

**FIRST REPORT ON THE STATE OF ANIMAL  
GENETIC RESOURCES IN FEDERAL  
REPUBLIC OF YUGOSLAVIA**

**FEDERAL DEPARTMENT FOR PLANT AND ANIMAL  
GENETIC RESOURCES**

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**Abbreviation which are used in this report:**

<b>FRY</b>	<b>Federal Republic of Yugoslavia</b>
<b>AnGR</b>	<b>Animal Genetic Resources</b>
<b>DAD-IS</b>	<b>Domestic Animal Diversity – Information Systems</b>
<b>EU</b>	<b>Europe Union</b>
<b>UNDP</b>	<b>Unated Nations Development Programme</b>
<b>GEF</b>	<b>Global Environmental Facility</b>
<b>FAO</b>	<b>Food and Agriculture Organisation</b>
<b>WAAP</b>	<b>World Association for Animal Production</b>
<b>EAAP</b>	<b>Europe Association for Animal Production</b>
<b>DAGENE</b>	<b>International Association for the Conservation of Animal Breeds in the Danubian Region</b>
<b>SAVE</b>	<b>Safeguard for Agricultural Varieties in Europe</b>
<b>GTZ</b>	<b>Deutsche Gesellschaft fur Technische Zusammenarbeit</b>
<b>UNESCO</b>	<b>Unated Nations Educational, Scientific and Cultural Organization</b>
<b>PDO</b>	<b>Protected designation of origin</b>
<b>PGI</b>	<b>Protected geographical indication</b>
<b>SME</b>	<b>Small and Medium Enterprises</b>
<b>V.O.</b>	<b>Artificial Insemination</b>
<b>E.T.</b>	<b>Embryo Transfer</b>
<b>NI</b>	<b>No Informations</b>

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## Introducing the Country

The Federal Republic of Yugoslavia was created by transformation of the former Socialist Federative Republic of Yugoslavia and consists of the Republic of Serbia and the Republic of Montenegro. It is situated in the South of Europe, in the Balkan Peninsula. The FRY occupies total area of 102,173 m<sup>2</sup>. Major part of FRY is situated between 41.52 and 46.11<sup>0</sup> of northern latitude and between 18.26 and 23.01<sup>0</sup> of eastern longitude. Territorial – land border of FRY borders in the Southeast with the Adriatic Sea (293 km). On the eastern, southern and western borders of FRY there are high mountains with over 2500 m above sea level, and from all sides the terrain descends towards the Pannonia plains in the north-eastern part of the country. Great rivers the Danube, the Sava, the Drina and the Tisa flow through these plains.

Territory of FRY, in regard to climatic conditions, is very complex and heterogeneous due to its geographical location in the Southeast Europe and the fact that it is open to different influences. However, three basic types of zone climate can be recognised: Mediterranean climate, typical temperate continental climate and dry temperate continental climate. Typical temperate continental climate is prevailing, characterised by cold winters and warm summers. All seasons are present. Quantity of annual precipitation is between 550 and 700 mm, with strongest most frequent deficit in July, August and September.



Influence of the Mediterranean climate is moderate, except around river basins of Bojana, Zeta and Morača. Mediterranean climate is characterized by mild winters and very hot summers. On higher altitudes mountain, that is sub mountain climate is prevailing. Mean annual temperatures vary from 3.7 to 16.5<sup>0</sup>C. Characteristic for FRY climate, apart from high temperatures, is also high number of sunny days during one year. For various purposes of planning, territory of Yugoslavia is divided in following regions: most frequently, Pannonian-plain region, hilly-mountainous region and coast region. Pannonian-plain region, southern part of which is on the territory of Serbia, includes: alluvial plains and terraces along river basins of great rivers (Danube, Tisa), plateaus (Banat, Titel and Srem) 100 to 140 m above sea level, and hilly-mountainous elevations (Fruška Gora and mountains around Vršac). Very fertile area in regard to plow crop production with major products – grain, industrial plants and corn. Also characteristic for this region is presence of intensive livestock production – pig production, poultry production and production of dairy cattle. Hilly-mountainous region is predominantly the region for fruit production, livestock production and plow-crop production. In regions where hills are predominant the greatest number of private farms engaged in mixed farming – combined production systems, are located. Mountain regions are characterized by great areas under mountain pastures which are suitable for extensive and semi-intensive livestock production in pasture-mow systems. Coast region is characterized by poorly jagged coast line with two distinguished entirities: Boka Kotorska - deep bay of the fiord type and Paštrović-Ulcinj coast line with predominant shallow bays and few islands.

(Tables 1. and 2.)

According to the most recent census taken in 1991, FRY had population of 10,394,026, 5,157,120 male and 5,236,906 female inhabitants, 2,870,676 households or 3.62 persons per household. Average age of population was 35.5 years, average life expectancy 71.4 years. On the territory of FRY there are over 700,000 refugees from war-stricken areas of Croatia, Bosnia and Herzegovina and Kosovo and Metohia. 361,452 citizens of FRY are temporarily employed in other countries – Germany 75,375, Austria - 67,916, Switzerland – 42,539, USA – 19,173.

Major production systems in FRY are represented through private ownership with low or medium level of investment in plow crop and livestock production. Plow-crop production is present in the region of Voivodina and in river valleys. Livestock production is present in all regions. Major plow crop products are wheat, corn, sugar beat, oleaceous plants. Major livestock products are meat, milk and eggs. Agricultural production is mostly realized on small private farms and properties with 74.3% of cultivable land, public sector - 17% and cooperatives – 2.7% of cultivable land.

(Tables 3. and 7.)

Livestock production is realized mostly on farms in private ownership, however, majority of mentioned livestock production is not market oriented. Exclusively market oriented are public farms and cooperatives, currently undergoing process of transformation – privatization. Proportion of large farms in total number of farms is very small. Only 4.5% of farms have over 10h of land, and their participation in total agricultural land is

approximately 17%. Out of total number of farms 50% has between 1 and 5 ha of land, and these properties mainly consist of great number of small parcels distributed on greater distances.

(Tables 4. and 5.)

The FRY has never experienced problems related to providing food for existing population. Our country disposes of natural resources for high level of production, for domestic needs, as well as export, however potentials were insufficiently used and shortages occur occasionally predominantly in great urban areas. Meat, milk and dairy products are imported occasionally as intervention by the state in order to reduce the prices on domestic market. The importance of animal products is fairly high. Milk and meat together with bread represent the basic and the most appreciated foodstuffs. However, there was a sudden drop in the share of meat intake in the nutrition of population within the past ten years with the decrease in the standard of living although from the cultural point of view it still represents, besides bread, the most important foodstuff. Lamb and beef meats were until the nineties among the main exports. During the past ten years, however, meat is almost not exported at all. Risks of potential shortages of food are moderate. Shortages are mainly caused by the instability of the market and elemental production (absence of associations of producers which could impose pressure on the government). Also, various natural catastrophes represent risk, lately extreme draughts during summer months and spring frosts. Risk of draught is extremely significant due to very small areas under irrigation systems.

(Tables 8. and 9.)

Certain regions, mainly great urban areas and less developed areas are more frequently endangered by temporary food shortage. With the increase in standard of living of population the demand in regard to the quality and quantity also increases. AnGR will have a significant role regarding satisfying the future demand of population for high quality food (production of healthy and safe food, organic production), ecological production and integral development of rural areas anticipating combination of agriculture and tourism.

Approximately 56% of general population of FRY lives in rural areas, 16% is agriculturally active population. Old people are left in villages, especially in hilly-mountainous regions. Distribution of population is rapidly changing in favor of cities and migration of inhabitants from rural to great urban areas continues. Migration so far has no greater effect on providing of food for human population. During recent years, interest for return to rural areas and agricultural appeared. The position of our government is to enable the return of industrial workers who were left unemployed due to the restructuring of ownership, to their properties in rural areas and to help them restore the agricultural production on their farms or to intensify the production. The standard of living of rural population is expected to increase in future, especially in plain regions where the intensity of development is the greatest, whereas in the hilly-mountainous regions the situation is expected to remain the same.

(Table 6.)

## 1.1 The State of Production Systems

In FRY, in all the branches of animal production, there are two types of production systems: a highly specialized high input production system and an extensive low input production system based on the combined crop/animal farming. The high input systems were used mainly by large public farms, and the combined, traditional low-input systems was dealt by small and medium private sector.

Public sector, monitored and supported by the state during previous period, had at disposal modern equipment and the latest scientific knowledge, and therefore represented a dominant producer. Public farms were organised in a specialised type of production, that is the intensive production. Cattle production, pig production, poultry and sheep production were predominant. In private sector, family households were mainly organised as combined production systems, directed towards this production type due to the state agricultural policy. Few of the individual farmers specialised in certain production and applied modern methods. Several types of animals are kept on such households, for instance cows, sheep, pigs, poultry, etc.

(Table 10.)

Two ownership types present in FRY are private and public. In regard to different animal species, proportion of private ownership varies in relation to public ownership. In case of cattle production, huge farms are generally in public ownership, whereas in private sectors cattle is raised on small farms or within a family household 1 or 2 cows. The typical size of a farm in private sectors is a small commercial unit. 95% of horses are raised on private farms and only 5% on public farms. Pigs are produced mainly on private farms (over 95%), and only 5% on public (state) farms. Size of farms owned by individual agricultural producers – farmers is usually 1 to 3 sows, rarely 5 to 10 or 50 sows, whereas public farms usually have 100 to 2500 sows, or most frequently 1000 to 1500 sows. Public farms have complete production cycle, breeding boars and sows, they are engaged in production of breeding gilts and boars for remountation and for sale. In case of sheep, 99% are raised on private farms and only 1% on public farms. In case of poultry, 70% of poultry farms are in private ownership and 30% in public ownership or some other type of holding company. Typical size of poultry farm is 1000 to 5000 birds in one production cycle, however, each family farm has in average 80 to 100 birds annually, for their own needs. In rural households production is mostly sustainable, and medium and large farms depend greatly on external inputs (purchasing of food components, veterinary assistance, breeding material, etc.).

(Tables 11-22.)

The most significant livestock products in FRY are: milk and dairy products, pork, beef and beef products, poultry meat, eggs, lamb, liquid manure, wool, skin, giblets and manufactured products. Importance of various livestock products is both economical and social. Even in relation to economical importance of these products, the order is identical. There are great differences in production, consumption and economical importance according to certain regions.

## 1.2 The state of Genetic Diversity

The locally adapted breeds in FRY are:

Cattle: *Podolian cattle, Busha, Buffalo, Domestic spotted cattle*

Horses: *Bosnian-mountain pony, Nonius, Yugoslav Trotter, Lipitsa*

Donkeys: *Italian and Cyprus*

Pigs: *Mangalitsa, Morava, Domestic meat breed, Yugoslav spotted*

Sheep: *Yugoslav Zackel (many strains), Tsigai, Vitoroga sheep, Lipska sheep*

Goats: *Domestic Balkan goat*

Poultry: *Golovrata hen breed (status – at risk), Sombor poultry (status – at risk), Kosovo singer (status – at risk), Svrlijig hen breed (status – at risk), Dečan hen breed (status – at risk), Sombor geese breed, Novopazar geese breed, Domestic Bronze turkey i Morka (Biserka)*

All the Locally Adapted Breeds show a decreasing trend of population.

The exotic breeds in FRY are:

Cattle: *Simmental, Holstein-Friesian, Holstein (Black and Red), Limousine, Charolais, Montafon (Alpsko goveče)*

Horses: *Thoroughbred, Arab horse, Štajerski konj, Irski poni*

Pigs: *Swedish Landrace, Large White, Dutch Landrace, German Landrace, Belgian Landrace, Danish landrace, Canadian landrace, Pietrain, Hampshire, Duroc*

Sheep: *Merino, Merinolandschaf (Wirtemberg), Ile de France, Bergamo, Jezersko-solčavska*

Goats: *Yugoslav Saanen, Alpine*

Poultry: *New Hampshire, Brahma, Košinšina hen breed, Sussex, Leghorn, Amrock, White Rock, Australorp, Italian Partridge poultry, Rodisland, Barnewelder, Orpington, Plymouth Rock, Viandotte, Italian White geese, Toulouse geese, Landska geese, Beijing (Chinese) duck, Muscovy duck, Rouane duck, Dutch White turkey, American Bronze turkey*

Some breeds have stable, and some a decreasing trend of population.

Wild relatives of domestic animals in FRY are:

Deer (*Cervus elaphus*), Roe Deer (*Capreolus capreolus*), Wild Boar (*Sus scrofa*), Chamois (*Rupicapra rupicapra*) and Partridge.

Some breeds have stable, and some a decreasing trend of population.

There is a real danger of AnGR diversity erosion in FRY.

(Table 23.)

### 1.3 The State of Knowledge of AnGR

Information on current status of breeds within each animal species is of great significance for the production of food and agriculture of Yugoslavia. Basic and regional selection services of the Republics of Serbia and Montenegro register, control and carry out other selection measures during entire year, and reports on current status and production of population under control – Exotic and Locally Adapted Breeds, are submitted to at the end of the year. Public sector is completely included in this program of selection measures, but private sector – individual producers/farmers, only partially. In case of Exotic and Locally Adapted Breeds, production and reproduction traits of animals raised on huge farms are registered and recorded. Through selection measures information on breeding structure and organization of each breed is maintained. Diminished ability to use and develop AnGR in FRY is caused by gaps in information network, such as: absence of systematical work, lack of standardization, and inadequate communication with elements of immediate or wider surrounding.

Priorities related to building of capacities that could induce increase of efforts for improvement of existing knowledge on status of diversity:

- legislation
- legal and normative regulations and standardization
- marking of animals
- introducing information system for monitoring of biodiversity

In FRY exists a system for monitoring of present status and trends for each animal species, and we are capable of monitoring breeds which are endangered.

The FRY has no national livestock oriented information system. There is internal livestock information system at the Federal Department for Plant and Animal Genetic Resources used for internal and research purposes. This information system includes data from Republic of Serbia, however, lack of data from Republic of Montenegro is caused by absence of obligatory regulations forcing the competent institutions of Montenegro to forward data into this information system. Information system is compatible to DAD-IS and should become part of the National Plant and Animal Gene Bank, which is supposed to be formed.

The following characterization studies were completed in FRY:

- With cattle, control of production capabilities, performance testing of potential head of breeding stock, and test of offspring of the bulls that had positive evaluation in performance test, as well as health protection, are done.
- With pigs, annual reports are completed on number of heads and production traits of registered herds.
- With sheep and goats, production cycles (for instance, number of lactations, exterior measures over several years, etc.) are completed.

- With poultry, annual reports are made on number of poultry and production performance of registered flocks.

Data obtained this way is gathered in agriculture stations, Veterinary and Agriculture institutes, centers for A.I., and Republic selection services, and they are at disposal at Ministries of Agriculture of Republic of Serbia and Republic of Montenegro. Studies of comparative characterization have not been carried out for any animal species. Until now studies of molecular characterization for any AnGR species weren't carried out in FRY. Priority at this moment is building of capacities for characterization: providing of financial support, equipment for laboratories, molecular characterization, education of people engaged in these activities and introduction of uniform and universal information system.

#### **1.4 Programs and Conservation Strategies**

FRY has the draft on strategy for conservation and preservation of AnGR. Objectives of this strategy are to preserve Locally Adapted Breeds that are becoming extinct, for social and economical purposes, as well as future scientific researches and education purposes. Priority is to preserve the breeds that are most severely endangered.

The aims of this strategy rest on the fact that awareness regarding the conservation and preservation of disappearing Locally Adapted Breeds is greatly developed in breeders, and that the adequate technology and technical capacities, as well as education of people responsible for their implementation exist, and that individual breeders are included in its realization.

The results of realization of strategig goals are the following:

*In situ* conservation is in progress for Podolian cattle with objective to prevent the negative trend and increase the population. The results that we have show that the above mentioned breed of cattle is owned by individual breeders on 4 locations, however, there is a great interest for raising this breed by other breeders and public subjects. There is also initiative to identify and form nucleus herd of Busha cattle and Buffalo in the region of Vranje and Novi Pazar municipalities.

*In situ* conservation of Bosnian-mountain pony and Nonius is also in progress with an objectives to prevent the negative trend (disappearance of this breed through crossbreeding), and increase the population. Heads of Bosnian-mountain pony are located on farms owned by individual agricultural producers on the territory of the Bosilegrad municipality. Agricultural producers use these heads in concordance with the purpose to which this breed was selected, however they are obligated to give 1 to 3 foals to the Federal Department for Plant and Animal Genetic Resources in order to provide conditions to create new herd on different location and increase population. The programme anticipates that agricultural producers should keep 2 to 4 foals as compensation. This programme started in year 2000 with outstanding results. Nucleus

herd of Nonius is located at the Military institution «Karadžorđevo» under the control of expert service of Yugoslav Army.

In case of donkeys, there is still no conservation programme since economical interest for breeding of this animal species is low, however in certain institutions initiatives for such programme exist. Future programme for preservation of these resources could be similar to that for Busha cattle realised on Kosovo and Metohia, and include certain financial support to farmers that already have donkeys in order to improve their breeding and follow the instructions on their preservation.

*In situ* conservation programme for pigs is in progress in case of Mangalitsa breed with objective to prevent the negative trend and increase the population. Heads are located on public farms and individual farms on total of 6 locations. During the last 3 years number of pigs was doubled, since there is great interest for raising this pig breed due to its genetic potential in production of fat of specific composition, which is suitable for people with increased level of cholesterol in blood. Initiative to form nucleus-herd of Moravka breed is also in progress.

*In situ* conservation programme for sheep and goats is carried out on public farms and households in private ownership. The activity is directed towards preservation of domestic milk breed Bardoka as well as identification of remaining members of other Yugoslav Zackel types. Balkan goat is in selection programme of some dairy processing plants that are supporting the survival of this breed through organisation of annual animal shows presenting intensive, mostly imported breeds and domestic breeds.

With poultry, conservation programme is in initial phase. Objective is to register flocks and determine the population. Small individual breeders will have in future the most important role in the process of conservation since it will be possible to organise the preservation of old selections as major part of tourist industry and similar activities related to diversification of rural economy.

There is awareness that mentioned programmes can not be realized without an adequate co-operation of individual breeders, non-governmental organisations, local and domestic communities and other interested subjects.

Wild species in FRY are protected under the Law on Protection of the Environment, Law regulating hunting, closed hunting season, different regulations, etc.

Cryoconservation has not been implemented in any breed in FRY for the time being.  
(Tables 33-36.)

## 1.5 The State of Utilisation of AnGR

Constitution of FRY determines that contracts ratified by former Socialist Federal Republic of Yugoslavia continue to be the part of internal legal order of FRY, which further leads to the conclusion that FRY is responsible before international community for their implementation on its entire territory. In accordance with principles of international law decrees, states have sovereign right to exploit their own resources in accordance with their policies. FRY, through its agencies passes and implements federal laws, other regulations and general acts. Policy and legislation determinations supporting the foundation of institutional mechanisms enabling and supporting the sustainable management of AnGR exist in FRY.

- Federal Law on Protection of the Environment determines conditions for the access to genetic resources (import, export and transit) – wild flora and fauna.
- Law on Protection of Animals from Contagious Diseases endangering the entire country determines the protection of animals from contagious diseases that could contaminate population, also veterinary and sanitary control of production and sale of products, raw materials and waste of animal origin.

Republics of Serbia and Montenegro have their own legal instruments such as:

- Law on Measures for Livestock Improvement regulating the sustainable management of Locally Adapted Breeds and Imported Foreign Breeds,
- Law on Protection of the Environment, Law on Protection of Nature,
- Law on National Reservation Parks regulating the sustainable management of wild flora and fauna.

Advisory agricultural services on regional level which are: conducting researches with Republic services, offering advice, educating farmers and participating in activities related to forming of breeders' associations, also exist in FR Yugoslavia. Activities of mentioned services are determined and regulated by the Law on Agricultural Expert Services of Republics of Serbia and Montenegro, and the new law which would improve these issues is expected next year.

The state of use of AnGR and their products is following:

- a) Cattle (milk and dairy products, meat, products (meat and bone), skin, manure, breeding material-calves, liquid manure, pulling power)
- b) Horse (meat, blood-serums, liquid manure, breeding material-colts, pulling power)
- c) Donkeys (meat, breeding material - calves; labor power )

- d) Pig (meat, dry meat products, semi durable meat products and durable meat products), skin, liquid manure, bristles, products (meat and bone), breeding material-piglets
- e) Sheep (meat, milk, wool, skin, liquid manure, breeding material-lambs)
- f) Goat (milk, meat, skin, liquid manure, breeding material-kids)
- g) Hen (eggs, meat, breeding material-eggs and offspring)
- h) Turkey, duck, goose (meat)
- i) Fish (processed fish and products, breeding material – fish-roe, baby-fish, mothers, young fish, table fish and fish products)
- j) Bee (honey, honeycomb, pollen, propolis, honeycomb with honey, bee poison, breeding material – queen bees and clusters)

(Tables 24-25.)

For domestic and foreign markets different breeds were used within each animal species. These breeds vary mainly in regard to the quantity and quality of product (for instance, light and heavy lambs, etc.), also in regard to the breeding method and purpose for individual breeds. Some markets have great demands for beef and lamb meat (regions with predominant Muslim population), whereas in other regions consumption of pork is predominant (rest of Serbia). However, there is no distinct difference in use of individual breeds, considering the quality of product achieved, although market differentiates products deriving from extensive mountain production systems, rural regions (with traditional production system) and industrial. This is in accordance with preferring of Locally Adapted Breed, considering the fact that precisely these breeds are predominant in mentioned production systems, however it can not be stated that market completely differentiates products originating from different AnGR, but more production systems.

In case of dairy products, there are certain specific issues relating to demand by dairy industry for certain types of milk depending on the fact whether it is conventional processing or traditional product. All mentioned above has moderate effect on forcing of certain breeds in particular regions. Consumption of horsemeat as well as meat products is becoming increasingly interesting for domestic market, exclusively in big cities. This occurrence however induces import of slaughter horses rather than breeding. Skin is currently not very attractive product, and use of liquid manure (mushroom production) is standard with oscillations. This doesn't affect the choice of breed nor improvement and increase of horse breeding and production in regions where mushroom growing production exists, but vice versa. Value of mare's milk is unknown in our country, therefore there is no interest for this particular product.

Tradition relating to use of certain AnGR products exists in pig production. In Kosovo and Sandžak regions, due to the religious choice, pork is consumed in insignificant quantities, contrary to other regions of FRY. In case of sheep production, various demands in regard to animal products within the country influence the use of different AnGR in the way that there is greater demand for lambs of certain breeds (for instance, in general demand for Tsigai sheep is minor compared to lambs of other breeds especially mountain breeds). In poultry production there is tradition regarding the use of certain AnGR products. In Voivodina, geese and duck meat is traditionally used in nutrition, and

in Central Serbia – Jagodina and Požarevac districts, turkey meat is consumed. Hen meat and eggs are equally use on the entire territory of FRY.

Current status in regard to technological development and use of different technologies according to species is following:

In cattle production, predominant specific technique is artificial insemination, embryo transfer is used rarely because it is expensive. Significance of artificial insemination is great like in other countries engaged in modern livestock production since it enables distribution of positive traits in population (use of this method has resulted in increased milk yield and improvement of other production traits). Beside exhibitions of cows and heifers, and the control of production capabilities (production of milk and meat), obligatory measures encompass also tests the head of breeding stocks (performance or personal test, biological test and progeny test or the test of offspring on characteristics of milking and feeding capacity), linear evaluation and grading of cows and bulls on exhibitions in centers for A.I. Test of offspring for milking capacity is performed based on control of productivity of daughters and their comparison to those of same age, whilst the test of feeding capacity is not performed for several years now. In horse production, performance and progeny test. In pig production, performance test, evaluation of values gained through the method of selection index, use of A.I., are performed for all mentioned breed used in intensive production system. In sheep production the following technologies are used: recording of performances, etc. In poultry production, extensive system is used for Locally Adapted Breeds and Exotic Breeds, performances of stated breeds are recorded (phenotypic evaluation and evaluation of traits within single flock). (Table 26.)

For the majority of Locally Adapted sorts and breeds are used extensive with low investments and semi-intensive technologies of breeding, whilst with exotic are mostly applied semi-intensive and intensive technologies with high investment. In cattle production during last decade, changes in breeds and breed structure of cattle population were not emphasized. In horse production, changes in use of breeds have occurred, however not in the way that could affect the breed structure of population during last decade. There are no significant changes regarding the use of individual pig breeds in intensive pig production system, therefore no affect on breed structure was registered. Combination of species changed in direction of increased use of pure breeds – genetically more valuable pig breeds. In sheep and goat production, changes relating to use of breeds have occurred but not to the extent of any considerable effect on breed structure of sheep and goat population during last decade. Considerable changes have been occurring in poultry production relating to use of breeds – in sense of increased use of commercial hybrids instead of Exotic Breeds. Combination of species changed towards the detriment of geese, ducks and turkeys.

Various breeds and breeding systems are developed in order to provide for domestic and partially foreign markets. Imported breeds adapted to our housing conditions are primarily used and these breeds are considered to be more important. It is expected that different markets and different demand for livestock products in the future would

influence genetic development of AnGR, due to certain specific traits and habits of consumers in certain regions. In the case of cattle production, differences regarding needs and habits of consumers specific to our conditions have influenced differently the development of individual breeds depending on the location. In the areas of high standard and certain placement on the market, for instance of milk, are kept highly productive noble milk sorts like Hohlstein-Frisian (Voivodina). In the other areas is, for instance, preferred cattle of combined milk-meat type, to compensate uncertain placement of milk (Central Serbia). In areas with extensive production of cattle food (passive mountain areas of Kosovo and Metohia) still hold Busha and its halfbreeds.

In Serbia, Preševo, Bujanovac and Novi Pazar regions, also Tutin and Sjenica regions, with predominant Muslim population, there is great demand for sheep milk products as well as mutton and lamb meat. In mentioned regions there is great impact of market and demand for animal products on genetic development of different AnGR. In Poultry production, different markets and consumer demands determine the development of different AnGR, for instance, in Vojvodina, geese and duck meat is traditionally used for nutrition, in Central Serbia – Jagodina region – turkey meat is consumed.

### **1.6 Development of AnGR (breeding strategies)**

With cattle, breeding structure is in pure breed (according to Selection Program and breeding objective). Simmental, Holstein – Friesian cattle and Red Holstein are raised, they are self replaceable / interchangeable and do not depend on the import, although from time to time fresh blood is imported, in order to achieve increase of production of milk. Reasons for use of Exotic Breeds is realization of better production results – quantitative and qualitative. Melioration crossing is carried out sporadically, Simmental females are crossed with bulls with less HF genes, not because of assimilation, but in order to improve production characteristics (in order to increase milk yield, it is necessary to improve the form of udder).

Reason for raising purebred horses is the specific value of mentioned horses. Systematic crossing of purebred animals for breeding is aimed to improve quality of horses in wide population in order to obtain high value halfbreed animals.

In pig production, breeding structures in pure breed include all stated breeds used for obtaining of breeding crosses as well as three breed fattening pigs. Locally Adapted Breeds are mostly raised in Exotic Breed.

With sheep and goats, following breeds are raised: Exotic Breed – Sjenica improved sheep, Pirot improved sheep, Merinolandschaf, Ile de France, Tsigai and Svrlijig sheep. Systematical crossing is carried out in case of Sjenica improved sheep and Svrlijig improved sheep with Merinolandschaf. Reasons for production in Exotic breed are production of meat and milk (Svrlijig sheep, Sjenica improved sheep, Tsigai sheep), meat and wool (Pirot improved sheep, Merinolandschaf and Ile de France). Some of the breeding systems are self replaceable / interchangeable, however, some are dependent on certain male-female replacements provided from abroad.

With poultry, breeding structures are based on pure breeds and are carried out by breeders (on one public farm “Živinarska zadruga”, Novi Sad). Locally Adapted Breeds are usually sustainable, however, random crossing occur. It was stated that Exotic Breeds depend to certain extent on import due to the exchange of “material” or due to the need for acquiring certain Exotic Breeds that are not raised continuously in FRY (for instance: Barnewalder).

(Tables 27-28.)

Results of major breeding systems used in case of certain species were evaluated in the following way:

Breeding systems for cattle, developed in research stations and on farms, include following parameters: yield of product, quality of product, reproduction level, resistance to diseases and parasites, consumption and conversion of food, longevity, lifetime production and total economical effects. With horses, results were evaluated on equestrian farms as well as research stations. Following production traits were evaluated: work ability, fertility, etc. In case of pigs, results relating to certain breeds were evaluated on farms. Following production traits were evaluated: daily gain, feed conversion, back fat thickness, meat – fat ratio. With sheep and goats results were evaluated on farms and in research stations. Following production traits were evaluated: yield of milk, meat, wool, fertility, growth. With poultry, for certain AnGR populations results were evaluated on farms focusing on following production traits: duration of production, egg production, number of eggs being hatched, laying percentage, mortality and consumption of food.

Factors limiting improved use of AnGR are: difficult economic situation causing complete social crisis, lack of education and knowledge in this field, ownership of resources – animals, small size properties – farms, old households, absence of turnover of capital, etc. Factors limiting genetic development of AnGR are: lack of financial resources for application of modern genetic and selection methods.

## **2. State of the Art**

### **2.1 Reviewing Past Policies, Strategies, Programmes and Management Practices**

Creators of the agrarian policy in the former Yugoslav federation included in the strategy of agrar development almost all the objectives which an agriculture of a modern country should have. According to the existing documents the agriculture had priority in the development of the country. The development on the principles of the free market has been anticipated, as well as modernisation using modern technical achievements, etc. Among all the listed priorities the development of science in the field of creating high yielding breeds, as well as the development of animal husbandry on the whole, especially cattle breeding and distinctive export orientation have been included. The measures to meet these objectives have also been anticipated, and these are permanent macro-programmes, measures of agrarian policy, coordination and development management,

education, improvement of agricultural services. In the reality, however, none of the objectives has been realised, neither there was any serious work on it.

Agriculture on the whole, and so the animal husbandry over the last ten years, has been the "hostage" of the state programme of keeping social peace and had unfortunate effects on all the aspects of production and so for the conservation of AnGR. Occasional heavy crises like that of 2000 which ended up with a massive slaughter of animals due to shortage of food after an extremely dry year, are just one of strikes which AnGR experienced due to lack of particular actions of the state for conserving animal resources. Recalling budget finances for conserving rare breeds on the republic levels which followed is one of the series of moves which had heavy consequences on maintaining AnGR conservation programme. A positive decision, however, has been made on the federal level, where the changes in the work policy on genetic resources enabled AnGR conservation programme to have its place and a part of necessary funds, thus saving some of the most endangered breeding stocks of rare domestic animals. The state has chosen to get ownership over them, and then to hand them over to holders instead of stimulating the existing holders who often blackmailed the state.

The heaviest adverse effect on animal husbandry, and conservation of AnGR, however, had the pricing policy in agriculture. Besides, the most adverse consequences suffered those breeds of domestic animals which in the conditions of sanctions had no alternative for imported animal feed, as well as the intensive systems of production in large public farms highly dependant on the food market. Private sector based on self sufficiency of the production system and combined farms to some extent successfully compensated for the problems in animal husbandry but this sector has also been completely exhausted until the end of 2000. In the long run, the lack of quality and more comprehensive programmes in the field of AnGR mostly affected cattle breeding, considering that the decimated animal resources are the slowest to recover.

Most of the activities connected with protection of AnGR in FRY have been based for years mainly on a moderate provision of funds for helping holders of several species and breeds of Locally Adapted Breeds and moderate research work on them. The research included maximally 4-5 research and educational institutions, mainly in Serbia. It has been symptomatic that, apart from the high inputs into the experimental farms of some state research institutions, practically none of them is interested in AnGR conservation. In conservation of collections mainly private breeders-enthusiasts have been engaged and only a few state enterprises. National Focal Point for animal genetic resources has also the increasing problem of conserving collections in the properties of production and educational institutions owned by state or cooperatives. However, the problem is not only material but organisational as well, because the work on these collections so far has been very moderate in volume terms even when the funds for that purpose were sufficient. That practically led to lack of integration of conserving animal genetic resources with production systems aimed at valorisation of the realised production and raising sustainability of the applied strategy. So, the benefit for farmers and consumers of animal products is very small.

(Tables 29-31.)

Due to the apparent disadvantages in protection system and possibility to lose the remaining material from the collections, in the early 2001, the reorganisation in AnGR conservation and protection strategy took place on the federal level. Apart from the lack of clearly defined investments for this purpose, a prompt action helped in saving another collection of Bosnian-mountain pony, location of Podolian breed in which the local partner did not have any more interest has been changed and breeding stock of Bardoka, which was endangered in the war-stricken area of Kosovo and Metohia, was formed. Unfortunately, the action of improving preservation and conservation systems came at the moment when the decisions of Animal Council at the Ministry of Agriculture of the Republic of Serbia were made not to appropriate funds for AnGR any more and to give the competence over all the activities to the Federal Department for Plant and Animal Genetic Resources. In that way the work on AnGR conservation has been brought under question until the approval of the next budget or reconstruction of the Federal State.

At the Federal Department for Plant and Animal Genetic Resources there has been founded an Advisory Committee for AnGR organised according to the FAO instructions. The Committee included 20 experts from 15 scientific, educational and production institutions of government and non-government sector. The expert team of specialists for animal genetic resources included for the first time the specialists for the field of protection of wild relatives of domestic animals – birds, mammals, fish and bees. This initiative emerged from the need of introducing new animal species into the food production programmes, due to the increased interest of foreign markets for the alternative meat resources from the FRY (primarily for the food from organic and agroforestry systems). The need has been identified for work on improving utilisation of AnGR of the following new species and groups of animals which were not worked on to date. There has also been identified the need for including into the protection programme some of the neglected species of domestic animals, like asses, buffalos, and some other species of domestic poultry (guinea fowl, etc.). There has been a marked interest of farmers and buyers of animal products to work on reintroduction of wild animals with a potential economic benefit in agroforestry and the similar systems like European buffalo, etc.

(Tables 37-38.)

On the basis of the classical simplified classification of the geographical regions, the territory of FR of Yugoslavia is divided into lowland, hilly-mountain and mountain region. The division on crop and animal growing, animal-fruit-wine growing and animal growing agricultural region matches this division.

Region: field crop growing – livestock breeding

Natural environment. Vojvodina lowland and valleys of large rivers belong to field crop and livestock region. Most of the territory is under the culture of steppe - plough fields with intensive agricultural production. Fields are, except saline field regions, mostly very fertile and belong to the class of csernozem and alluvium. There are no restrictions regarding intensive cultivation and irrigation. Except for Deliblatska Peščara, which is protected by law as a reservation, other sand terrain are cultivated. Natural vegetation is organized in

mosaic pattern and covers smaller areas with meadow and steppe vegetation, wooded steppe, saline areas with puszta vegetation and sand terrains. Along the Sava, Danube, Tisa and Tamiš, several swamp enclaves exist, some of which belong to protected zones according to Ramsar Convention. Along greater lowland rivers, flooded and non-flooded forests with rich fauna have been preserved. The environment of this region provides possibility for high input production based on intensive animal and plant production, but unexpectedly this is actually the region where we have the most of interest for conserving rare AnGR and this is for cultural reasons not for reason of producing any of products.

Rural environment. The region has well-developed infrastructure. Food production is the foundation of lowland rural economy. Large commercial farms and food-industry are mainly industrialised. Farmers co-ops and other forms of associations based on interests exist, they have good access to modern achievements in agriculture which makes number of species and breeds grown in the region as limited as possible. The dominant branches are field crop growing, swine and poultry breeding and dairy-related cattle breeding based on high productive exotic breeds. The use of field crop by-products justifies the production of young beef and mutton. Sheep production is based on locally adapted breed, mainly Tsigai. Market is however pushing farmers towards thoughts about exotic breeds import to provide improvement of carcasses.

Development strategy anticipated for the region:

Development of intensive commodity production in conventional and alternative agriculture.

Complete revitalization of mixed farming for solving problem of environmental degradation and pollution which can offer space for diversification of livestock production including breeds

Protection and revitalization of traditional environment through incentives for integral development of typical household – farm (salas). This is the only place in the regional strategy where locally adapted rare breeds are also seen as a sustainable option. Encouraging agricultural development, especially game hunting, fishery and fungi growing for the better valorization of available water and forest resources. Here some space for developing resources of wild relatives and their conservation is seen

Region: livestock breeding-fruit growing-vineyards

Natural environment. Highland territory of Central Serbia, Negotinska and Timocka Krajina, uplands of valleys of larger rivers in southern Serbia and Kosovo and Metohija belong to the livestock breeding, fruit growing and wine-growing region. Most of the territory consists of anthropo-zoogenous areas, which were the result of forests clearing in the oak zone. Pedological basis is divergent; there are fertile, semi-fertile and poor fields. Most fields belong to the category of land difficult for cultivation. Great percentage of land is acid. The irrigation is possible mostly in uplands of large river valleys, but it is rational only in fruit growing. In this area growing locally adapted breeds is dominant (Domestic spotted cattle and Zackel sheep; poultry and pigs are mostly crossbreeds), however most of the rare species are lost. Some interest for their re introduction exist in tourist zones (mainly spas and surrounding of monasteries and monuments).

Rural environment. Food production makes the larger segment of rural economy. Part-time farming is extremely present due to state policy of emphasizing industry growth. Since industry collapsed in last ten years of transition towards market economy and economic hardships arising from political blockade, surplus of industrial labor has turned to small-scale agriculture (mainly vegetable and livestock production). Being permanently in contact with modern society, and their owners tend to grow exotic high productive animals in high input systems if possible, however poorly managed considering many technical aspects. The area has fairly well developed infrastructure. Small and medium-sized farms and foodstuff industry are developed having the same orientation like those in lowlands. Farmers' co-ops and other forms of associations of interests are insufficiently developed and poorly organized. The dominant branches are livestock-cattle breeding and swine breeding, fruit growing and wine-growing. Crop growing is also well developed, however most of field production is dedicated for supplying livestock with fodder. Vegetable growing is a complementary branch having no serious impact on farm status.

Development strategy anticipated for the region:

Development of intensive fruit growing and wine-growing, and increase of planted areas and intensive agro-technique is the main task of the agriculture strategy in the region, however livestock production should be complementary developed to provide its sustainability. The region needs territory related modern mixed-farming models, which can provide in the future some changes in AnGR. Bringing probably some exotic species and breeds too, but also reviving of some abandoned branches of animal husbandry and possibly growing of some wild relatives too. In general, region could benefit of :

Focusing on the development of more accumulative forms of plant production (e.g. fruit growing instead of field crops) and organic agriculture in small farm households.

Favoring self-sufficiency in ruminant production (assessing the volume of production according to available land area for fodder output).

Introduction of modern technologies in the preparation of fodder in bulk and especially complete use of field crop growing by-products and foodstuff industry in livestock breeding.

Supporting further development of co-ops, especially regarding existing processing capacities.

Supporting better organization of traditional mixed farming on a small farm and improvement of organization of agriculture extension through branch associations of producers.

Integral development of typical household with special favoring of local market expansion in agro-tourism. This is the point where chance for conservation of rare breeds can be emphasized too, along with the next one.

Incentive for development of para-agriculture, especially apiculture.

Region: livestock breeding

Natural environment. Mountainous land of eastern Serbia, southern Serbia, Kosovo and Metohia, western and southwestern Serbia and Montenegro belong to the livestockbreeding region. Geographically, they include Balkan mountain ranges, Scardic-Pind and Dinaric mountain range and edges of Carpathian Mountains. Most of the

territory encompasses the beech and conifer region. Clearing forests created most of the arable land and grassland, except for high mountain climatogenous pastures. Anthropozoogenous influence is felt less and less in mountainous regions, and greater part of agricultural land is exploited without use of chemical substances for at least 5 and even more years. Pedagogical basis is particularly divergent, but those are mostly poor, shallow and acid fields. Irrigation of the terrain varies greatly, but, except for the extremely rocky terrain of Montenegro, most pasture areas are well supplied with water. Irrigation is possible in highlands of south-eastern Serbia, where it makes sense only in more accumulative branches such as vegetable growing. This is the region where we still have preserved rare breeds in traditional animal husbandry. Farmers are aware that their locally adapted animals have better chances in severe climate and with limited food resources. What is important is to provide them possibilities to better valorise this production, so to be ready to refuse all kinds of modernisation that is offered to them and asking for high mainly ecologically non-sustainable inputs.

Rural environment. Livestock production is the basis of mountainous rural economy. It is founded on the available grassland resources. It is mostly extensive, rarely semi-intensive, and only on large state farms. Livestock breeding region is extremely depopulated, and the efforts to keep the population by the great state farms failed in the 80's. The plans for most farms were not drawn up in line with available forage resources. There are conditions for development of almost all types of tourism, but this opportunity is insufficiently exploited.

Development strategy anticipated for the region:

The region is valuable for biodiverse nature, having favorable conditions for development of "ecological food" mass production, namely organic production of mutton, beef and horsemeat. This point could influence positively revitalization of horse production, particularly locally adapted breeds in extensive production systems, but also influence import of exotic breeds. Revitalization of horse meat production in the country could help further survival of smuggling of horses from Asia to EU which badly influences animal health security in the country. Generally region could benefit also of:

Favoring self-sufficiency in production of ruminants based on exploitation of available grassland resources and production of cereal crops is a favorable strategy for both protecting nature and environment and conserving locally adapted AnGR.

Support to countryside revitalization programs and integral development based on diversification of mountain economy is also space for valorizing on-farm conservation of AnGR.

Support to better organization of traditional mixed farming on small land property and forming co-ops especially pertaining to SME processing capacities in dairy and meat industry.

Systematic identification of products with high competitiveness potential on the world market among typical products and their protection according to international standards.

Modernization of expert small-scale processing of foodstuffs.

Development of game hunting and cold-water fishing.

Development of picking industry and finalization of products in household processing and expert small-scale processing capacities.

Integral development of typical household particularly favoring expansion of local market in agro-tourism, which could be the main way to valorize on-farm rare species, programs.

The public sector which has been monitored by the state and stimulated in the previous period used a modern technique and knowledge and was a dominant producer. In that way large commercial public farms were specialised for particular sort of production, that is for intensive production with all negative repercussions for AnGR conservation primarily in cattle breeding, pig breeding, and partly in poultry breeding and sheep breeding which were predominant in this sector. In the private sector, family households in most of the cases are of combined type of production, with a small percent of private farmers which has specialized and applied the more modern practices. This fact, however, from the point of view of conservation of genetic diversity, is much more favourable, although on the other hand it complicates to the great extent monitoring of transferring material, crossing etc. (because of weak organisation and small capacities of the agricultural service which is not organised to control small-scale natural producers). This sector has the majority of livestock, and almost every household keeps besides cattle and/or sheep, pigs and poultry as well, often exactly the Locally Adapted Breeds.

As stated above, most of intensive management systems have influenced negatively AnGR. Intensification of farming systems mainly provided for co-operatives and state-own farms (public sector) almost erased most of differences between regions. Last ten years made things worse since no fresh blood of introduced breeds was imported, so flocks/herds start degrading. However, Yugoslav private farmers still manage their animals in more or less traditional way. Being away from extension service routes, mountain areas have protected extensive management practice in forage provision as much as for animal production, so logically locally adapted breeds had certain advantage before exotic and survived. Influence of some agriculture development programs government was running in these areas had limited results since there were based on management practice suitable for different environments (rules working in lowlands were applied in mountains). Considering the situation we can clearly conclude that AnGR were mainly preserved (without governmental support) in the areas where influence of agriculture extension programs was weak, although some of the rare breeds collections holders were state own farms strongly influenced and controlled by republican extension services (with financial input from the governmental budget). This make us believe that extensively managed farms where rare AnGR were conserved due to environmental conditions, rather than order from government could be used for modelling future system of conservation. This system has to be based on providing a benefit for farmer through adding value on to animal products, and limiting expenses using experiences of traditional mixed-farming (with certain upgrade towards meeting new food-safety standards).

Mixed farming – fundamentals of Yugoslav village. These systems are already identified in the world as those with better position for adapting to the constraints imposed by the need for protection of the nature and the environment on the whole. Traditionally, in the FRY, mixed farming is in the base of rural household subsistence. It is based on combining the crop growing and animal production, and according to the production region they are combination of farming and animal production (plain region), or farming, fruit production and animal production (hilly region) or grass and animal production (mountainous region). The latter ones are the closest to the natural production and are

based on growing ruminants on pasture. There is a series of variants of the main systems, which comprise more or less agricultural procedures in food production, which are added to the main system, like apiculture, collecting and processing of wild fruits, hunting and fishing, as well as some sorts of agro-forestry systems. Basically, the traditional mixed farming in Yugoslavia holds all the characteristics of a modern low-input, as well as an organic agriculture. Most of the breeds used in these systems are locally adapted. The most suitable systems for conserving AnGR are traditional highland animal husbandry, mixed farming based on indigenous grasslands and traditional agro-forestry systems. Traditional food processing is a living practice, however no scientific research or development oriented programs have been launched yet to connect AnGR with this production. Few initiatives exist on local level to support this production to reach international standards for organic production, which may bring additional income, as well as registration of geographic origin of the product and original processing technology according to EU standards (PDO and PGI). To elevate awareness on necessity for interaction between typical production development and AnGR conservation have to be included in future AnGR conservation strategy. The production of typical products is the basis for sustainable agricultural production in regions with sensitive natural environment in FRY, so national advisory committee have to take care to provide AnGR conservation programme to become part of nature conservation strategy, programs and projects as a tool and complementary activity.

## **2.2 Analysing future demands and trends**

Livestock production is an important branch for the agriculture of FRY, and for a part of the farms it is a main source of income. Since the number of farm animals in FRY has been decreasing since the beginning of the past decade very dramatically (all kinds, excluding pigs) its clear that next few years will be years for recovery of the branch. What is expected, and is already trend, that farmers will try to fill gaps with imported animals, although local production could be able to meet most of demands, except for terminal breeds needed for improvement. On the other hand the increase of demand for meat will ask for the increase in meat production. So far this was realised on the account of the number of heads, what can have long-term unfavourable consequences on the development of animal production. Since national market is going to be fully opened for import soon, some high quality work is expected to upgrade local animal husbandry to be able to compete. This will push local farmers towards abandoning local AnGR and make a temptation for them to try to solve problem quickly by importing exotic breeds. With raising living standard of the population demand for quality will be elevated on the higher level, which might push completely out some of locally adapted breeds.

Decline of the animal growth in FRY as much as decline in quality of production which occurred in last decade might endanger future transition towards sustainability, particularly due to decreased total number, however quality structure of the preserved animal fund is not that bad as expected. In contrary to total destruction of herds/flocks in state owned farms, natural selection made by private growers, although insufficient to provide upgrade, preserved valuable nucleus for revitalization. Recent health hazards

from abroad, however, could greatly influence health security of livestock and revitalization of production in FRY due to lack of investments in veterinary extension.

The problems of slaughter industry, besides the reduction in the volume of production, are reflected in the unfavourable changes in the structure of production, on the account of more quality products with higher processing phase. Strategic interest of the agriculture of FRY is to feed own market, but also to conquer (regain) the foreign market, however if it is not able to meet new standards and food safety rules, this will cause additional problems in animal husbandry.

Over the last 10 years the percentage of our animal products (milk, meat and other products) for domestic and foreign market has significantly changed due to sanctions which had their influence on the reduction of the scale of our domestic production and removing of our animal products from the foreign market (Italy, Greece, etc.). In the following period the increase in production scale and better placing of domestic products on the foreign market is expected. First of all there is an opportunity in production of so called »green products«, products with geographically protected origin (Njegush prshut, Stara Planina cheese) etc. For the time being, the foreign market does not have some important influence on AnGR in FRY.

Over the last 10 years heavy declension of large public farms and agricultural estates led to a dramatic decline in the number of animals. The reasons for these changes are in the immediate war environment and many years of sanctions, government policy, drop in living standard of the inhabitants and the state on the market. Since recently, more and more private producers show the interest in leasing empty public farms and starting production, so that the gradual increase in the number of animals may be expected. It will be developing into two directions, first of all, the type of production which utilizes cheap grassland resources on the principles of low-input production, and then highly modernized production based on the intensive farming in large commercial farms. The newly emerged competition will probably push out small-scale, unprofitable und disorganized producers and those who still base their production on high inputs.

The main recent changes in the infrastructure of livestock production e.g. change in ownership (privatisation), government policy of opening market, and (still present) lack of investments to production, as well as market for placement of products which would stimulate mobilisation of internal reserves, may slow down the recovery of animal husbandry and further jeopardize conservation of specially rare AnGR. Among the constraints to faster improvement of livestock production are, by all means, property size and bad organisation of producers, as well as provision of quality food, lack of labour (when grazing is in question), poor housing conditions, expensive and non-quality vaccines and medicines, etc.

A positive turn of events may however be influenced by changes in demand for different kinds of products, towards expansion of the scale of products according to the world trends. It is primarily reflected in the expansion of the scale of pork products, than, in annual quality of beef, not only seasonal, due to the system of out-of-season mating in the

meat production. Also, the supply of sheep and goat cheese is higher and more diverse. These changes are related to the imported breeds which are used for crossing and improvement.

### **2.3 Discussion of alternative strategies in the conservation use and development of AnGR**

In difficult economic conditions in FRY, the conservation of animal genetic resources is a luxury, unless this activity is provided with any sort of economic justification. The question of rational, economically sustainable conservation of animal genetic resources is primarily a question of finding possibilities of valorisation of extensive production systems. Integrating conservation of animal genetic resources with profitable combined farm systems and non-agricultural activities based on the principles of ecologic agriculture is one of possibilities to meet this objective. The research work in this level is a preferred activity which has to be included in the activity level of conserving animal genetic resources.

It is necessary to conceptualize the research in such a manner that it could follow the contemporary trends of changes in food production development policy from the concept of quantity to concept of quality in food production. The targeted results should favour multifunctionality of agriculture and rely on the ecological concept of agricultural production. The diversification of rural economy is crucial for conservation and advanced utilisation of animal genetic resources, especially towards the development of tertiary activities like rural and other forms of tourism, as an efficient mechanism for strengthening local market (autochthonous animals and their products as a tourist product).

### **2.4 Outlining future national policy, strategy and management plans for the conservation, utilisation and development of AnGR**

The plan of action for conservation of animal resources in FRY should include a prompt multiplication of breeding stocks of Locally Adapted Breeds due to a pronounced danger of diseases and poor management in the conditions of small financial subsidies. The realisation of the plan of action should be preceded by the selection of geographic locations which may give the best economic, ecological and social valorisation in this job. This can be achieved only by making space for improvement and intensification of work on conservation and improvement of the genetic resources in an interdisciplinary work (protection of natural and cultural heritage etc.)

The significance of animal genetic resources within the frames of the new policy of sustainable development must be considered from the aspect of multifunctionality of agriculture on the whole. Among the most important aspects will certainly be the possibilities which may emerge from the comprehensive utilisation of animal genetic resources with the aim of valorisation of different food resources, then those related to the food safety, diversification of rural economy and development of non-agricultural activities, and finally the possibilities as to the upkeep of the regional diversity and protection of the environment on the whole. However, the animal genetic resources

protection, conservation and improvement concept must undergo significant changes to that purpose. The first objective would be integration of animal genetic resources conservation with profitable combined farm systems and non-agricultural activities as part of the integral development of village. The second objective is integration of animal genetic resources conservation concept with modern systems of sustainable agriculture (e.g. organic, biodynamic etc.) which enable valorisation of production systems with low yield and high quality.

Production systems in the regions of limited agricultural production and conservation of animal genetic resources for food production

The agricultural production regions which are marginal today are exactly those ones where the creation of different breeds of domestic animals in the past was the most intensive and where they were in contact with their wild relatives the longest period of the time. These regions in FRY are mostly abandoned in agricultural production due to poor soil or rough climate. The interest for revitalisation of food production in these regions, however, still exists. This interest is based upon the idea of the production intensification introducing the intensive breeds and aggressive melioration of production lands for animal feed provision. Untenability of such an idea may be documented even by the research from the early seventies when, particularly for the production in mountainous meadow-pasture systems, it has been clearly pointed out that the production logic on them cannot be equalized with that on the fertile arable lands of Vojvodina. It is clear, however, that these resources are very conducive to the production of quality food, especially if it is subjected to strict standards of ecological production, production with geographic origin or production of typical products. However, valorization of such production is possible only with low-input production systems on the basis of autochthonous material - material from the local AnGR reservoir, since it is best adapted to the conditions of the environment. Eventual genetic improvements are possible, by all means, but their graduation must be realised according to the available potentials of the natural environment.

Conservation of animal genetic resources serving to conservation of biodiversity

Modern livestock production over the last decades of the twentieth century caused extinction of hundreds of autochthonous species from grassland composition, in all the countries where it is practiced. 95% of grasslands rich in species have been replaced with simple grass-leguminose mixtures. Hundreds of species of insects, birds, mammals and fish have become extinct, too. On the other hand, neglect of livestock production in some regions led to dissipation of biodiversity. Thus, in depopulated mountain regions, for example, grassland communities of high biodiversity value are increasingly endangered since the absence of grazing which enabled them changed the conditions for development of species and their competition and survival ability.

Even many of the regions of the preserved nature in which exactly the anthropo-zoogenic grasslands have been protected, are not currently used for livestock production, neither. The reason for that is not always depopulation caused by the policy of favouring

industrialisation and urban life, but often the mistakes in conceptualization and application of protection of these regions. Fortunately, nowadays the concept of nature protection is increasingly changing. The regions of interest for protection, especially those which owe their worthiness to the activity of the man, are protected integrally. The integral protection means sustainable rural development in which traditional activity of the man and the protection of nature are functionally related. In FRY this system of protection is still not working, but it has been institutionally adopted and the first projects of this type of protection are in realisation already. Programme on Man and the Biosphere conducted by UNESCO is a form of protection which is the most similar to creating, among the other things, and the ideal environment for work on conservation of animal genetic resources. Since it implies extensification of agriculture, conservation and revitalisation of traditional systems, as well as preservation of autochthonous animal species and breeds and their wild relatives, this programme imposes first of all the revitalisation of combined farming. Besides, the combined farming implies active relation between agriculture and para-agriculture, collecting agriculture, traditional handicrafts and tourism, and similar activities which can economically valorize biodiversity targeted for conservation.

#### Conservation of animal genetic resources and protection of regional diversity

Traditional extensive agricultural production in the last century brought about tens of types of regions considered nowadays very valuable from both ecological and economic standpoint. Rural environment of Spain, Italy, France, and more often other countries in Europe and worldwide becomes the setting of attractive human activities and working place for millions of people. Their economic valorization is more and more obvious, and the perspective clearer and better with the increase of public interest for getting closer to the nature again and awareness of the need for its conservation, in many countries has triggered initiatives for conservation of autochthonous species and breeds of animals and their integration into profitable production systems.

#### Protection and improvement of forests and water management in light of conservation of animal genetic resources for food production

Management of forest and water resources for food production in Yugoslavia is considered secondary, even unfavourable or adverse form of mixing into basic activities of forestry, water management and electric power industry. This paradoxal situation is a result of monopoly over exploitation of forest and water national resources, as well as social disturbances and economic crises which have been experienced in our parts for tens of years. Untenability of this situation is obvious, but the initiatives for its change are rare and solitary. Integral utilisation of these resources is above all in the possession of the lawmakers, but the science has responsibility to provide appropriate inputs which will enable understanding of the advantage of multisided over onesided exploitation.

Underexploited are also the possibilities of raising game, especially in so called agroforestry systems. Locally Adapted Breeds of domestic animals as well as wild animals (first of all wild boar, roe deer and fallow deer), which are efficiently raised in forestry ecosystems in combination with animal feed production for their feeding, bring

about not only the possibility of conserving genetic resources of these animals but also the economically favourable environment for profit making. Traditional domestic pig farming in forests on the banks of the rivers in plains (especially Srem - pig Srem), is also one of systems which deserves attention, when the survival of domestic Mangulitza (as well as other breeds which have become practically extinct in the parts of FRY, but may be reintroduced from other countries). A great interest for pork from *free range* system have already induced some domestic već je navelo neke domaće businessmen to deal with the import of foreign breeds adapted for efficient meat production in "open stalls". Although there was also the interest of foreign partners for domestic production, the lack of at least one relevant comparative investigation was enough reason for domestic business not to give advantage to a domestic breed. What opportunity has been missed to rehabilitate domestic Mangulitsa through a profitable business, time will tell.

#### Conservation of animal genetic resources serving to conservation of the environment

The most sensitive relations between agriculture and the environment are seen in the need for extensification of agriculture for conservation of water resources. The intensive agriculture of the twentieth century caused many problems with water pollution than any other activity of humans; pollution with nitrates and phosphates, eutrophication, emergence of causative agents of some fifty zoonoses in water, pollution with pesticides... increase the cost of water refining and conservation of water reservoirs, natural and artificial, against filling with suspended particles of soil. Conservation of water resources is an imperative in particular regions and globally as well and assumes transformation of agriculture towards sustainability. Extensification and integration of agricultural production is seen as the most important mechanism in this transformation. The experience shows that extensification costs are paid back to the tax payers, and even up to 85% of targeted pollution can be removed. Since the most targeted issues within the extensification are reduced chemisation, and thus yields, as well as possibility of diseases control using medicaments, it is clear that the targeted systems are ecological. The autochthonous animal species with genetic potential to resist disease and better utilise the available natural feed resources naturally find their place in such systems with application of appropriate technologies of ecological production which imitate biological cycles and use their knowledge in balancing the necessary production.

#### Cultural heritage and conservation of animal genetic resources

Nowadays, the protection of cultural monuments is in the competence of institutions dealing with the protection of nature. Management of agricultural resources in such locations, however, is not in the slightest conceptualized, and certainly not realised in favour of its improvement and achieving sustainability. If these are not active monastery or similar live complexes, these locations are isolated, like abandoned isles with wild vegetation and mostly rarely visited. Such cultural treasure is certainly very alienated from the local population, which sees in it only bans and limitations. Therefore they feel as if it belongs to them and practically do not participate in their conservation, neither they have any benefit from it.

Traditional combined farm systems and agricultural production based on autochthonous breeds of domestic animals are a part of necessity of cultural heritage protection. Integration of conservation of animal genetic resources within such systems enables rational connection of population with their material and immaterial cultural heritage. Formation of ethnic complexes gives to this sort of integration a recognisable shape which can be easily valorized through rural tourism.

Little work has been done on protection and building of ethnic complexes. Rare individual attempts are based on building adventures and upheavals in a completely alien environment, what makes their first intention to attract tourists and bring economic benefit to the surroundings, rarely permanently and successfully realized. Integration of such ideas with protection of autochthonous animal genetic resources is possible and desirable.

#### Maintaining traditional knowledge and technologies in food production

Recently, traditional knowledge and technologies in food production have been realised, as well as in production of clothes and other products of raw materials from agriculture, became a very interesting direction of transition from quantity to quality. The success of agriculture and tourism in many Mediterranean countries is related exactly to the successful management of this part of cultural heritage. For FRY the image of autochthonous product remained completely economically unappreciated. Not following the trend of changing standards in food production, autochthonous products and technologies from our parts either remained unknown in our market or became a feather in someone other's tuft. Thus, typical products in our climate – plum brandy and kachkaval became an exclusive trademark of other nations. Under the pressure of difficult economic situation, once adequately valorized autochthonous product in the local market became completely unappreciated in the local market, what endangered its survival. Thus, many of the autochthonous products started to lose in their quality or completely disappeared.

The most tragic loss, however, is not neglecting of some technologies of production but the loss of adequate raw material base originating from the autochthonous breeds of domestic animals. Thus, it is even impossible nowadays to find an original sheep katchkaval, more and more difficult is to find buffalo butter, and completely impossible to weave an original Pirot rug since Pirot Pramenka sheep almost became extinct. Since the autochthonous products – products with traditional production technology and geographical origin are extremely appreciated in the solvent markets (in which penetrating with a conventional product is almost impossible), there is an excellent opportunity to link conservation of animal genetic resources with typical production of animal products.

#### Conservation of animal genetic resources as a support to diversification of rural economy

As it has been already pointed out, a great portion of natural biological diversity originates from a century old practice of agriculture – the rural regions as they appear today are such thanks to agriculture. That is the same environment which creates today additional sources of income and working positions for rural population, through

different forms of tourism. The role of agriculture in that sense in FRY is seen in a very simplified way, through input in food. That food is called healthy as it is, just because it originates from the rural environment, and the improvement and conservation of the environment in which it is created is in the second place. Intensive, unbalanced food production for the needs of rural tourism, however makes an untenable pressure on the resources and loss of the environment which attracts the tourists. The feedback of losing interest for inflation of "healthy village food in the urbanized village environment" is expected and unavoidable.

The work on dimensioning of agricultural production and modelling of combined farm systems and part-time farming with activity in rural tourism strongly emphasizes the problem of choice of species and breeds of animals. Different movements in the world, as well as different business solutions showed that the use of autochthonous animals and traditional farm systems, may strongly contribute to modelling of economically efficient and socially desirable systems.

### **3. Assessment of National Capacities**

The FRY is signatory country of the Convention on Biodiversity. On November 5<sup>th</sup>, 2001. This document was ratified in our Parliament. With the act of ratification the state has accepted the obligations deriving from and determined by this Convention.

Primary institutions and organisations included into the process of AnGR management in FRY are:

1. Federal Department for Plant and Animal Genetic Resources, Belgrade
2. Competent Federal and Republic ministries
3. Institute for Application Science in Agriculture, Belgrade
4. Institute for Animal Husbandry – Faculty of Agriculture, Novi Sad
5. Faculty of Agriculture, Belgrade
6. Faculty of Veterinary Medicine, Belgrade
7. Biotechnical Institute, Podgorica
8. Institute for Nature Protection of the Republic of Serbia

Activities related to management of AnGR are organised and sponsored on the level of the Federal state where within the authority of the Federal Ministry of Economy and Internal Trade the Federal Department for Plant and Animal Genetic Resources was established. Main engagement of this Institute is management and preservation of AnGR, development of programmes for conservation of AnGR, development and bringing up to date of National data base, creation of plant and animal gene bank. Also, Ministries of Agriculture, Ministries of Natural Resources and Environment and Ministries of Science, Technologies and Development of Republic of Serbia and Republic of Montenegro are in different ways included in these programmes. It is understood that mentioned programmes could not be realised without adequate co-operation of individual breeders, non-governmental organisations, local and domestic communities and other interested subjects. Relations between government institutions, various non-governmental organisations, individual breeders, local and domestic communities and other subjects are

good due to existing awareness regarding the preservation of biodiversity and conservation of disappearing Locally Adapted Breeds. Existing co-ordination mechanisms do not hinder the use and realisation of set objectives in regard to AnGR conservation, however they don't support them adequately and efficiently. However, there is a sort of interaction between public and private organisations in the sense of extension service and education of farmers, with the aim primarily to increase the public awareness of AnGR conservation. Lately, great support was given by the media and public communication services to activities of private sector and it's increased participation in management of AnGR, which is in concordance with the new state policy, federal and republic, on privatisation.

Programmes of conservation are supported by national ministries, then by private companies, non-government organisations, local communities and foreign donations. Preservation of AnGR resources is institutionalised, although it greatly relies on enthusiasm. Science and experts follow the world trends in this field, however in majority of cases there are no financial means to apply this acquired knowledge. There are initiatives relating to AnGR use coming from certain corresponding governmental institutions (competent ministries) as well as other factors (research institutions, universities, individual breeders, non-governmental organisations, etc.). Initiatives by governmental institutions are mostly directed towards Exotic Breeds intended to improve production efficiency of domestic populations. Support by government institutions as well as other factors in the country for Locally Adapted Breeds is becoming more important. Awareness of possible worthiness of AnGR conservation from the standpoint of its utilisation in the future is at the very beginning. However, it has been constantly developing, although not intensively enough, under the influence of government institutions on one hand and private farmers-enthusiasts and local non-government organisations on the other.

For now, there are no systematic and continuous activities oriented towards the raising of awareness regarding the role and importance of AnGR and need to preserve them for future use and further development, but from time to time scientific symposia and congresses are organised where these issues are discussed in the context of development of livestock production and other fields of rural economy. Raising awareness regarding the significance of AnGR is also carried out by publishing articles in magazines as well as daily newspapers (articles on farms with collections of rare breeds). There were also efforts to present on the market products deriving from Locally Adapted Breeds (certain types of cheeses) with protected and determined geographical origin, whose role was to support the preservation of mentioned breeds, however such efforts were not supported by government but relies on enthusiasm of local producers.

Basically, flow of information regarding AnGR is carried out through network of the national agricultural service and university centres. Central communication service is on the level of the Federal Government. Communication between this central service and relevant organisations participating in the process of conservation is conducted in combination of written reports, fax messages and e-mail messages. Gathering of data is not computerised and servicing of data bases is carried out annually in agricultural

services on the level of republics. In certain regions of our country people engaged in activities regarding conservation programmes are still not very well trained in use of computers and sending e-mail messages, therefore communication is considerably limited. Although there are continuous efforts directed towards the introduction of modern means of communication and in spite of great interest for progress, the process is slowed down due to the lack of financial support for obtaining of personal computers.

The FRY has no bilateral or multilateral arrangements with other governments relating to AnGR. Since our country was isolated during last decade, only few contacts with research institutions from neighbouring Hungary and Bulgaria survived. This co-operation is more or less still on the level of exchange of researchers and experts. Activities now present on the international level are co-operation with FAO on implementation of Global Strategy of AnGR Management. We have received from the FAO office necessary primary and secondary instructions relating to activities that each country must undertake in regard to the AnGR management. We are striving to follow and observe in full those instructions in order to realise better organisation in the process of AnGR management and preservation. Our objective is to participate adequately in the process of AnGR management and to follow experiences of countries already engaged in such activities. Results are following: level of public awareness regarding the significance of AnGR preservation as part of preservation of biodiversity in general, has been considerably raised. Individual farmers are expressing increasing interest for breeding and preservation of Locally Adapted Breeds.

There are legal and stimulating measures in FRY (programme of measures for livestock improvement) aiming to support producers producing in concordance with AnGR. This programme includes all Locally Adapted as well as Exotic Breeds. Producers receive annual stimulation for raising high quality heads of pure breed livestock (they receive premiums for first calving cows and first lambing sheep, under condition that breeding animals are included in the productivity control programme, and bonuses for male heads of livestock of high quality) or for producing breeds that are included in protection and preservation of genetic resources. There are also legislative regulations determining the quality of the product and health condition of livestock (prevention and therapies), housing, flow of animals and agricultural products as well as control over registered heads of livestock. Legal instruments are under authority and competence of Republic of Serbia and Republic of Montenegro, individually. On the level of republics, distribution according to districts for certain animal species (sheep, cattle, horses) was adopted in 1995. Distribution according to districts included only heads of livestock under productivity control programme, it was not binding but more in form of recommendation by the experts based on geographical position, soil, climate, experience and tradition. In regard to the land management, there are plans defined on the level of republics as well as detailed plans for certain areas.

There are still no policies and legislation determinations supporting and promoting conservation and use of domestic scientific knowledge relating to use of AnGR, however in future these issues should be included in new Law on Livestock whose finalization is expected next year. However, policy or legislation determining, supporting and

promoting the use of profits deriving from use of AnGR is lacking. Sector for ecology and preservation of environment operating within the Federal Ministry of development and Environment, regulates by implementation of Law on Protection of the Environment the sustainability of environment. This Ministry in future will have more impact in regard to AnGR, probably only relating to wild flora and fauna, if by the reform of Federal Government competence of Federal Department for Plant and Animal Genetic Resources is not transferred to the level of Republics. In regard to domestic animal species no such laws exist.

Breeds existing in FRY with so far no considerable contribution in regard to either nutrition or agriculture are:

Cattle: Podolian cattle (status – at risk), Busha (status – at risk) and Buffalo (status – at risk). Reasons for their status are following: economically non-profitable primitive breeds with particularly low production, also the need for their use as working animals no longer exists (combined type for milk – meat – work).

Horses: Bosnian-mountain pony (status – at risk) and Nonius (status – at risk). In numerous regions, the single purpose of mentioned horse breeds - pulling and working – no longer exists, which caused decrease in interest for breeding of these specific horse breeds. However, certain hilly-mountainous regions attempt to find interest in preservation of Bosnian-mountain pony with the support of the State. Current status in regard to number of heads or expression of interest by broad community have caused the “at risk status” of both breeds.

Donkeys: In many regions practical application of pulling role disappeared, which led to decrease of interest for breeding of them.

Pigs: Mangalitsa breed (status – at risk) and Moravka breed (status – at risk). There is not enough interest for raising of above mentioned breeds due to predominant Exotic Breeds.

Sheep: Vitoroga sheep (status – at risk), Lipska sheep (status – at risk), Bardoka (status – at risk), Pirot Zackel (status – at risk), Zetska žuja (status – at risk) i Pivska sheep (status – at risk). Besides Bardoka, all mentioned sorts and breeds lost importance with the introduction of more productive sorts, but even more due to the depopulation of rural regions where sheep were raised in extensive production systems. Bardoka as the milkiest domestic breed is endangered due to the migration caused by war actions in Kosovo and Metohia region.

Goats: Domestic Balkan goat (status – at risk). Under the influence of advisory services, also media, Alpine breed and Sanska breed were promoted as more productive, in this way domestic selection has lost market almost everywhere where better conditions for housing and nutrition could be provided.

Poultry: Golovrata hen breed (status – at risk), Sombor poultry (status – at risk), Kosovo singer (status – at risk), Svrljig hen breed (status – at risk), Dečan hen breed (status – at

risk), Sombor geese breed, Novopazar geese breed, Domestic Bronze turkey. These breeds are present in extremely small number hence their contribution is not significant, and status of mentioned poultry breeds decreasing, therefore urgent measures must be taken in order to preserve and protect these breeds. In general, there is no economical interest for production of any mentioned breeds, therefore they are raised purely for recreational and cultural reasons.

Technical and advisory services, as well as education and research capacities at disposal in FRY ready to support AnGR are republic and regional services, institutes and faculties, with completion of necessary laboratories and equipment.

Long term, intermediate and annual programmes of development and improvement of livestock production with defined breeding and selection objectives and which include all livestock species, fish and bees are being developed. These programmes refer to period until 2006 and 2015, and are currently in Parliament procedure. This refers to Republic of Serbia since this Republic has far greater interest for development of mentioned programmes compared to Republic of Montenegro where agriculture is no priority in relation to other fields of economy. Programmes for breeding in Exotic breed is sustainable in cattle production since they contribute to increased production of milk, meat, liquid manure, skin and other by products. In horse production, same programmes are also sustainable since pure breeds are mainly used for sport and recreational purposes. In pig production, breeding programmes currently applied could become sustainable for a while, however improvements in regard to better keeping of records and marking of heads of livestock, use of unified information system (registration of all herds), also inclusion of new biotechnological methods for increase of reproduction efficiency and researches in the field of molecular genetics, investigation of fatty acid composition and cholesterol content in fat and tissue are necessary. In sheep and goat production, programmes of breeding in pure breed are also sustainable because of the great importance of pure sheep breeds for production of milk, meat and wool. In poultry production, existing programmes could stay sustainable for a while, however improvements in regard to better keeping of records and marking of heads of livestock, use of unified information system (registration of all flocks and populations), also inclusion of new biotechnological methods and researches in the field of molecular genetics are necessary. Major breeding – selection programme is devised and developed on national level, and institutes and regional agricultural services and farms are responsible for its implementation. They advise and offer expert assistance for breeding programmes in pure breed on private farms or public organizations.

#### **4. National Priorities for Conservation and Utilisation of AnGR**

The FRY still does not have a National programme for conservation of animal genetic resources. There are some initiatives for drawing up a programme on the federal level, but since there are no concrete steps made due to reorganisation and redefinition of the federal state, these initiatives did not bear fruit. In this regard, national priorities in AnGR conservation have not been precisely defined. However, in the basis of the programmes carried out on AnGR conservation which have been mainly created and realised so far on the republic levels, the conservation priorities are mainly directed to those breeds which are the most endangered. The aim of these programmes is to protect, that is to conserve the Locally Adapted Breeds at risk, for both social and economic values and future research and education, as well as to monitor the status of the breeds which are not at risk.

As for FRY, the following aspects of AnGR conservation will be specially emphasized:

1. Production systems in the areas of limited agricultural production and conservation of animal genetic resources for food production
2. Conservation of animal genetic resources serving to biodiversity conservation
3. Conservation of animal genetic resources and protection of regional diversity
4. Protection and improvement of management of forestry and waters in the light of for food production
5. Conservation of animal genetic resources serving to environment protection
6. Cultural heritage and conservation of animal genetic resources
7. Maintaining traditional knowledge and technologies in food production
8. Conservation of animal genetic resources as a support to diversification of rural economy

The work on dimensioning of agricultural production and modelling of combined farm systems and part-time farming with activity in rural tourism strongly emphasises the problem of choice of species and breeds of animals. Different movements in the world, as well as different business solutions showed that the use of autochthonous animals and traditional farm systems, may strongly contribute to modelling of economically efficient and socially desirable systems.

The main priorities which should also become the integral part of the National Programme are:

1. Identification of AnGR (domestic animals and their wild relatives) and their habitats as well as their potentials in the sense of achieving economic justification of model for conservation in active on farm conservation systems.
2. Characterisation of AnGR, realising the scope, distribution, main characteristics and current state of AnGR. The objective is to provide the insight into those genetic resources which are the most endangered, as well as those that are not at risk. The priorities of our country for building capacities in characterisation are: provision of finances, training personnel, introducing uniform information system and equipping the laboratory for implementing mollecular characterisation.

3. Clear definition of the role, utilisation and conservation of AnGR, that is precisising the current and the future needs of the nation in livestock production from the standpoint of meeting national requirements in animal products, as well as conquering the foreign markets.
  - a. In that sense it is necessary to make sure that securing national safety in nutrition and production of animal products for export must adhere to the concept of sustainable development, as well as to secure the support to rural development.
  - b. Planning of sustainable use of breeds should assume the development specific for all breeds and agrosystems which exist in the country, that is to provide continued and exclusive use of Locally Adapted Breeds, as well as the use of exotic breeds as original. This because it is necessary to see in advance the perspective of those species and breeds which are not used in FRY any more, and probably will be imported, or might be used during the following decade.
  - c. In that respect, within this priority it is necessary to permanently advance in work of the Advisory Committee, as well as the whole net which takes care of livestock production development in the country, in order to provide through initiation of the research work timely and quality information on the species and breeds which may be prosperous in tthe adequate conditions and assist the producers in that way to prevent mistakes which were common in the previous period.
  - d. For survival of Locally Adapted Breeds and species of domestic animals it is necessary to develop markets of traditional products, ethno, agro and rural tourism, in order to enable creation of added value which would compensate for the losses due to extensivity.
4. Enhancement of capacities of communication and information systems
  - a. In the first place formation of a uniform information system and central database at the Gene Bank in the Department for Plant and Animal Genetic Resources.
  - b. Development of interactive network of non-government and government organisations, which would be capable of timely forwarding and receiving information on the state of the endangered breeds by holders and local communities.
  - c. Introduction of technically more perfect method of co-ordination of in situ AnGR conservation work establishing the interactive horisontal communication between the holders for timely reaction to emergency situations.
5. Establishment of permanent programmes for monitoring farm AnGR and their wild relatives, which have agricultural, economic, cultural or scientific value. The monitoring programmes should be made so as to provide feedback to farmers and the rest involved in AnGR conservation.
6. Training of personnel, especially when it is about the new technologies applied in conservation. The institutions in the country with real capacities to provide training in AnGR conservation should be identified. These institutions would

- include all the relevant faculties and research institutions, as well as the network of the non-government organisations engaged in this business.
7. Development of permanent and functional relationship with the public. Through means of public communications, providing appropriate publications, as well as through public affirmation of scientific and professional papers etc. the public would be continually acquainted with the requirements and significance of conservation of the endangered AnGR and the need for their conservation. The need for protection of AnGR should be also taken through affirmation of the maintaining traditional knowledge and cultural heritage on the whole, an enable the campaigns of culturological type not primarily directed towards the very AnGR to contain this component whenever possible. Communication with public should develop through affirmation of AnGR through production with protected geographic origin and similar productions in which for example locally adapted breeds have significant place. Development of movement for conserving tradition should be efficiently connected with ecological movements, insisting on the significance of introducing young people into the activities of protection and promotion.
  8. Development of legislation and regulations. Through appropriate ministries in the federal and republic levels it is necessary to point at the significance of coordination of domestic legislation and regulations with international regulations, especially the EU regulations, as well as those emerging from the Convention on Biodiversity. When passing the relevant laws and regulations which are missing, it is necessary to use the experience of the developed countries.
  9. The increase in the level of international communication. A special importance is given to making network of holders of mutual genetic resources in the region and exchange of genetic material, as well as replication of breeding stock on a territorially higher space in all AnGR divided by the region, especially those which does not exist anymore in individual countries.
  10. Inducing the initiative for AnGR to be accepted by economic policy as a development factor.

(Tables 39-41.)

## **5. International co-operation**

The FRY experience in the international co-operation is great, both on bilateral and multiilateral level, and may be sublimated into two premises:

- a) International cooperation is a prerequisite for survival and better usefulness of national programmes, and
- b) Only well developed national programme provides useful and equal international co-operation

Unfortunately, FRY in the last ten years lived in isolation - political, cultural,s scientific...and the experience in the international co-operation needs development.

The FRY is signatory country of the Convention on Biodiversity and in that respect it takes the necessary steps with regard to fulfilling the undertaken obligations. However ,

the undertaken activities still do not correspond to actual needs and conservation of animal genetic resources. Modest finances for its implementation were enough only for the initial activities on conservation of animal genetic resources.

In the global level FRY co-operates with FAO, responsible for keeping, co-ordinating and reporting on global genetic resources of domestic animals. FAO developed a Global Strategy of managing farm animal genetic resources, which FRY intends to implement in its territory. The efforts have been put to implementing as soon as possible all the elements of this strategy concerning identification, description, development, utilisation and monitoring of animal genetic resources, conservation of unique and endangered breeds, training and inclusion of people into conservation of animal genetic resources and enhanced international communication related to animal genetic resources. According to FAO instructions, the National Focal Point has been appointed with the task to supervise the development and execution of the plan of animal genetic resources conservation, to establish efficient connections and identify contacts inside the country for implementing FAO Global Strategy. National Focal Point still has good communications with National Focal Point of other countries. Efforts are put into improvement of communication, especially with the countries of the regions that have similar and mutual interests. Also, good communication links were established with Regional Focal Point.

The FRY is aware of the fact that international communication and co-operation represents a critical part of the process of implementing the Convention on Biodiversity. There is also awareness that nations which chose to actively participate and co-operate in global efforts on conservation and sustainable use of biodiversity may secure the leadership for themselves and anticipate new advantages of these arrangements. The failure to join a broad network of national and international connections has already led us to the international isolation, excluding the nation from participation in the global activities and utilisation of animal genetic resources.

On bilateral and multilateral level, FRY does not have arrangements with other governments concerning animal genetic resources, since it was isolated during the last years. Only a few contacts with the scientific institutions from the neighbouring Hungary and Bulgaria have survived. This co-operation is still more or less on the level of short-term exchange of experts. The co-operation on the regional level, mutual interests are to be clearly defined, then priorities and plans of actions for conservation by breeds, all the necessary measures should be taken for the undisturbed flow of information, scientific knowledge and achievements of modern technology (establishment of genetic maps), and the conditions for sharing benefits of mutual animal genetic resources. Appropriate localities should be chosen (depending on the conservation in situ or ex situ), and carry out additional education of the existing personnel which would be included into the process of conservation. In the provided and selected objects it is necessary to adjust the equipment to the given situation and needs for preserving particular breeds.

One of the most important actions which should be taken is induction and development of the local non-government organisations and businesses to increase activities in AnGR conservation, as well as help to their horizontal and vertical connection with the

authorities. The authoritative institutions for AnGR in FRY already actively co-operate with NGO and business sector in raising level of public awareness and providing for financial support for the process of conservation. However, the progress is to be expected in this business, since the status of non-government sector in FRY is still not defined enough and the economy expects restructuring and privatisation.

Interinstitutional co-operation is also a useful mode of co-operation which should be favoured. To that purpose, the FRY needs help to make co-operation with all the relevant organisations both on regional and global level, dealing with management and enhancement of conservation of AnGR. The most important organisations to make co-operation with are: EAAP (European Association for Animal Production), RBI (Rare Breeds International), DAGENE (Danubian Alliance for Gene Conservation), SAVE (Safeguard for Agricultural Varieties in Europe), GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit), UNDP, GEF, World Bank etc.

## **6. How the Country Report was prepared**

On the invitation of General Director of FAO Mr. Jacques Diouf, that our country participate in preparing a Draft Report on the State of AnGR, the Federal Ministry of Agriculture accepted to participate in this project and put in charge Federal Department for Plant and Animal Genetic Resources to take over all the activities both on the international level and on the interinstitutional cooperation inside the country in preparing this report. On the proposal of Federal Department for Plant and Animal Resources a network of domestic institutions which have played important roles in the previous period in management of AnGR. The role of these institutions was to deliver all the information the Department for Plant and Animal Genetic Resources related to AnGR, according to the instructions obtained from the Federal Department for Plant and Animal Genetic Resources. Also under the auspices of the Federal Department for Plant and Animal Genetic Resources, the National Consultative Committee (NCC) was established and given mandate to finalize the preparation of this report before offering it to the Government for adoption.

The list of main institutions included in preparation of the Draft Report on the State of AnGR in FRY is as follows:

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## **EXECUTIVE SUMMARY**

### **Main findings**

A main part of agricultural production is realised on the small private households which account for 74.3%, public sector 17%, cooperative 2.7% arable lands. Production in private sector is extensive to semi-intensive with low inputs, while in public sector it is based on high inputs to industrial, but mostly out-of-date production systems. Most of livestock production is realised in private farms, however a greater part of this production does not have marketable character. The FRY has never had problems in providing food for the existing population. The country disposes of natural resources for great production, both for domestic requirements and for exports, but these potentials are not

exploited enough, so the country occasionally imports meat, milk and milk products with the aim to reduce prices in the domestic market.

The importance of animal products for domestic population is exceptional. Milk and meat are the most appreciated foodstuffs. The share of meat in the nutrition of population, however dropped to the great extent with decline in living standard during the last ten years, although it still culturally represents the most important foodstuff apart from bread. The risks of shortage in food are moderate. The highest risk is in natural disasters, and lately mainly droughts during summer and late spring frost. The increase in the living standard gives rise to demand for quality and quantity. AnGR will have a significant role in meeting demands of the population for high-quality food (safe food production, organic production, spreading of ecological agriculture and integral rural development with anticipated combining of agriculture and tourism).

#### **Results of the assessment:**

- **state of diversity**

-

The Locally Adapted Breeds in FRY are:

Cattle: *Podolian cattle, Busha, Buffalo, Domestic spotted cattle*

Horses: *Bosnian-mountain pony, Nonius, Yugoslav Trotter, Lipitsa*

Donkeys: *Italian and Cyprus*

Pigs: *Mangalitsa, Morava, Domestic meat breed, Yugoslav spotted*

Sheep: *Yugoslav Zackel (many strains), Tsigai, Vitoroga sheep, Lipska sheep*

Goats: *Domestic Balkan goat*

Poultry: *Golovrata hen breed, Sombor poultry, Kosovo singer, Svrljig hen breed, Dečan hen breed, Sombor geese breed, Novopazar geese breed, Domestic Bronze turkey i Morka (Biserka)*

All the Locally Adapted Breeds show a decreasing trend of population.

The Exotic Breeds in FRY are:

Cattle: *Simmental, Holstein-Friesian, Holstein (Black and Red), Limousine, Charolais, Montafon (Alpsko goveče)*

Horses: *Thoroughbred, Arab horse, Schtaier horse, Irish pony*

Pigs: *Swedish Landrace, Large White, Dutch Landrace, German Landrace, Belgian Landrace, Danish landrace, Canadian landrace, Pietrain, Hampshire, Duroc*

Sheep: *Merino, Merinolandschaf (Wirtemberg), Ile de France, Bergamo, Jezersko-solčavska*

Goats: *Yugoslav Saanen, Alpine*

Poultry: *New Hampshire, Brahma, Košinšina hen breed, Sussex, Leghorn, Amrock, White Rock, Australorp, Italian Partridge poultry, Rodisland, Barnewelder, Orpington, Plymouth Rock, Viandotte, Italian White geese, Toulouse geese, Landska geese, Beijing (Chinese) duck, Muscovy duck, Rouane duck, Dutch White turkey, American Bronze turkey*

Some breeds have stable, and some a decreasing trend of population.

Wild relatives of domestic animals in FRY are:

Deer (*Cervus elaphus*), Roe Deer (*Capreolus capreolus*), Wild Boar (*Sus scrofa*), Chamois (*Rupicapra rupicapra*) and Partridge.

Some breeds have stable, and some a decreasing trend of population.

There is a real danger of AnGR diversity erosion in our country. In FRY different breeds and breeding systems are developed with the aim to provide for domestic markets on the whole and partly foreign markets. Primarily the breeds imported and adapted to our housing conditions are used and these breeds are paid more attention. Different markets or different demand for animal products influence the genetic development of different AnGR, due to some specificities and habits of consumers in particular regions.

- **state of capacity**

Primary institutions and organisations involved into the process of AnGR management in FRY are:

1. Federal Department for Plant and Animal Genetic Resources, Belgrade
2. Appropriate Federal and Republic Ministries
3. Institute for Application of Science in Agriculture, Belgrade
4. Institute for Animal Science - Institute for Animal Science - Faculty of Agriculture, Novi Sad
5. Faculty of Agriculture, Belgrade
6. Veterinary Faculty, Belgrade
7. Biotechnical Institute, Podgorica
8. Institute for Nature Protection of the Republic of Serbia

All the activities are carried out in co-operation with private breeders, non-government organisations and local communities: the efforts have been made to include into the network for AnGR conservation local business sector as well as all other interested entities activated with the newly emerged changes in the society. The activities in managing AnGR are also organized and sponsored on the level of the Federal state, where within the Federal Ministry of Economy and Internal Trade the Federal Department for Plant and Animal Genetic Resources have been formed. The main activity of the Department is management and conservation of AnGR, preparation of the programme of AnGR conservation, preparation and updating of central database, forming of animal gene bank. The Republic ministries of agriculture, Ministries for natural resources and environment, Ministries for science and development have been also included in different ways. Although, the conservation of AnGR in FRY has been institutionalised, it relies to the great extent to enthusiasm. The science and profession

in principle follow the world trends in this field, although in most of the cases there are no financial opportunities to apply the new knowledge.

Initiatives by government institutions are to much higher extent directed towards Exotic Breeds to improve productivity of domestic populations, but the support for Locally Adapted Breeds gains more and more importance from both government institutions and the other authorities in the country. There is only the beginning of awareness of possible values of AnGR conservation from the aspect of utilisation in the future. This awareness, however, although not intensively enough, continually develops under the influence of government institutions on one hand and private farmers-enthusiasts and local non-government organisations on the other.

In principle, the flow of information in the field of AnGR is realised through network of national agricultural service and through university centers. Central communication hub is on the level of Federal Government. The FRY does not have arrangements with other governments on billateral or multilateral level related to AnGR. Since it has been in isolation, only few contacts survived with scientific institutions from the neighbouring Hungary and Bulgaria. This co-operation is still more or less on the level of short term exchange of experts. Activities which now exist in the international level are co-operation with FAO on implementing Global Strategy of AnGR Management.

In FRY, there are legislative and stimulative measures (Programme of measures for improvement of Animal Husbandry) to induce the producers of AnGR. This programme does not make difference between special breeds and species, but it includes both Autochtonous and Imported Breeds.

On the level of the Republics the regionalisation have been adopted for particular animals (sheep, cattle, horses) in 1995. Regionalisation included only animals under the control of productivity, it is not obligatory but is recommended by experts on the basis of geographical location, soil, climate, as well as the experience and tradition.

As for the soil management, there are regional plans on the level of the Republics as well as detailed regional plans for specific regions. There is no policy or legislation in our country which support and promote conservation and utilisation of domestic knowledge and practice, which are related to utilisation of AnGR, but in the future they should be included into new Law on Animal Husbandry, whose preparation is expected next year. There is no policy or legislative which supports and promotes share of benefits emerging from the use of AnGR.

Technical and advisory services, as well as the capacities for training and research available inside the country to support utilisation of AnGR are as follows:  
republic, regional services, institutes and faculties may serve well as advisory services and services for training and research after completing necessary laboratories and equipment.

- **state of art**

Most of the activities connected with protection of AnGR in FRY is based for years on modest provision of finances for assistance to holders of several species and breeds of autochthonous domestic animals and modest research work on them. The research included mahimally 4-5 research and educational institutions, mostly in Serbia. It is symphomatic that, apart from the great investments into experimental farms of some federal research institutions, practicaly none is interested in AnGR conservation. In conservation of collectioins mainly private farmers-enthusiasts have been engaged and only several state enterprises. National Focal Point for animal genetic resources in the Department for Plant and Animal Genetic Resources has the increasing problem with conservation of collections on the properties of production and educational institutions in federal and co-operative ownership. However, the problem is not only material but organisational as well, because the work on these collections so far has been very moderate in volume terms even when the funds for that purpose were sufficient. That practically led to lack of integration of conserving animal genetic resources with production systems aimed at valorisation of the realised production and raising sustainability of the applied strategy. Due to clearly apparent shortcomings in the system of protection and recognised danger to loose the remaining material from the collections, in the early 2001 the reorganisation of the strategy of conservation and preservation of AnGR has been undertaken at the level of Federation. At the Department for Plant and Animal Genetic Resources, an Advisory Committee for AnGR has been founded, organized according to the instructions of FAO. The committee included 20 experts from 15 scientific, educationla and production institutions, of government and non-government sector. The team of experts for animal genetic resources included for the first time experts for protection of wild relatives of of domestic animals which are birds, mamals, fish and bees. This iniative emerged from the need of introducing new animal species into the food production programmes, due to the increased interest of foreign markets for the alternative meat resources from FRY (primarily for the food from organic and agroforestry systems. There has also been identified the need for including into the protection programme some of the neglected species of domestic animals, like asses, buffalos, and some other species of domestic poltry (guinea fowl, etc.). Protection, conservation and improvement of utilisation of animal genetic resources in FRY is still in its infancy.

- **critical needs**

In difficult economic conditions in FRY, the conservation of animal genetic resources is a luxury, unless this activity is provided with any sort of economic justification. The plan of action for conservation of animal resources in FRY should include a prompt multiplication of breeding stocks of autochthonous animals due to a pronounced danger of diseases and poor management in the conditions of small financial subsidies. The realisation of the plan of action should be preceded by the selection of geographic locations which may give the best economic, ecological and social valorisation in this job, as well as realisation of appropriate protection programmes.

The question of rational, economically sustainable conservation of animal genetic resources is primarily the question of finding possibilities of valorisation of extensive production systems. Integration of conservation of animal genetic resources with profitable combined farm systems and non-agricultural activities based on the principles of ecological agriculture are one of methods to achieve this goal. The research work on this level is a preferential activity which should be included into the plan of action for conservation of animal genetic resources.

Among the most important aspects there will certainly be possibilities which may result from a comprehensive use of animal genetic resources with the aim of valorisation of different food resources, than those related to food safety, diversification of rural economy and development of non-agricultural activities, and finally the possibilities concerning conservation of regional diversity and environment protection on the whole. Concept of protection, conservation and enhancement of animal genetic resources, however, must suffer significant changes in that respect. As the first objective there is integration of conservation of animal genetic resources with profitable combined farm systems and non-agricultural activities within the integral rural development. The other is integration of concept of conservation of animal genetic resources with modernly conceptualized systems of sustainable agriculture (e.g. organic, biodynamic etc.) which enable valorisation of production systems with low yields and high quality.

#### **- priorities for action**

National priorities in conservation of AnGR are not clearly defined, however on the basis of the programmes carried out for conservation of AnGR which have been coordinated and processed on the republic levels are mainly directed towards conservation of the most endangered breeds. Besides, among the priorities there is monitoring of status of those breeds which are not at risk.

For FRY the special importance will be on the following aspects of AnGR conservation:

1. Production systems in the fields of limited agricultural production and conservation of animal genetic resources for food production
2. Conservation of animal genetic resources in service of conservation of biodiversity
3. Conservation of animal genetic resources and protection of regional diversity
4. Protection and improvement of management of forestry and waters in the light of food production
5. Conservation of animal genetic resources serving to environment protection
6. Cultural heritage and conservation of animal genetic resources
7. Maintaining traditional knowledge and technologies in food production
8. Conservation of animal genetic resources as a support to diversification of rural economy

The main priorities which should also become the integral part of the National Programme are:

1. Identification of AnGR (domestic animals and their wild relatives) and their habitats as well as their potentials in the sense of achieving economic justification of model for conservation in active on farm conservation systems.
2. Characterisation of AnGR, realising the scope, distribution, main characteristics and current state of AnGR..
3. Clear definition of the role, utilisation and conservation of AnGR, in livestock production from the standpoint of meeting national requirements in animal products, as well as conquering the foreign markets.
4. Enhancement of capacities of communication and information systems.
5. Establishment of permanent programmes for monitoring farm AnGR and their wild relatives, which have agricultural, economic, cultural or scientific value. The monitoring programmes should be made so as to provide feedback to farmers and the rest involved in AnGR conservation.
6. Development of permanent and functional relationship with the public.
7. Development of legislation and regulations.
8. The increase in the level of international communication.
9. Inducing the initiative for AnGR to be accepted by economic policy as a development factor

## ANNEX 1.

**Table 1. Land use and current trends (1000 ha)**

Category	Area (1000 ha)	Area (1000 ha)
	1990	1999
Arable land	3720	3402
Permanent crops	360	332
Permanent pastures	2158	1903
Agricultural area	6238	5637

**Table 2. Land use for livestock and current trends**

Category	Area (1000 ha)	Area (1000 ha)
	1990	1999
Cropping for food	1434	1246
Cropping for feed	2771	2642
Cropping for food and feed	4205	3888
Natural pasture	1332	1163
Improved pasture	NI	NI
Fallow	NI	144
Forest	2858	2858
Non-agricultural	1822	2164

**Table 3. Land tenure for livestock production**

Category	Area (1000 ha)	%
Private	2907	76
Government and communal	898	24
Total	3805	100

**Table 4. Farm structure and distribution**

Category	Number of farms / households	%	Number of farms / households with livestock	%
Landless	1145	0	1145	0
> 0 to 2 ha	478000	41	300500	43
> 2 to 10 ha	604000	52	364000	52
> 10 to 50 ha	57000	5	22325	3
> 50 to 100 ha	21	0	21	0
> 100 to 500 ha	19	0	19	0
> 500 ha	36	0	36	0
Unknown	21747	2	10875	2
Total	1161968	100	698921	100

**Table 5. Livestock population, number of owners/house-holders and employment by species**

Species	Livestock population (1000)	Number of owners / householders	Number of persons additionally employed	
			Fully	Partially
Cattle	1810	314315	NI	NI
Buffalo	21	15000	NI	NI
Sheep	2195	200000	NI	NI
Goats	326	2000	NI	NI
Horses	76	12000	NI	NI
Donkeys	NI	NI	NI	NI
Pigs	4372	150000	NI	NI
Chicken	26492	NI	NI	NI
Turkey	NI	NI	NI	NI
Ducks	NI	NI	NI	NI
Geese	NI	NI	NI	NI

**Table 6. Human population in the country**

Year	Total (millions)	Rural or Farming (%)	Urban or Non Farming (%)	Total
1990	11	17	83	100
1999	11	NI	NI	#####
Average annual growth rate	0.01	NI	NI	

**Table 7. Major livestock primary production (1000 tonnes/numbers)**

Species	Meat (t)		Milk (t)		Eggs (t)		Fiber (t)		Skin (No.)	
	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
Cattle	161	104	1898	1825					NI	NI
Buffalo	NI	NI	NI	NI					NI	NI
Sheep	25	22	58	34			5	3	NI	NI
Goats	NI	NI	NI	NI			NI	NI	NI	NI
Horses	NI	1	0	0					NI	NI
Donkeys	NI	NI	0	0					NI	NI
Pigs	291	357							NI	NI
Chicken	113	73			98	76	NI	NI	NI	NI
Turkey	NI	NI			NI	NI	NI	NI	NI	NI
Ducks	NI	NI			NI	NI	NI	NI	NI	NI
Geese	NI	NI			NI	NI	NI	NI	NI	NI

**Table 8. Major livestock primary product imports (1000 tonnes/numbers)**

Species	Meat (t)		Milk (t)		Eggs (t)		Fiber (t)		Skin (No.)		Animals (N)
	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990
Cattle	NI	1596	NI	4044					NI	NI	NI
Buffalo	NI	NI	NI	NI					NI	NI	NI
Sheep	NI	NI	NI	NI			NI	530	NI	NI	NI
Goats	NI	NI	NI	NI			NI	NI	NI	NI	NI
Horses	NI	145	0	0					NI	NI	NI
Donkeys	NI	NI	0	0					NI	NI	NI
Pigs	NI	1564							NI	NI	NI
Chicken	NI	2562			NI	205	NI	NI	NI	NI	NI
Turkey	NI	NI			NI	NI	NI	NI	NI	NI	NI
Ducks	NI	NI			NI	NI	NI	NI	NI	NI	NI
Geese	NI	NI			NI	NI	NI	NI	NI	NI	NI
Rabbits	NI	NI					NI	NI	NI	NI	NI

**Table 9. Major livestock primary product exports (1000 tonnes/numbers)**

Species	Meat (t)		Milk (t)		Eggs (t)		Fiber (t)		Skin (No.)		Animals (No.)	
	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1991
Cattle	NI	1707		2820					NI	NI	NI	47
Buffalo	0	0	0	0					0	0	0	0
Sheep	NI	268	NI	NI					NI	NI	NI	9
Goats	NI	NI	NI	NI			NI	NI	NI	NI	NI	NI
Horses	NI	1477	0	0					0	0	NI	NI
Donkeys	0	0	0	0					0	0	0	0
Pigs	NI	97860							NI	NI	NI	1046
Chicken	NI	13630			NI	6	NI	NI	NI	NI	NI	8263
Turkey	NI	NI			NI	NI	NI	NI	NI	NI	NI	NI
Ducks	NI	NI			NI	NI	NI	NI	NI	NI	NI	NI
Geese	NI	NI			NI	NI	NI	NI	NI	NI	NI	NI
Rabbits	NI	NI					NI	NI	NI	NI	NI	NI

**Table 10. Distribution of livestock by production system (%)**

Species	Production systems			Total
	Low input	Medium input	High input	
Cattle	10	75	15	100
Buffalo	100	0	0	100
Sheep	20	70	10	100
Goats	20	70	10	100
Horses	70	20	10	100
Donkeys	100	0	0	100
Pigs	10	70	20	100
Chicken	10	50	40	100
Turkey	10	80	10	100
Ducks	30	70	0	100
Geese	30	70	0	100
Rabbits	0	100	0	100

**Table 11. Type of livestock farm by production system for cattle (%)**

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	50	50	0	100
Smallholder	10	80	10	100
Small-scale-commercial	0	60	40	100
Large-scale-commercial	0	40	60	100

Comments:

- **Subsistence:** less than 50% of production is marketed.
- **Smallholder:** small family farms with more than 50% of production marketed
- **Small-scale-commercial:** medium family farms with more than 50% of production marketed
- **Large-scale-commercial:** large farms or companies with all production marketed

**Table 12. Type of livestock farm by production system for buffalo (%)**

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	100	0	0	100
Smallholder	0	0	0	0
Small-scale-commercial	0	0	0	0
Large-scale-commercial	0	0	0	0

**Table 13. Type of livestock farm by production system for sheep (%)**

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	90	10	0	100
Smallholder	50	50	0	100
Small-scale-commercial	40	60	0	100
Large-scale-commercial	30	70	0	100

**Table 14. Type of livestock farm by production system for goats (%)**

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	90	10	0	100
Smallholder	50	50	0	100
Small-scale-commercial	40	60	0	100
Large-scale-commercial	30	70	0	100

**Table 15. Type of livestock farm by production system for horses (%)**

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	100	0	0	100
Smallholder	0	50	50	100
Small-scale-commercial	0	50	50	100
Large-scale-commercial	0	10	90	100

**Table 16. Type of livestock farm by production system for donkeys (%)**

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	100	0	0	100
Smallholder	0	0	0	0
Small-scale-commercial	0	0	0	0
Large-scale-commercial	0	0	0	0

**Table 17. Type of livestock farm by production system for pigs (%)**

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	100	0	0	100
Smallholder	0	50	50	100
Small-scale-commercial	0	40	60	100
Large-scale-commercial	0	10	90	100

**Table 18. Type of livestock farm by production system for chicken (%)**

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	30	70	0	100
Smallholder	10	50	40	100
Small-scale-commercial	0	30	70	100
Large-scale-commercial	0	10	90	100

**Table 19. Type of livestock farm by production system for turkey (%)**

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	40	60	0	100
Smallholder	20	50	30	100
Small-scale-commercial	0	30	70	100
Large-scale-commercial	0	20	80	100

**Table 20. Type of livestock farm by production system for ducks (%)**

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	50	50	0	100
Smallholder	20	80	0	100
Small-scale-commercial	10	90	0	100
Large-scale-commercial	0	100	0	100

**Table 21. Type of livestock farm by production system for geese (%)**

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	50	50	0	100
Smallholder	20	80	0	100
Small-scale-commercial	10	90	0	100
Large-scale-commercial	0	100	0	100

**Table 22. Type of livestock farm by production system for rabbits (%)**

Type of operation	Production systems			Total
	Low input	Medium input	High input	
Subsistence	0	0	0	0
Smallholder	0	0	0	0
Small-scale-commercial	0	100	0	100
Large-scale-commercial	0	0	0	0

**Table 23. Breed Diversity (Number of Breeds)**

Species	Number of breeds									
	Current Total		At risk		Widely used		Others		Lost (last 50 yr)	
	L	E	L	E	L	E	L	E	L	E
Cattle	3	5	2	0	0	5	0	0	1	0
Buffalo	1	0	0	0	1	0	0	0	0	0
Sheep	10	4	8	0	2	1	0	0	2	5
Goats	1	2	1	2	0	0	0	0	0	1
Horses	5	1	4	0	2	0	0	0	1	0
Donkeys	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Pigs	6	9	2	0	0	8	0	0	4	1
Chicken	6	12	4	0	1	12	0	0	1	0
Turkey	1	3	0	2	0	1	12	0	0	1
Ducks	1	6	0	0	0	6	0	0	0	0
Geese	2	7	2	2	0	5	0	0	0	0
Rabbits	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

*Comments:*

- L = Locally Adapted or Native; E = Exotic (Recently Introduced and Continually Imported). Breeds at risk are those with total number of breeding females and males are less than 1,000 and 20, respectively; or if the population size is less than 1,200 and is decreasing.

**Table 24. Relative importance of livestock products and services within species (%)**

Species	Milk	Meat	Eggs	Fiber	Skin	Risk management	Fertiliser	manure	Draught	Culture	Recreation	Fuel	Feather	Environmental management	Total
Cattle	50	32			5	1	7	5	0	0	0			0	100
Buffalo	40	25			10	0	5	20	0	0	0			0	100
Sheep	12	87		1	0	0	0		0	0	0			0	100
Goats	60	35		0	5	0	0		0	0	0			0	100
Horses	0	0		0	6	65	10	2	5	7	0			5	100
Donkeys	NI	NI		NI	NI	NI	NI	NI	NI	NI	NI			NI	####
Pigs		95		2		1	2		0	0					100
Chicken		47	50			0	1		0	2			0	0	100
Turkey		97	2			0	1		0	0			0	0	100
Ducks		94	5			0	1		0	0			0	0	100
Geese		89	1			0	1		0	2			7	0	100
Rabbits		NI		NI	NI	NI	NI		NI					NI	####

**Table 25. Relative importance of species within livestock products and services (%)**

Species	Milk	Meat	Eggs	Fiber	Skin	Risk management	Fertiliser	manure	Draught	Culture	Recreation	Fuel	Feather	Environmental management
Cattle	98	25			85	0	70	50	0	0	0			0
Buffalo	NI	NI			5	0	5	45	0	0	0			0
Sheep	2	7		100	0	0	7		0	0	0			0
Goats	NI	1		0	NI	0	3		0	0	0			0
Horses	0	1		0	0	0	3	5	0	95	0			0
Donkeys	0	0		0	NI	0	0	0	0	0	0			0
Pigs		50		0		0	11		0	0				
Chicken		13	100			0	1		0	5			10	0
Turkey		1	0			0	0		0	0			0	0
Ducks		1	0			0	0		0	0			0	0
Geese		1	0			0	0		0	0			90	0
Rabbits		NI		0	NI	0	0		0					0

**Table 26. Number of widely used breeds with breeding strategies (No. of breeds)**

Species	Total number of breeds	Breeding strategies		
		Purebred selection	Cross-breeding	Both
Cattle	7	5	2	7
Buffalo	1	1	0	1
Sheep	6	6	3	6
Goats	3	2	3	3
Horses	6	6	6	6
Donkeys	NI	NI	NI	NI
Pigs	10	6	4	10
Chicken	17	17	0	17
Turkey	3	3	0	3
Ducks	7	7	0	7
Geese	9	9	0	9
Rabbits	NI	NI	NI	NI

**Table 27. Number of breeds with current breeding strategies and tools being used (No. of breeds)**

Species	Breeding goals	Breeding strategies		Tools				
		Designed	Designed and implemented	Individual identification	Recording	AI	ET	Genetic evaluation
Cattle	5	5	5	6	5	3	0	3
Buffalo	NI	NI	NI	NI	NI	NI	NI	NI
Sheep	8	8	8	14	14	5	0	0
Goats	3	3	3	3	3	0	0	0
Horses	5	5	5	5	5	2	0	0
Donkeys	NI	NI	NI	NI	NI	NI	NI	NI
Pigs	9	9	9	9	9	8	0	0
Chicken	2	2	2	0	2	0	0	0
Turkey	0	0	0	0	0	0	0	0
Ducks	0	0	0	0	0	0	0	0
Geese	1	1	1	0	1	0	0	0
Rabbits	NI	NI	NI	NI	NI	NI	NI	NI

**Table 28. State of the art of technologies / methodologies used in breeding strategies**

Technology or Methodology	Used for:	
	Research	Breeders
Multi-trait selection index construction	0	0
Optimization tools for breeding plans	0	0
Electronic database related to recording schemes	50	50
Genetic evaluation Software for: phenotypic selection breeding values	NI	NI
Reproductive technologies (AI, ET, etc)	75	25
Microsatellite linkage maps for QTL identification for Marker Assisted	0	0
Other technology (specify)	0	0

**Table 29. Role of stakeholders in the implementation of tools for the development of AnGR**

Stakeholders	Breeding goals	Individual identification	Recording	Artificial insemination	Genetic evaluation
Federal Government	1	1	1	1	1
State Government	2	2	5	2	5
Local Government	1	1	1	1	1
Breeder's	1	4	2	3	1
Private companies	1	1	1	1	1
Research	5	2	2	2	5
NGO's	1	1	1	1	1

*Comments: (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high)*

**Table 30. Involvement of stakeholders in activities related to the development of AnGR**

Stakeholders	Legislation	Breeding	Infrastructure	Human	Farmer's
Federal Government	5	1	2	0	5
State Government	5	1	3	0	5
Local Government	1	1	1	0	4
Breeder's associations	1	1	1	0	1
Private companies	1	5	1	0	1
Research	4	5	3	0	3
NGO's	1	1	1	0	1

*Comments: (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high)*

**Table 31. Stakeholders preference for animal genetic resources**

Stakeholders	Locally adapted breeds	Imported within region	Imported exotic breeds
Federal Government	5	0	1
State Government	5	0	5
Local Government	1	0	1
Breeder's associations	1	0	3
Private companies	1	0	5
Research	4	0	5
NGO's	1	0	1

Comments: (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high)

**Table 32. Priority of needs for utilization of technologies for the development of AnGR**

Technology	Needs			
	Knowledge	Training	Financial resources	Breeder's organization
Recording	5	5	5	5
Genetic evaluation	5	5	4	1
AI / ET	5	5	5	3
Molecular techniques	0	0	0	0
Breed organisation techniques	0	0	0	0

Comments: (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high)

**Table 33. Current number of breeds in managed conservation programmes**

Species	Number of locally adapted breeds at risk			
	Total	Managed <i>in situ</i>	Managed <i>ex situ</i>	Both ( <i>in</i> and <i>ex situ</i> )
Cattle	2	2	0	2
Buffalo	0	0	0	0
Sheep	9	5	0	5
Goats	3	1	0	1
Horses	2	2	0	2
Donkeys	NI	NI	NI	NI
Pigs	1	1	0	1
Chicken	4	4	0	4
Turkey	2	2	0	2
Ducks	0	0	0	0
Geese	4	4	0	4
Rabbits	NI	NI	NI	NI

**Table 34. Current number of breeds receiving incentives and for which tools for *in situ* conservation programmes are used**

Species	Incentives				Technical tools			
	Gov.	NGO	Market	Private	Recording	AI	ET	Others
Cattle	2	0	0	2	2	0	0	0
Buffalo	0	0	0	0	0	0	0	0
Sheep	6	0	0	0	6	1	0	0
Goats	1	0	0	0	1	0	0	0
Horses	2	0	0	0	2	0	0	0
Donkeys	NI	NI	NI	NI	NI	NI	NI	NI
Pigs	1	0	0	1	1	0	0	0
Chicken	4	0	0	4	4	0	0	0
Turkey	2	0	0	2	0	0	0	0
Ducks	0	0	0	0	0	0	0	0
Geese	4	0	0	4	2	0	0	0
Rabbits	NI	NI	NI	NI	NI	NI	NI	NI

**Table 35. Stakeholders involvement in the management of conservation programmes**

Stakeholders	<i>In situ</i> Conservation	<i>Ex situ</i> Conservation
Government	5	0
Breeder's associations	0	0
Private companies	5	0
Research institutions/universities	5	0
NGO's	0	0

Comments: (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high)

**Table 36. Priority of needs for utilization of technologies for *in situ* conservation programmes**

Technology	Needs			
	Knowledge	Training	Financial resources	Technology
Recording	5	5	5	4
Genetic evaluation	5	5	5	4
AI / ET	5	5	5	4
Molecular techniques	5	5	5	4
Breeder improvement techniques	3	3	5	3

Comments: (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high)

**Table 37. Effects of existing policies and legal instruments on the utilization (use and development) of AnGR**

Species	Urban/peri-urban systems		Rural production	
	Industrial systems	Small-holder systems	Industrial systems	Small-holder systems
Cattle	0	0	0	5
Buffalo	0	0	0	0
Sheep	2	0	1	9
Goats	0	0	0	3
Horses	0	0	0	5
Donkeys	NI	NI	NI	NI
Pigs	0	0	0	5
Chicken	0	2	0	5
Turkey	0	2	0	5
Ducks	0	0	0	0
Geese	0	2	0	5
Rabbits	NI	NI	NI	NI

*Comments: (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high)*

**Table 38. The focus of current policies on activities related to the utilization (use and development) of AnGR**

Species	Activities			
	Use of exotic breeds	Use of locally adapted breeds	Training, research and extension	Organization of breeders/farmers
Cattle	3	5	5	5
Buffalo	0	0	0	0
Sheep	2	4	4	5
Goats	2	4	4	5
Horses	4	2	2	2
Donkeys	NI	NI	NI	NI
Pigs	3	5	5	5
Chicken	2	5	5	5
Turkey	2	4	4	5
Ducks	0	0	0	0
Geese	3	4	4	5
Rabbits	NI	NI	NI	NI

*Comments: (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high)*

**Table 39. Prioritising the needs to enable the development of AnGR policies**

Needs	Required		
	Immediately	Medium term	Long term
Recording	2	0	2
Training/Research	2	0	2
Ex situ conservation	2	0	2

**Table 40. The priority of future needs in policy development for AnGR conservation programmes**

Species	Technology	Infrastructure	Human resources	Financial resources	Organizational structures
Cattle	4	3	4	5	4
Buffalo	4	5	4	5	4
Sheep	4	3	2	5	3
Goats	4	3	2	5	3
Horses	4	4	3	5	3
Donkeys	NI	NI	NI	NI	NI
Pigs	4	3	4	5	4
Chicken	4	3	4	5	4
Turkey	5	2	4	5	3
Ducks	0	0	0	0	0
Geese	4	3	4	5	4
Rabbits	NI	NI	NI	NI	NI

*Comments: (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high)*

**Table 41. The priority of future needs in policy development for the utilization (use and development) of AnGR**

Species	Policy development related to:				
	Technology	Infrastructure	Human resources	Financial resources	Organizational structures
Cattle	4	3	4	5	4
Buffalo	0	0	0	0	0
Sheep	4	3	2	5	3
Goats	4	3	2	5	3
Horses	4	4	3	5	3
Donkeys	NI	NI	NI	NI	NI
Pigs	4	3	4	5	4
Chicken	4	3	4	5	4
Turkey	5	2	4	5	3
Ducks	0	0	0	0	0
Geese	4	3	4	5	4
Rabbits	NI	NI	NI	NI	NI

*Comments: (1 = none, 2 = little, 3 = regular, 4 = more, 5 = high)*