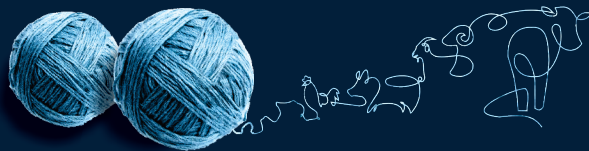


12th
INTERNATIONAL
SYMPOSIUM

MODERN
TRENDS
IN LIVESTOCK
PRODUCTION



P R O C E E D I N G S

9 -11 October 2019, Belgrade, Serbia

Institute for Animal Husbandry

Belgrade - Zemun, SERBIA

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AGRO BIODIVERSITY AND LIVESTOCK FARMING: AUTOCHTHONOUS SPECIES AND BREEDS IN SERBIA

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Abstract: Agro biodiversity or genetic resources for agriculture and food is one of the most significant component of total biodiversity, and it encompasses various animals, plants and micro-organisms that are necessary to maintain the key functions of agro-ecosystems. According to the United Nations, the world population has reached as much as 7.3 billion to date, with a forecast of 9.7 billion in 2050 and 11 billion by the end of the century. Well-adapted and well-developed livestock farming is an essential element of the agricultural production system, especially important in difficult conditions when crop production in the agro-ecosystem cannot sustain and increase its productivity and adapt to changing circumstances, and is crucial for the food security of the population. Preservation and improvement of livestock farming, animal genetic diversity, preservation of autochthonous and development of new breeds, preservation of genetically diverse populations provide society with a greater range of options to meet the future challenges in the development of agriculture. This paper gives review of the condition of farm animals and autochthonous breeds: Podolian bovine, Busha, domestic buffalo, domestic-mountain horse, Nonius, Balkan donkey, Mangalitsa, Moravka, and Resavka pig, Pirot sheep, Bardoka, Krivovir sheep, Karakachan sheep, Lipska sheep, Vlačka-Vitoroga sheep, Čokan Tsigai goat, Balkan goat, Svrlijig hen, Banat Naked Neck hen and Sombor Kaporka hen. Genetic resources in animal husbandry represent all species, breeds and strains of farm animals and they have economic, scientific and cultural significance for our country.

Key words: biodiversity, autochthonous species, autochthonous breeds, genetic resources

Introduction

Agricultural biodiversity is the product of thousands of years of activity in which people have tried to meet their needs within a wide range of social, climatic and environmental conditions. According to the United Nations Population Division (2019), the world population has reached 7.3 billion today. The world's population is expected to increase by 2 billion people in the next 30 years, from 7.7 billion currently to 9.7 billion in 2050, according to a new United Nations report launcher today. According to projections, as many as 11 billion people will live on Earth by the end of the century. The UN indicates that by 2050, half of the world's population will live in nine countries: India, Pakistan, Nigeria, Congo, Ethiopia, Tanzania, the United States, Indonesia and Uganda, cited by size for their contribution to overall population growth. It is also estimated that India will exceed China in terms of population over the forecast period.

Europe, on the other hand, is facing the phenomenon of global aging and is estimated to have more than 34 percent of the population over 60 by 2050. The UN also predicts a population decline in eastern European countries, including Serbia, as well as neighboring countries Croatia, B&H, Hungary, Bulgaria and Romania. The UN population forecast is generally projected to decline in 48 countries. The estimated population in the Republic of Serbia in 2018 is 6.982.604, which is by 5.5% less than in the previous year.

Well-adapted and well-developed livestock farming is an essential element of the agricultural production system, especially important in difficult conditions where crop farming in the agro-ecosystem cannot sustain and increase its productivity and adapt to changing circumstances, and is crucial for the food security of the population. Preservation and improvement of livestock farming, animal genetic diversity, preservation of autochthonous and development of new breeds, preservation of genetically diverse populations provide society with a greater range of options to meet the future challenges in the development of agriculture. Genetic selection may lead to loss of homeostatic balance of animals, resulting in the occurrence of pathologies and consequently in impaired animal welfare (*Petrović et al. 2017*). Responsible management of agricultural biodiversity worldwide is becoming a growing challenge for the international community. Especially in the livestock sector, as it is undergoing dramatic changes, intensifying production by trying to meet the increasing demands for increased production of meat, milk and eggs.

Significance of agro biodiversity

Agrobiodiversity or genetic resources for food and agriculture is one of the most significant component of total biodiversity, and it encompasses various

animals, plants and micro-organisms that are necessary to maintain the key functions of agro-ecosystems.

Agrobiodiversity is the result of the interaction of the environment, genetic resources, management systems and how it is practiced.

Numerous plant varieties, also breeds and strains of animals have emerged as a result of multi-millennial natural selection on the one hand, and planned selection and executed by men, on the other.

The growing of cultivated plants and the domestication of animals, together with the invention of fire, represent the most remarkable achievements of humanity and form the three main pillars upon which human civilization and its development rest.

Numerous studies and experiences indicate that the richness of agrobiodiversity contributes to:

- increase of production,
- secure food supply and economic profit,
- reducing agricultural pressure on poorer - barren areas, forests and endangered species,
- development of stable and sustainable agricultural production,
- sustainable intensification of agricultural production,
- increasing the efficiency of the use of available resources and the environment,
- improving the quality of human nutrition,
- reducing the risk of pests and diseases,
- preserving the soil and increasing its natural fertility and
- preserving ecosystem structure and species diversity.

During the twentieth century, many structural changes occurred at the level of global agrobiodiversity. About 75% of plant genetic diversity has been lost mainly because farmers replaced many autochthonous varieties with genetically more uniform and high-yielding varieties. Also, about 30% of the breeds in the livestock sector are at risk of complete disappearance, and an average of six breeds are lost every month. Climate change and the occurrence of new animal diseases require the preservation and conservation of plant and animal resources due to their adaptive capacity. For hundreds of millions of poor rural households, livestock and crop plant farming is a key resource for life. According to FAO records, almost 75% of present food production is obtained from only 12 species of plants and 5 species of animals. To meet food needs, the human population uses only 150 to 200 of the total of 250,000 to 300,000 edible plant species, of which three (rice, corn and wheat) account for 60% of the calories and proteins derived from plant foods. On the other hand, farmed animals provide 30% of the human population's food

needs. According to FAO estimates, the demands and needs for animal products in the world will increase by 20-30% in the next 20-30 years. Autochthonous breeding also encourages the revitalization of rural areas, providing the autochthonous population with additional sources of income, suitable for the use and maintenance of grazing land and preventing the devastation and succession of natural habitats. Recently, interest in native autochthonous breeds has increased not only for the purpose of gene preservation but also the production of meat products manufactured in the traditional way (*Petrović et al. 2010*).

The state of animal genetic resources in the world

According to the FAOSTAT (2006) Global Database for Animals Genetic Resources, there are 7616 breeds of various species of domestic animals (10 species of mammals and eight species of birds - poultry), of which 6536 are autochthonous (autochthonous) races and 1080 are widespread, regionally or globally (these are usually high-yielding breeds). According to the same report, 20% of the total number of breeds listed are at risk of complete disappearance (effective population size less than 100 individuals). In the period from 1999 to 2006 alone, 690 breeds disappeared, of which 9 were highly productive and all others were autochthonous breeds. By species, 209 breeds of cattle, 19 breeds of goats, 87 breeds of horses, 140 breeds of pigs, 180 breeds of sheep and 6 breeds of donkeys have disappeared.

Given the above data, there is a growing emphasis on the general - global need to study and conserve all species, breeds and strains of livestock, especially autochthonous ones. Primarily because of their importance, as the carrier of specific genes necessary to create new breeds and genetic combinations for immediate exploitation, as well as to preserve the gene pool needed for future generations.

In order to preserve autochthonous breeds and strains, extensive efforts are being made and significant financial resources are being invested worldwide through various international institutions, notably the United Nations Food and Agriculture Organization (FAO), as well as numerous regional and national organizations.

To this end, FAO (1992) made recommendations for the preparation of the Global Animal Genetic Resources Management Program, on the basis of which a document entitled: Global Strategy for the Management of Farm Animal Genetic Resources was prepared and adopted in 1993.

In accordance with the recommendations of this strategy, a Global Domestic Animal Diversity Information System (DAD-IS) has been established and national and regional focal points designated.

In 2001, the FAO launched an initiative to produce Member States' National Reports on the state of animal genetic resources, their contribution to the development of agriculture and rural areas and the national capacity to manage and conserve genetic resources (FAO, 2001). Based on 169 national reports collected, out of a total of 188 FAO member countries, the first global report was prepared: The state of animal genetic resources for food and agriculture in the world, as well as the report: A priority strategy for activities for the sustainable use, development and conservation of animal genetic resources for food and agriculture.

First Technical Conference on Animal Genetic Resources and Declaration adopted: Global Action Plan for Animal Genetic Resources, defining global priorities for further conservation of genetic resources in livestock (FAO, 2007).

Livestock situation in the Republic of Serbia

Table 1 shows the number of cattle, pigs, sheep and poultry from 1999 to 2018. We see that in the period from 1999 to 2018, the number of cattle decreased by 31.6%, pigs by 35.2% and poultry by 30.3%, while the only increase recorded was in the number of sheep by 7.1%.

Table 1. Number of livestock and poultry in Serbia since 1999 (in 000)

Year	Cattle	Index	Pigs	Index	Sheep	Index	Poultry	Index
1999	1283	100.0	4293	100.0	1598	100.0	23278	100.0
2000	1246	97.1	4066	94.7	1611	100.8	20360	87.5
2002	1128	87.9	3587	83.6	1448	90.6	18804	80.8
2004	1102	85.9	3439	80.1	1586	99.2	16280	69.9
2006	1106	86.2	3999	93.2	1556	97.4	16595	71.3
2008	1057	82.4	3594	83.7	1605	100.4	17188	73.8
2009	1002	78.1	3631	84.6	1504	94.1	22821	98.0
2010	938	73.1	3489	81.3	1475	92.3	20156	86.6
2011	937	73.0	3287	76.6	1460	91.4	19103	82.1
2012	921	71.8	3139	73.1	1635	102.3	18234	78.3
2013	913	71.2	3144	73.2	1616	101.1	17860	76.7
2014	920	71.7	3236	75.4	1748	109.4	17167	73.7
2015	916	71.4	3284	76.5	1789	111.9	17450	75.0
2016	893	69.6	3021	70.4	1665	104.2	16242	69.8
2017	899	70.0	2911	67.8	1704	106.6	16338	70.2
2018	878	68.4	2782	64.8	1712	107.1	16232	69.7

Source: Statistical Office of the Republic of Serbia (2019)

According to the data presented in the report of the Statistical Office of the Republic of Serbia (2019), as of December 1st, 2018, as compared to the previous situation, the trend of decrease in the number of cattle, pigs and livestock has

continued, in case of cattle by 2.3%, pigs by 4.1% and poultry by 0.7%, while the total number of sheep increased by 0.4%. Cattle are mostly reared in the Region of Šumadija and Western Serbia (46.7% compared to the total number of cattle in the territory of the Republic of Serbia), and pigs in the Region of Vojvodina (44.3%).

In Table 2 we can see that in 2018 milk production decreased by only 4.4% compared to 2008 in spite of the decrease in the total number of cattle (Table 1) by 16.9%. Sheep milk production is up by 5.9% in 2018 compared to 2008, as is the number of sheep, which is by 6.6% higher than the number of sheep in 2008. Of particular note is the increase in honey production in 2018 by 274.4% compared to 2008.

Table 2. Production of milk, eggs, honey and wool

Year/Product	Cow milk total, mil. Lit.	Sheep milk total, mil. Lit.	Goat milk total, mil. Lit.	Eggs, mil. pieces	Honey, t	Wool, t
2008	1561	14	36	1726	4164	2596
2009	1505	10	28	1711	7354	2403
2010	1485	10	27	1705	7281	2461
2011	1462	11	29	1760	6963	2385
2012	1465	12	33	1794	6983	2662
2013	1451	18	34	1755	8554	2720
2014	1492	20	38	1892	4383	2687
2015	1501	19	44	2061	12263	2769
2016	1504	17	37	1853	5761	2848
2017	1506	14	33	1759	7014	2831
2018	1493	18	34	1796	11427	2844

Source: Statistical Office of the Republic of Serbia (2019)

Table 3 shows the meat production in the Republic of Serbia for ten years. Beef production declined by 23.23% over the ten year period, while the population decreased by 16.9% over the same period. Increase in pork production compared to 2008 is by 13.9% although the number of pigs is lower by 22.6% compared to 2008, which can be interpreted by the change of breed composition, more fertile and meaty genotypes, especially on smaller farms. Sheep and poultry meat also has an increasing trend compared to 2008.

Table 3. Meat production (in 000 t)

Year/Product	Beef	Pork	Mutton	Poultry
2008	99	266	23	76
2009	100	252	24	80
2010	96	269	23	84
2011	81	271	24	103
2012	82	252	22	94
2013	70	249	30	92
2014	73	258	27	94
2015	77	278	30	86
2016	77	301	34	88
2017	71	307	30	95
2018	76	303	32	106

Source: Statistical Office of the Republic of Serbia (2019)

Table 4 contains data on population size and number of breeders in the Republic of Serbia for 2018. The largest number of breeds within the species is found in sheep breeding, and looking at the individual breeds, the largest population is Mangalitsa with 2105 heads.

Table 4. Autochthonous breeds of domestic animals, population size and number of breeders

Species	Breed	Population size (number of breeding animals under control)	Number of breeders
Bovine	Busha	1274	23
	Podol cattle	304	89
Buffalo	Domestic buffalo	1031	322
Horse	Domestic mountain horse	1039	334
	<i>Nonius</i>	91	23
Donkey	Balkan donkey	541	59
Pig	Mangalitsa	2105	100
	Moravka	402	35
	Resavka	44	6
Sheep	Bardoka	198	7
	Krivovir sheep	1112	38
	Pirot sheep	194	11
	Karakačan sheep	213	7
	Lipska sheep	1302	39
	Vlaško-Vitoroga sheep	838	16
	Čokan Tsigai	1236	19
Goat	Balkan goat	781	25
Poultry	Svrljig hen	82	1
	Sombor Kaporka hen	273	4
	Banat Naked Neck hen	522	5

Source: Ministry of Agriculture, Forestry and Water Management

The population trend of autochthonous breeds of domestic animals for the period 2000–2018 is shown in Table 5.

Table 5. Population trend of autochthonous breeds of domestic animals in the Republic of Serbia for the period 2000–2018

<i>Species</i>	<i>Breed</i>	<i>2000</i>	<i>2005</i>	<i>2010</i>	<i>2015</i>	<i>2018</i>
Bovine	Busha	-	32	750	669	1274
	Podol cattle	110	134	350	240	304
Buffalo	Domestic buffalo	/	93	800	423	1031
Horse	Domestic mountain horse	9	19	80	110	1039
	<i>Nonius</i>	17	34	90	74	91
Donkey	Balkan donkey	/	10	250	281	541
Pig	Mangalitsa	124	254	400	780	2105
	Moravka	/	32	100	103	402
	Resavka	/	3	40	16	44
Sheep	Bardoka	/	89	300	687	1302
	Krivovir sheep	/	258	350	532	1112
	Pirot sheep	/	30	60	81	198
	Karakačan sheep	/	74	400	468	838
	Lipska sheep	/	/	60	101	194
	Vlaško-Vitoroga sheep	/	/	130	165	213
Goat	Čokan Tsigai	100	376	450	650	1236
	Balkan goat	242	157	250	521	781
Poultry	Svrljig hen	/	113	200	250	82
	Sombor Kaporka hen	100	352	250	260	273
	Banat Naked Neck hen	50	222	900	560	522

Source: Ministry of Agriculture, Forestry and Water Management

Organisations for breeding, monitoring, and conservation

Breeding is regulated by the Law on Livestock (2016). Institute of Animal Husbandry, University of Belgrade Faculty of Agriculture and the University of Novi Sad, Faculty of Agriculture are the authorized Head Breeding Organizations for the selection and recording of breeding livestock in Serbia. The conservation of LAGs in the Republic of Serbia is defined by a series of regulations and by-laws: the Agriculture and Rural Development Strategy 2014-2024, the National Rural Development Program 2018-2020, the Law on Ratification of the Convention on Biological Diversity, the Livestock Act, the Law on Agriculture and Rural Development, the Law on incentives in agriculture and rural development. Of the by-laws of importance are: the Rulebook on the List of Genetic Reserves of Domestic Animals, the Method of Preserving the Genetic Reserves of Domestic Animals, and the List of Indigenous Breeds of Domestic Animals and Endangered

Indigenous Breeds and the method of keeping a register of breeders of indigenous breeds of domestic animals, the Rulebook on incentives for the conservation of animal genetic resources, and the Ordinance on incentives for the conservation of animal genetic resources in the gene bank. *Ex-Situ* preservation is regulated by the Rulebook on incentives for the conservation of animal genetic resources in the gene bank (2017).

Conservation methods for animal genetic resources

The conservation of autochthonous and adapted species or animal genetic resources (AnGR) is a major problem, but even more worrying is that some AnGRs were lost before their characterization and their potential has been explored. No nuclei with adequate numbers of animals were formed (*in-situ* conservation) and there was no cryopreservation of the embryos and *ex-situ* conservation for the lost autochthonous breeds. The population trend of autochthonous breeds of domestic animals by nucleus formation with an appropriate number of animals (*in-situ* conservation) has stabilized and is on the rise. We have also started *ex situ* conservation and there is now a legal framework for that. Conservation strategies that involve both *in situ* measures (supporting the maintenance of livestock populations in their usual production environments) and cryo-conservation (storage of frozen genetic material) are widely discussed as the optimal means of protecting threatened breeds from extinction. In vitro gene banks have been established by 64 countries and a further 41 countries are planning to do so (FAO, 2015). The very concept of animal genetic resources denotes all species, breeds and strains of scientific, cultural and economic importance to a single country. Particular attention should be paid to the conservation of native breeds of domestic animals, because of the risk of their extinction and extinction. These breeds represent an important source of genetic potential for future livestock work.

Conclusion

Given that, according to projections, as many as 11 billion people are expected to live on Earth by the end of the century, livestock production needs to be promoted, populations increased and more productive breeds created while preserving the quality of the end product. With regard to autochthonous breeds, *in situ* and *ex situ* conservation should be increased so that they are not endangered. The last decade has been marked by a much larger number of scientific and professional publications on autochthonous species and breeds of domestic animals. It is necessary to form a national gene bank *in situ* and *ex-situ* because

autochthonous breeds have specific genes and are more resistant to certain diseases, more stress tolerant, or not as sensitive as allochthonous commercial breeds and better adapt to climate change. In this regard, natural disasters and the coming climate change can be a great challenge to preserve agro biodiversity.

In addition to the National Gene Bank, further alignment of national legislation with the regulations of the European Union and other international organizations is required.

When it comes to breeding allochthonous-commercial species, the fact that the population of cattle, pigs and poultry has fallen by more than 30% in the last 18 years is worrying. In contrast, the fact that the number of breeders and heads of autochthonous breeds has increased in recent years is encouraging. The reason for the increase is primarily due to incentive measures for cultivation by the Ministry of Agriculture, Forestry and Water Management, marketing and market.

The richness and diversity of the living world – biodiversity, is a distinctive feature of the Republic of Serbia. Extremely rich genetic resources of plants and animals, as well as a large number of varieties and breeds, and especially autochthonous plant and animal populations obtained through centuries-old, mostly natural selection, are very significant resources of Serbia, that is, the biological basis for agriculture and food production.

Agrobiodiverzitet i stočarstvo: lokalne vrste i rase u Republici Srbiji

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Rezime

Agrobiodiverzitet ili genetički resursi za poljoprivredu i hranu predstavljaju jednu od najznačajnijih komponenti ukupnog biodiverziteta, a obuhvata razne životinje, biljke i mikroorganizme koji su neophodni za održavanje ključnih funkcija agro-ekosistema. Prema podacima Ujedinjenih nacija svetska populacija je do danas dostigla čak 7,3 milijardi predviđanje je da će 2050. godine biti 9.7 milijardi a do kraja veka 11 milijardi. Dobro prilagođeno i razvijeno stočarstvo je bitan element sistema poljoprivredne proizvodnje, posebno je važno u teškim uslovima kada ratarstvo u agro-ekosistemu ne može da održi i poveća svoju produktivnost i da se prilagodi promenljivim okolnostima, i od ključnog je značaja za prehrambenu sigurnost stanovništva. Očuvanje i unapređenje stočarstva, životinjskih genetskih

različitosti, očuvanje autohtonih i razvoj novih rasa, očuvanje genetski različitih populacija pružaju društvu veći opseg opcija u susret budućim izazovima i razvoju poljoprivrede. U ovom radu je prikazano brojno stanje domaćih životinja i stanje autohtonih rasa: podolskog govečeta, buše, domaćeg bivola, domaćeg-brdskog konja, noniusa, balkanskog magarca, mangulice, moravke, resavke, pirotске ovce, bardoke, krivovirske ovce, karakačanske ovce, lipske ovce, vlaško-vitoroge ovce, čokanske cigaje, balkanske koze, svrljiške kokoši, banatskog gološijana i somborske kaporke. Genetički resursi u stočarstvu predstavljaju sve vrste, rase i sojeve domaćih životinja i one imaju ekonomski, naučni i kulturološki značaj za našu zemlju.

Ključne reči: biodiverzitet, lokalne vrste, lokalne rase, genetički resursi

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References

- FAO (1992): The management of global animal genetic resources. FAO Animal Production and Health, Paper No. 104. Rome.
- FAO (2001): Guidelines for the Development of Country Reports on Animal Genetic Resources, Rome.
- FAO (2007): Global Plan of Action for Animal Genetic Resources and Interlaken Declaration, Commission on Genetic Resources for Food and Agriculture, Food and Agriculture, 1-48.
- FAO. (2010): Breeding strategies for sustainable management of animal genetic resources. FAO Animal Production and Health Guidelines.No. 3. Rome.
- FAO (2015): The second report on the state of the world's. Commission on genetic resources for food and agriculture. Assessments, 1-16.
- FAOSTAT data (2006): at <http://faostat.fao.org/faostat/collections?version=int&hasbulk=1&subset=agriculture> (Accessed 8 September 2006)
- PETROVIĆ M., RADOVIĆ Č., PARUNOVIĆ N., MIJATOVIĆ M., RADOJKOVIĆ D., ALEKSIĆ S., STANIŠIĆ N., POPOVAC M. (2010): Quality traits of carcass sides and meat of Moravka and Mangalitsa pig breeds. *Biotechnology in Animal Husbandry*, 26, 1-2, 21-27.
- PETROVIĆ P.M., RUŽIĆ MUSLIĆ D., CARO PETROVIĆ V., MAKSIMOVIĆ N., CEKIC B., YULDASHBAEV A. Y., SELIONOVA I. M. (2017): Trends and

challenges in the genetic improvement of farm animals. Proceedings of the 11th International Symposium Modern Trends in Livestock Production October 11-13, 1-14.

Republički statistički zavod (2019): <http://data.stat.gov.rs> (Accessed 8 August 2019)

Republic of Serbia. Law on Livestock (2016): Official Gazette of the Republic of Serbia. No. 41/2009, 93/2012 and 14/2016

Republic of Serbia (2017): Rulebook on incentives for the conservation of animal genetic resources in the gene bank. Official Gazette of the Republic of Serbia. No. 110/2017

Republika Srbija (2019): Statistika poljoprivrede - Broj stoke 1. decembra 2018. Godine. Republički zavod za statistiku, Saopštenje, 032, LXIX, 1-2.

United Nations: <https://www.un.org/development/desa/publications/world-population-prospects-2019-highlights.html> (Accessed 07/08/2019).