Calf	887	1,382	2,291	3,366	4,884	5,912	7,163	8,818	10,230	11,010	11,322	13,248	15,035	15,653
in vitro fertilized egg transfer	No. of recipient			390	1,184	1,920	3,916	4,229	5,102	6,264	6,918	4,642	7,211	9,479	9,328
	No of Calf			160	475	621	1,147	1,020	1,317	1,107	1,216	1,583	2,123	2,007	
Total Calf		887	1,382	2,291	3,526	5,359	6,533	8,310	9,838	11,547	12,117	12,538	14,831	17,158	17,660

Not include the number of calves produced by experimental research.

Livestock Industry Bureau, MAFF Livestock Breeding Related References (2000)

2. Transition of Conception Rate by Embryonic Transfer in Each Different Condition (%)

		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
in vivo fertilized egg transfer	Fresh	48	51	52	51	50	51	51	51	51	50	51	50
	Frozen	31	35	39	41	41	43	42	43	46	46	45	46
in vitro fertilized egg transfer	Fresh											36	41
	Frozen	41	37	38	36	36	33	30	28	34	37	32	32

One embryo was transferred in each case

Not include the number of calves produced by experimental research.

Livestock Industry Bureau, MAFF Data Related to Livestock Improvement (2000)

Table 32A Target Concerning Improvement and Increased Production of Livestock

1. Target Concerning Performance in Dairy Cattle (Average of Whole Country)

	Breed	Milk yield kg	Milk fat %	SNF %	Milk protein %	Delivery interval month	Age at primipara month
2000	Holstein	7,300	3.9	8.7	3.2	13.6	27
	Jersey	5,700	4.9	9.3	3.8	13.4	25
2010	Holstein	8,800	3.9	8.9	3.4	13.0	26
	Jersey	6,500	5.2	9.6	4.1	13.0	25

SNF: Solid-Not-Fat

2. Target Concerning Performance in Castrated Cattle for Fattening (Average of Whole Country)

	Breed	At end of fattening		Daily Gain of
		Age month	Body weight kg	Body Weight kg
2000	Japanese Black	30.0	680	0.65
	Japanese Brown	24.0	745	1.00
	Japanese Shorthorn	23.0	670	0.90
	Dairy Breed	22.0	755	1.05
2010	Japanese Black	24-25	670-685	0.85
	Japanese Brown	22-23	710-730	1.05
	Japanese Shorthorn	19-20	650-675	1.10
	Dairy Breed	17-18	735-760	1.40

3. Target Concerning Performance in Bulls of Beef Cattle Breeds (Average of Whole Country)

	Breed	Daily Gain of kg	TDN Requirement kg	Beef Marbling	
				BMS	No
2000	Japanese Black	0.89	6.6	7.5	
	Japanese Brown	0.98	6.8	5.9	
	Japanese Shorthorn	1.16	6.2	2.6	
2010	Japanese Black	0.95	6.4	8.3	
	Japanese Brown	1.05	6.3	6.7	
	Japanese Shorthorn	1.20	5.9	3.0	

4. Target Concerning Performance in Sows for Feeder Stock Production (Average of Whole Country)

	Litter Size head	Piglet Weaning Rate %	No. of Partition times	No. of Weaning head
2000	9.9	91	2.2	19.8
2010	10.8	93	2.3	23.1

6. Target Concerning Performance in Fattening Pig (Average of Whole Country)

	Age at Shipping day	Body Weight at Shipping kg	Food conversion ratio
2000	220	108	3.0
2010	172	112	2.9

Table 32B Target Concerning Improvement and Increased Production of Chicken

1. Target Concerning Performance of Egg production in Layers (Average of Whole Country)

	Egg Production Rate %	Egg Weight g	Daily Egg Productio n g	Age at First Laying day	Food Conversion Ratio
2000	82	62	51	150	2.2
2010	83以上	62-63	52以上	145-150	2.2以下

2. Target of Performance Ability in Broilers (Average of Whole Country)

	Body Weight g	Rate of Raising %	Food Conversio n Ratio
2000	2,600	96	1.9
2010	2,700	over 98	under 1.9

Table 33 Farm Households in Each Animal Species by Numbers of Animals Raising (2001)

	No. of Households	Total No. of Animals	1-9	10-14	15-19	20-29	30-39	40-39	50-79	80-99	100<	Undelivered cows only
Milk cows	31000	1703	3360	2440	2470	5560	5110	3970	6170	840	1360	830

	No. of Households	Total No. of Animals	1-2	3-4	5-9	10-19	20-29	30-49	50-99	100-199	200<
Beef cattle	109700	2806	24500	21500	26100	16700	6210	5120	4200	2810	2560

	No. of Households	Total No. of Animals	1-9	10-29	30-49	50-99	100-299	300-499	500-999	1000-1999	2000<	Breeding only
Pigs	10500	9725	260	390	340	610	1780	1270	1960	1250	840	1840

	No. of Households	Total No. of Animals	<50	50< <100	100<<200	200<<300	300<<500	500<
Broilers	3502	569234	963	677	1129	393	222	118

	No. of Households	Total No. of Animals	1<<5	5<<10	10<<50	50<<100	100<	Breeding Only	Others
Layers	4720	139423	1260	750	1660	340	340	310	60

Report of Livestock, as of February 1, 2001 <http://www.maff.go.jp/esokuhou/sei200138.PDF>

Table 34 Production and Self-Sufficiency Ratios of Various Meat and Egg

(1000t, %)

FY	Beef					Pork				Chicken				Hen's Egg		
	Domestic Production	From Beef Cattle Breeds	Imported	Ratio of Self-Sufficiency	Domestic Production	Imported	Ratio of Self-Sufficiency	Domestic Production	Imported	Ratio of Self-Sufficiency	Domestic Production	Imported	Ratio of Self-Sufficiency			
1975	235	91	64	299	0.79	716	146	862	0.83	759	28	787	0.96	1807		
1980	302	93	120	422	0.72	1001	145	1146	0.87	1122	80	1202	0.93	1992	49	2041
1985	389	145	158	547	0.71	1091	190	1281	0.85	1351	115	1466	0.92	2160	39	2199
1986	394	140	188	582	0.68	1091	205	1296	0.84	1397	187	1584	0.88	2273	61	2334
1987	398	130	224	622	0.64	1115	290	1405	0.79	1438	217	1655	0.87	2394	36	2430
1988	398	129	285	683	0.58	1104	339	1443	0.77	1436	272	1708	0.84	2402	46	2448
1989	378	133	364	742	0.51	1118	366	1484	0.75	1417	296	1713	0.83	2423	45	2468
1990	388	145	384	772	0.50	1075	342	1417	0.76	1380	297	1677	0.82	2420	50	2470
1991	407	153	327	734	0.55	1026	442	1468	0.70	1358	392	1750	0.78	2532	73	2605
1992	417	159	423	840	0.50	1003	467	1470	0.68	1365	398	1763	0.77	2575	92	2667
1993	416	169	567	983	0.42	1006	455	1461	0.69	1319	390	1709	0.77	2599	99	2698
1994	424	183	584	1008	0.42	964	503	1467	0.66	1256	489	1745	0.72	2563	104	2667
1995	413	179	658	1071	0.39	910	535	1445	0.63	1252	542	1794	0.70	2549	110	2659
1996	383	172	611	994	0.39	884	663	1547	0.57	1236	564	1800	0.69	2564	110	2674
1997	370	175	659	1029	0.36	902	517	1419	0.64	1234	510	1744	0.71	2573	104	2677
1998	371	175	682	1053	0.35	904	546	1450	0.62	1212	522	1734	0.70	2536	104	2640
1999	381	175	683	1064	0.36	892	653	1545	0.58	1211	567	1778	0.68	2539	119	2658
2000	364	168	738	1102	0.33	878	651	1529	0.57	1195	572	1767	0.68	2540	121	2661

Preliminary Report on Meat and Egg (2001)

Table 35 Transition of Consumption of Animal Products and Other Economical Indices

	Consumption of Animal Products *1 (kg/person)						Gross Domestic Product (billion yen)		No. of farm household *4 (10 ⁴)	Agricultural Income Produced *5			
	Beef	Pork	Chicken	Meat Total	Hen's Egg	Total	Real GDP *2 (Base Year : 1971)	Real GDP *3 (Base Year : 1991)		Total (100million yen)	Per Household (100thousand yen)	To GDP Ratio (1970=1.00 (1990=1.00))	
1970	2.1	5.3	3.7	11.1	14.5	25.6	190448.0		5342	26293	4.92	1.00	
1975	2.5	7.3	5.3	15.1	13.7	28.8	237329.5		4953	52054	10.51	1.70	
1980	3.5	9.6	7.7	20.8	14.3	35.1	292737.4		4661	45839	9.83	1.29	
1985	3.9	9.3	8.4	21.6	14.5	36.1	345446.0		4376	43800	10.01	1.11	
1986	4.2	9.6	9	22.8	15.4	38.2	356286.3		4331	42018	9.70	1.05	
1987	4.5	10.1	9.3	23.9	16	39.9	373233.2		4284	38352	8.95	0.92	
1988	4.9	10.3	9.6	24.8	16	40.8	395531.6		4240	40009	9.44	0.92	
1989	5	10.4	9.6	25	16.1	41.1	413120.4		4194	46145	11.00	1.02	
1990	5.5	10.3	9.4	25.2	16.1	41.3	436043.8	450,532.4	3835	48172	12.56	1.11	1.00
1991	5.6	10.4	9.6	25.6	17	42.6	448902.7	474,626.6	2936	50274	17.12	1.47	1.30
1992	6	10.4	9.8	26.2	17.3	43.5	450605.9	483,188.6	2888	49309	17.07	1.46	1.27
1993	6.7	10.3	9.5	26.5	17.5	44	452757.6	487,527.8	2835	47694	16.82	1.43	1.24
1994	7.2	10.4	9.8	27.4	17.2	44.6	455690.0	492,265.8	2787	51084	18.33	1.55	1.34
1995	7.5	10.3	10.1	27.9	17.2	45.1	469382.4	501,960.3	2651	46255	17.45	1.43	1.25
1996	6.9	10.5	10.3	27.7	17.2	44.9	489852.4	515,248.9	2606	44421	17.05	1.34	1.19
1997	7.2	10.2	10.1	27.5	17.2	44.7	487834.1	520,177.4	2568	39651	15.44	1.22	1.07
1998	7.3	10.4	9.9	27.6	16.9	44.5		513,244.7	2522	40440	16.03		1.12
1999	7.3	10.7	10.2	28.2	17	45.2		514,348.7	2475	36865	14.89		1.04

*1 Meat Marketing Statistics (2001)

*2 National Finance of Japan Homepage (<http://plaza4.mbn.or.jp/~zaiseihan/>)

*3 Annual Report on National Accounts of 2002, A Integrated Accounts, 1 Gross Domestic Product and Expenditure Account

*4 JAPAN STATISTICAL YEARBOOK 2002 6-1 FARM HOUSEHOLDS BY DEGREE OF ENGAGEMENT AND SIZE OF OPERATING CULTIVATED LAND (1915--2000)

*5 2001 GROSS AGRICULTURAL OUTPUT AND AGRICULTURAL INCOME PRODUCED (Estimated)

Table 36 Transition of Importation of Forage Crops

	Coarse Feeds					Concentrate Feed Fodder									
	Hay	cube	Hay	Rice Straw	Total	y/y	Bran	Sorghums	Wheat & Barley	Oil-Seed Cake	Cassava	Animal-Derived	Others	Total	y/y
1965							429	4618	1350	152		196	381	7126	
1970							488	8110	2391	378	7	244	817	12435	
1975	52.6	43.3	0.7	96.6			482	9222	2111	126	29	215	506	12691	
1980	294.6	114.5	48.2	457.3			880	13595	2884	394	3	427	562	18745	
1985	491.5	200.2	87.0	778.7			1088	14906	2982	335	426	390	424	20551	
1987	594.8	495.3	126.3	1216.4			1133	15666	2753	606	40	585	405	21188	
1988	657.2	751.3	168.9	1577.4	1.30		1078	15712	2790	729	215	524	480	21528	1.02
1989	723.3	731.1	172.0	1626.4	1.03		1123	15050	2616	784	244	550	498	20865	0.97
1990	695.0	885.0	180.9	1760.9	1.08		1125	15493	2790	829	172	526	534	21469	1.03
1991	740.0	1101.1	213.5	2054.6	1.17		1124	15502	3157	1035	144	668	580	22210	1.03
1992	762.0	1072.8	212.6	2047.4	1.00		1115	14746	3166	1172	152	648	540	21539	0.97
1993	802.3	1333.4	248.2	2383.9	1.16		1100	15162	3012	1220	123	656	555	21828	1.01
1994	703.5	1260.8	220.5	2184.8	0.92		1018	14277	3037	978	45	724	516	20595	0.94
1995	701.4	1383.1	214.0	2298.5	1.05		1005	13444	2974	1014	8	922	492	19859	0.96
1996	662.1	1518.9	229.4	2410.4	1.05		988	13751	2787	957	19	689	482	19673	0.99
1997	624.5	1521.9	268.0	2414.4	1.00		973	13897	2604	955	11	784	499	19723	1.00
1998	576.8	1561.6	216.9	2355.3	0.98		897	13464	2585	1102	14	610	426	19098	0.97
			(1998/1975)		24.38								(1998/1975)		1.50
			(1998/1985)		3.02								(1998/1965)		2.68

Data Related to Self-Sufficiency in Feedstock (2000)

Table 37 Major Targets of Investigation Concerning Livestock in 10 years

<p style="text-align: center;">Animal Production</p>	<p>* Upgrading and Stabilization of Reproductive Technology, such as Embryo Transfer, Cloned Animal from Embryonic Cell Nucleus (Conception Rate by Embryonic Transfer : 50% to 70%, Delivering Rate of Embrvonic Cell Cloned Animal : 25% to 50%) * Improving Efficiency and Upgrading of Animal Breeding and Selection by Development and Utilization of DNA Markers * Establishing Milking and Nursing Robot Utilizing System Suitable for Livestock Management Condition in Japan * Reducing the emission of Nitrogen and Phosphor by Development of Barn-Waste Water Treating and Accurate Nutrient Managing Technology in Practical Scale * Development of Facility- and Labor-Saving Grazing Management Technology Utilizing Grazing Habit of Cattle * Upgrading of diagnostic technique for Major Disease of Cattle, Pig, Chicken and Development of Multivalent and Labor-Saving Vaccine</p>
<p style="text-align: center;">Forage Crops</p>	<p>* Breeding New type Grass Breed with Higher Digestibility and Perenniality, such as Intergeneric Hybrid between <i>Lolium</i> spp. And <i>Festuca</i> spp. * Development of Rice Breed Suitable for Whole Crop Silage, increasing Total Dietary Nutrition (TDN) from 0.9t/10a to 1.1t/10a in earlier stage, and then Develop Breed with TDN production as high as Maize (1.3t/a)</p>
<p style="text-align: center;">Advanced Technology such as Genome Research</p>	<p>* Isolate Genes Related to Production of Antibacterial Agent from Animal and Plant and Breed Organisms Producing Valuable Pharmaceuticals</p>

The Basic Plan on Food, Agriculture and Rural Areas (2000)

Table 33 Farm Households in Each Animal Species by Numbers of Animals Raising (2001)

	No. of Households	Total No. of Animals	1-9	10-14	15-19	20-29	30-39	40-39	50-79	80-99	100<	Undelivered cows only
Milk cows	31000	1703	3360	2440	2470	5560	5110	3970	6170	840	1360	830

	No. of Households	Total No. of Animals	1-2	3-4	5-9	10-19	20-29	30-49	50-99	100-199	200<
Beef cattle	109700	2806	24500	21500	26100	16700	6210	5120	4200	2810	2560

	No. of Households	Total No. of Animals	1-9	10-29	30-49	50-99	100-299	300-499	500-999	1000-1999	2000<	Breeding only
Pigs	10500	9725	260	390	340	610	1780	1270	1960	1250	840	1840

	No. of Households	Total No. of Animals	<50	50< <100	100<<200	200<<300	300<<500	500<
Broilers	3502	569234	963	677	1129	393	222	118

	No. of Households	Total No. of Animals	1<<5	5<<10	10<<50	50<<100	100<	Breeding Only	Others
Layers	4720	139423	1260	750	1660	340	340	310	60

Report of Livestock, as of February 1, 2001 <http://www.maff.go.jp/esokuhou/sei200138.PDF>

Table 34 Production and Self-Sufficiency Ratios of Various Meat and Egg

(1000t, %)

FY	Beef					Pork				Chicken				Hen's Egg		
	Domestic Production	From Beef Cattle Breeds	Imported	Ratio of Self-Sufficiency	Ratio of Self-Sufficiency	Domestic Production	Imported	Ratio of Self-Sufficiency	Ratio of Self-Sufficiency	Domestic Production	Imported	Ratio of Self-Sufficiency	Ratio of Self-Sufficiency	Domestic Production	Imported	Ratio of Self-Sufficiency
1975	235	91	64	299	0.79	716	146	862	0.83	759	28	787	0.96	1807		
1980	302	93	120	422	0.72	1001	145	1146	0.87	1122	80	1202	0.93	1992	49	2041
1985	389	145	158	547	0.71	1091	190	1281	0.85	1351	115	1466	0.92	2160	39	2199
1986	394	140	188	582	0.68	1091	205	1296	0.84	1397	187	1584	0.88	2273	61	2334
1987	398	130	224	622	0.64	1115	290	1405	0.79	1438	217	1655	0.87	2394	36	2430
1988	398	129	285	683	0.58	1104	339	1443	0.77	1436	272	1708	0.84	2402	46	2448
1989	378	133	364	742	0.51	1118	366	1484	0.75	1417	296	1713	0.83	2423	45	2468
1990	388	145	384	772	0.50	1075	342	1417	0.76	1380	297	1677	0.82	2420	50	2470
1991	407	153	327	734	0.55	1026	442	1468	0.70	1358	392	1750	0.78	2532	73	2605
1992	417	159	423	840	0.50	1003	467	1470	0.68	1365	398	1763	0.77	2575	92	2667
1993	416	169	567	983	0.42	1006	455	1461	0.69	1319	390	1709	0.77	2599	99	2698
1994	424	183	584	1008	0.42	964	503	1467	0.66	1256	489	1745	0.72	2563	104	2667
1995	413	179	658	1071	0.39	910	535	1445	0.63	1252	542	1794	0.70	2549	110	2659
1996	383	172	611	994	0.39	884	663	1547	0.57	1236	564	1800	0.69	2564	110	2674
1997	370	175	659	1029	0.36	902	517	1419	0.64	1234	510	1744	0.71	2573	104	2677
1998	371	175	682	1053	0.35	904	546	1450	0.62	1212	522	1734	0.70	2536	104	2640
1999	381	175	683	1064	0.36	892	653	1545	0.58	1211	567	1778	0.68	2539	119	2658
2000	364	168	738	1102	0.33	878	651	1529	0.57	1195	572	1767	0.68	2540	121	2661

Preliminary Report on Meat and Egg (2001)

Table 35 Transition of Consumption of Animal Products and Other Economical Indices

	Consumption of Animal Products *1 (kg/person)						Gross Domestic Product (billion yen)		No. of farm household *4 (10 ⁴)	Agricultural Income Produced *5			
	Beef	Pork	Chicken	Meat Total	Hen's Egg	Total	Real GDP *2 (Base Year : 1971)	Real GDP *3 (Base Year : 1991)		Total (100million yen)	Per Household (100thousand yen)	To GDP Ratio (1970=1.00 (1990=1.00))	
1970	2.1	5.3	3.7	11.1	14.5	25.6	190448.0		5342	26293	4.92	1.00	
1975	2.5	7.3	5.3	15.1	13.7	28.8	237329.5		4953	52054	10.51	1.70	
1980	3.5	9.6	7.7	20.8	14.3	35.1	292737.4		4661	45839	9.83	1.29	
1985	3.9	9.3	8.4	21.6	14.5	36.1	345446.0		4376	43800	10.01	1.11	
1986	4.2	9.6	9	22.8	15.4	38.2	356286.3		4331	42018	9.70	1.05	
1987	4.5	10.1	9.3	23.9	16	39.9	373233.2		4284	38352	8.95	0.92	
1988	4.9	10.3	9.6	24.8	16	40.8	395531.6		4240	40009	9.44	0.92	
1989	5	10.4	9.6	25	16.1	41.1	413120.4		4194	46145	11.00	1.02	
1990	5.5	10.3	9.4	25.2	16.1	41.3	436043.8	450,532.4	3835	48172	12.56	1.11	1.00
1991	5.6	10.4	9.6	25.6	17	42.6	448902.7	474,626.6	2936	50274	17.12	1.47	1.30
1992	6	10.4	9.8	26.2	17.3	43.5	450605.9	483,188.6	2888	49309	17.07	1.46	1.27
1993	6.7	10.3	9.5	26.5	17.5	44	452757.6	487,527.8	2835	47694	16.82	1.43	1.24
1994	7.2	10.4	9.8	27.4	17.2	44.6	455690.0	492,265.8	2787	51084	18.33	1.55	1.34
1995	7.5	10.3	10.1	27.9	17.2	45.1	469382.4	501,960.3	2651	46255	17.45	1.43	1.25
1996	6.9	10.5	10.3	27.7	17.2	44.9	489852.4	515,248.9	2606	44421	17.05	1.34	1.19
1997	7.2	10.2	10.1	27.5	17.2	44.7	487834.1	520,177.4	2568	39651	15.44	1.22	1.07
1998	7.3	10.4	9.9	27.6	16.9	44.5		513,244.7	2522	40440	16.03		1.12
1999	7.3	10.7	10.2	28.2	17	45.2		514,348.7	2475	36865	14.89		1.04

*1 Meat Marketing Statistics (2001)

*2 National Finance of Japan Homepage (<http://plaza4.mbn.or.jp/~zaiseihan/>)

*3 Annual Report on National Accounts of 2002, A Integrated Accounts, 1 Gross Domestic Product and Expenditure Account

*4 JAPAN STATISTICAL YEARBOOK 2002 6-1 FARM HOUSEHOLDS BY DEGREE OF ENGAGEMENT AND SIZE OF OPERATING CULTIVATED LAND (1915--2000)

*5 2001 GROSS AGRICULTURAL OUTPUT AND AGRICULTURAL INCOME PRODUCED (Estimated)

Table 36 Transition of Importation of Forage Crops

	Coarse Feeds					Concentrate Feed Fodder									
	Hay	cube	Hay	Rice Straw	Total	y/y	Bran	Sorghums	Wheat & Barley	Oil-Seed Cake	Cassava	Animal-Derived	Others	Total	y/y
1965							429	4618	1350	152		196	381	7126	
1970							488	8110	2391	378	7	244	817	12435	
1975	52.6	43.3	0.7	96.6			482	9222	2111	126	29	215	506	12691	
1980	294.6	114.5	48.2	457.3			880	13595	2884	394	3	427	562	18745	
1985	491.5	200.2	87.0	778.7			1088	14906	2982	335	426	390	424	20551	
1987	594.8	495.3	126.3	1216.4			1133	15666	2753	606	40	585	405	21188	
1988	657.2	751.3	168.9	1577.4	1.30		1078	15712	2790	729	215	524	480	21528	1.02
1989	723.3	731.1	172.0	1626.4	1.03		1123	15050	2616	784	244	550	498	20865	0.97
1990	695.0	885.0	180.9	1760.9	1.08		1125	15493	2790	829	172	526	534	21469	1.03
1991	740.0	1101.1	213.5	2054.6	1.17		1124	15502	3157	1035	144	668	580	22210	1.03
1992	762.0	1072.8	212.6	2047.4	1.00		1115	14746	3166	1172	152	648	540	21539	0.97
1993	802.3	1333.4	248.2	2383.9	1.16		1100	15162	3012	1220	123	656	555	21828	1.01
1994	703.5	1260.8	220.5	2184.8	0.92		1018	14277	3037	978	45	724	516	20595	0.94
1995	701.4	1383.1	214.0	2298.5	1.05		1005	13444	2974	1014	8	922	492	19859	0.96
1996	662.1	1518.9	229.4	2410.4	1.05		988	13751	2787	957	19	689	482	19673	0.99
1997	624.5	1521.9	268.0	2414.4	1.00		973	13897	2604	955	11	784	499	19723	1.00
1998	576.8	1561.6	216.9	2355.3	0.98		897	13464	2585	1102	14	610	426	19098	0.97
			(1998/1975)		24.38								(1998/1975)		1.50
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Animal Production	<ul style="list-style-type: none"> * Upgrading and Stabilization of Reproductive Technology, such as Embryo Transfer, Cloned Animal from Embryonic Cell Nucleus (Conception Rate by Embryonic Transfer : 50% to 70%, Delivering Rate of Embrvonic Cell Cloned Animal : 25% to 50%) * Improving Efficiency and Upgrading of Animal Breeding and Selection by Development and Utilization of DNA Markers * Establishing Milking and Nursing Robot Utilizing System Suitable for Livestock Management Condition in Japan * Reducing the emission of Nitrogen and Phosphor by Development of Barn-Waste Water Treating and Accurate Nutrient Managing Technology in Practical Scale * Development of Facility- and Labor-Saving Grazing Management Technology Utilizing Grazing Habit of Cattle * Upgrading of diagnostic technique for Major Disease of Cattle, Pig, Chicken and Development of Multivalent and Labor-Saving Vaccine
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