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## Total Number of Cattle in the Republic of Serbia after an Outbreak of Lumpy Skin Disease

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### Abstract

Numerous studies conducted worldwide indicate a tendency towards a continuous decline in number of cattle. Appropriate measures should be taken to prevent the reduction of the number of cattle and to increase the concentration of animals per farm. In this regard, the objective of this study was to analyze the total number of cattle after an outbreak of Lumpy Skin Disease (LSD) in the Republic of Serbia. Due to the occurrence of this highly dangerous infectious disease in the Balkans and Eastern Europe, emergency and preventive vaccination was performed in infected and vulnerable areas in the Republic of Serbia. To prevent the spread of LSD, competent authorities banned public gatherings of cattle at fairs, exhibitions, livestock markets and purchase places, which resulted in economic losses for certain farmers. This disease is believed to have impacted the total number of cattle slaughtered and the number of deaths, as well as the import and export of live cattle, animal products and by-products of animal origin. The comparison between indices for the number of cattle shows a decline in the total number of cattle in the analyzed period across statistical territorial units. Results on the total number of cattle can be used, among other things, to create new and more complex questions arising from current and future farming problems.

*Key words:* basic index, Lumpy Skin Disease, territorial units for statistics

## Introduction

Lumpy Skin Disease (LSD) is a viral disease of cattle with symptoms such as fever, depression, exhaustion, nodes and oedema of the skin, enlarged lymph nodes, nodules on the mucous membrane, discharge from the nose and eyes, decreasing milk production, lameness and swollen legs (Babiuk et al., 2008; Abutarbush, 2015; VAMA, 2016a). It is an endemic disease in most African countries, but its epizootics outside the African continent occurred in the Middle East in 2006 and 2007 and in Mauritius in 2008 (Hunter and Wallace, 2001; VAMA, 2016b). The emergence of LSD in Turkey in 2013 announced the spread of this disease on the European continent (VAMA, 2016a; VAMA, 2016b), followed by Greece in mid-2015, and Bulgaria and Macedonia in April 2016 (VAMA, 2016a), with a tendency towards further spread in the region. In mid-2016, there were reports on the spread of this highly dangerous infectious disease in the Republic of Serbia, which were followed by amendments to the Ordinance on the 2016 Animal Health Protection Program (OGRS, 2016). Emergency vaccination was carried out primarily in Pčinja and Jablanica Districts using the vaccine donated by the European Commission as an aid to Serbia to control and prevent the spread of LSD (OGRS, 2016; Toplak et al., 2017), and later according to the plan in other districts. Apart from the health aspect, the disease has a significant economic impact due to animal production losses (reduced milk production, reduced quality of the skin), restrictions on the movement of susceptible animals and restrictive trade measures which are in force in infected areas (VAMA, 2016a). In cases of suspicion of LSD occurrence on the farm or health problems in animals attributable to this infectious disease noticed by the owner, possessor or veterinarian during active or passive control, during intervention or in any other case, such suspicions must be immediately notified to the competent veterinary inspector (OGRS, 2016).

After effective emergency and preventive vaccination in protection and surveillance zones, the Veterinary Administration of the Republic of Serbia issued a decision in October 2016 to lift the protection and surveillance areas (VAMA, 2016c).

Given the tendency of LSD to spread further in the region and the absence of specific treatments of sick animals, the aim of this study was to analyze the total number of cattle after the outbreak of this highly dangerous infectious disease in the Republic of Serbia. Another objective of this study was to raise awareness about the importance of infection with the LSDV (lumpy skin disease virus), which has not yet been registered on the American continent and in Australia (VAMA, 2016b).

## Materials and Methods

The analysis of number of cattle in the Republic of Serbia was based on data obtained from the central database (AIR) managed by the Veterinary Administration of the Ministry of Agriculture and Environmental Protection of the Republic of Serbia. The data were analyzed according to the first-, second- and third-level Nomenclature of Territorial Units for Statistics. It should be noted that AIR does not keep records of the Kosovo and Metohija region which includes Kosovo, Kosovska Mitrovica, Kosovo-Pomoravlje, Peć and Prizren Districts. This study involves an analysis of the total number of cattle starting from 08/02/16 until 01/04/17 at 31-day intervals.

The data were statistically analyzed by a Single Factor Analysis of Variance (ANOVA) and relative indicators. Basal indices showing the percentage change between regional and average numbers of cattle, as well as the total number of cattle in the analyzed period were used in the study.

## Results and Discussion

Among major human activities, the production and processing of foods of plant and animal origin have been the focus of many studies, the results of which are designed to contribute to food safety as well as to improving the cost-effectiveness of production and its support activities. Particular attention is given to diseases that have a significant economic impact due to production losses in animals, restrictions on the movement of susceptible animals and restrictive trade measures enacted in infected areas.

Lumpy skin disease (LSD) is an important disease of cattle included in the OIE list of the notifiable terrestrial animal diseases because of its great economic importance (Vidanović, *et al.*, 2016). During 2016 attention was particularly drawn to the situation in the Balkans and Eastern Europe, where there were cases of LSD and reports of the spread of the disease in Turkey, Greece, Bulgaria, Macedonia and Serbia. In 2016, at the NUTS-1 level in the Republic of Serbia, particularly dangerous infectious LSD was recorded in the Serbia-south functional entity (without data for the Kosovo and Metohija region).

More specifically, according to available data, at the NUTS-2 level in the Republic of Serbia, cases of LSD were reported in Southern and Eastern Serbia.

Given that there is no specific treatment of LSD, appropriate preventive measures were implemented to control and prevent the further spread of the disease (VAMA, 2016a). The etiological agent of LSD is the lumpy skin disease virus (LSDV) (Vidanović, *et al.*, 2016), which is not pathogenic to humans (Bowden *et al.*, 2009; VAMA, 2016a).

The results on the second level of the Nomenclature of Territorial Units for Statistics (NUTS-2) for the period analyzed (see Table 1) revealed that Šumadija and Western Serbia accounted for  $\geq 44.5\%$  of total cattle numbers in Serbia (without data for the Kosovo and Metohija region), while the number in Vojvodina was slightly lower ( $\geq 28.63\%$ ). The lowest number of cattle belonging to the NUTS-2 functional entity was recorded in the Belgrade region ( $\geq 5.57\%$ ), which is also a unit at the third level of the Nomenclature of Territorial Units for Statistics (NUTS-3), which covers the territory of Belgrade.

The number of cattle in the NUTS-2 functional entity for the Vojvodina region was the highest in the South Bačka District territorial unit. The highest numbers of cattle at the NUTS-3 level were recorded in Šumadija and Western Serbia in the Mačva District, and in Southern and Eastern Serbia in the Braničevo District (see Table 1).

In the Republic of Serbia, where the primary scientific interest is targeted towards large ruminants (Lazic, *et al.*, 2016), in mid-2016 there was an outbreak of LSD in Jablanica, Pirot, Toplica, Pčinja, Zaječar and Bor Districts (VAMA, 2016c). The first cases of LSD requiring emergency vaccination (OGRS, 2016) were recorded in Pčinja and Jablanica Districts. Also, it is noteworthy that a certain number of some indigenous breeds of cattle was found in the contaminated territory.

As stipulated by some Regulations (OGRS, 2016), following reports of the first suspected case of infectious LSD in the municipality, the competent veterinary inspector, epizootiologist and veterinary authority are to perform clinical examination, conduct epizootic tests and inspect documents on the farm. Prompt disease diagnosis and safe disposal of infected animals are key factors in the prevention of the spread of the disease (Vidanović, *et al.*, 2016).

Results on the percentage analysis of the total number of cattle in the Republic of Serbia for the analyzed period are presented in Table 1.

The first level of the Nomenclature of Territorial Units for Statistics (NUTS-1) shows a significantly lower number of cattle in the Serbia-north functional entity, which includes the Belgrade and Vojvodina regions, than in the Serbia-south functional entity (without data for the Kosovo and Metohija region) (Table 1-3).

Tab. 1. ANOVA and percentage of cattle in the analyzed period across statistical territorial units after the outbreak of lumpy skin disease in the Republic of Serbia

Regions and Districts	2016/17					
	2 Aug	2 Sep	3 Oct	3 Nov	4 Dec	4 Jan
Belgrade region	5.63	5.60	5.64	5.61	5.63	5.57
Vojvodina region	$F_{(6,35)} = 733.07; p \leq 0.001$					
Central Banat District	4.76	4.88	4.90	4.92	4.89	4.85
North Bačka District	4.02	4.09	4.12	4.10	4.09	4.07
North Banat District	4.55	4.65	4.62	4.56	4.52	4.50
South Bačka District	5.16	5.29	5.31	5.32	5.26	5.28
South Banat District	3.12	3.13	3.16	3.12	3.11	3.10
Srem District	3.81	3.62	3.64	3.70	3.69	3.69
West Bačka District	3.27	3.23	3.25	3.24	3.19	3.13
Total, %	28.69	28.90	29.00	28.96	28.75	28.63
Šumadija and Western Serbia	$F_{(7,40)} = 1201.24; p \leq 0.001$					
Kolubara District	5.98	6.05	5.99	6.03	6.11	6.08
Mačva District	9.14	8.57	8.57	8.74	9.01	9.26
Moravica District	4.29	4.36	4.30	4.25	4.23	4.23
Pomoravlje District	2.97	2.95	2.96	2.98	2.99	3.01
Rasina District	3.39	3.40	3.36	3.35	3.32	3.30
Raška District	5.84	5.87	5.89	5.94	5.98	5.99
Zlatibor District	8.75	8.88	8.86	8.71	8.59	8.59
Šumadija District	4.49	4.52	4.56	4.57	4.57	4.59
Total, %	44.85	44.62	44.50	44.57	44.80	45.04
Southern and Eastern Serbia	$F_{(8,45)} = 1633.42; p \leq 0.001$					
Bor District	1.58	1.60	1.57	1.56	1.54	1.54
Braničevo District	3.43	3.46	3.45	3.45	3.45	3.42
Jablanica District	3.05	3.03	2.96	2.96	2.95	2.94
Nišava District	2.68	2.68	2.70	2.75	2.74	2.71
Pirot District	1.16	1.17	1.17	1.15	1.15	1.14
Podunavlje District	2.36	2.25	2.30	2.31	2.31	2.32
Pčinja District	3.03	3.06	3.06	3.08	3.11	3.13
Toplica District	1.37	1.42	1.42	1.41	1.40	1.40
Zaječar District	2.18	2.22	2.22	2.19	2.18	2.16
Total, %	20.83	20.88	20.86	20.85	20.82	20.77
Kosovo and Metohija*	-	-	-	-	-	-
Grand Total	$F_{(24,125)} = 2128.76; p \leq 0.001$					
	100%	100%	100%	100%	100%	100%

\*For this region, no reliable statistical data are at disposal and it was not covered by the calculations.

A comparison between the base indices of NUTS-2 territorial units i.e. areas during the period 08/02/16 to 01/04/17 for the total number of cattle after the occurrence of the highly dangerous infectious LSD in the Republic of Serbia is presented in Table 2.

Tab. 2. Comparison between the base indices of the second level of the Nomenclature of Territorial Units for Statistics (NUTS-2) in the period analyzed

2016/17.	NSTJ-2	BG	RV	SZS	JIS	KM*
2 Aug	BG	100.00	19.64	12.56	27.05	-
	RV	509.12	100.00	63.96	137.71	-
	SZS	795.99	156.35	100.00	215.31	-
	JIS	369.70	72.62	46.45	100.00	-
	KM*	-	-	-	-	-
2 Sep	BG	100.00	19.37	12.55	26.81	-
	RV	516.17	100.00	64.77	138.37	-
	SZS	796.94	154.40	100.00	213.64	-
	JIS	373.02	72.27	46.81	100.00	-
	KM*	-	-	-	-	-
3 Oct	BG	100.00	19.44	12.67	27.03	-
	RV	514.43	100.00	65.18	139.06	-
	SZS	789.23	153.42	100.00	213.34	-
	JIS	369.94	71.91	46.87	100.00	-
	KM*	-	-	-	-	-
3 Nov	BG	100.00	19.36	12.58	26.89	-
	RV	516.55	100.00	64.98	138.89	-
	SZS	794.94	153.90	100.00	213.75	-
	JIS	371.90	72.00	46.78	100.00	-
	KM*	-	-	-	-	-
4 Dec	BG	100.00	19.58	12.57	27.04	-
	RV	510.76	100.00	64.18	138.10	-
	SZS	795.82	155.81	100.00	215.17	-
	JIS	369.86	72.41	46.47	100.00	-
	KM*	-	-	-	-	-
4 Jan	BG	100.00	19.46	12.37	26.82	-
	RV	513.89	100.00	63.56	137.84	-
	SZS	808.53	157.33	100.00	216.87	-
	JIS	372.82	72.55	46.11	100.00	-
	KM*	-	-	-	-	-
Total	BG	100.00	19.48	12.55	26.94	-
	RV	513.46	100.00	64.43	138.33	-
	SZS	796.88	155.20	100.00	214.68	-
	JIS	371.19	72.29	46.58	100.00	-
	KM*	-	-	-	-	-

NSTJ 2- The second level of the Nomenclature of Territorial Units for Statistics; BG- Belgrade region, RV- Vojvodina region, SZS- Region of Šumadija and Western Serbia, JIS- Region of Southern and Eastern Serbia, KM- Region of Kosovo and Metohija. \*For this region, no reliable statistical data are at disposal and it was not covered by the calculations.

The total number of cattle in Southern and Eastern Serbia expressed in relative indicators was 46.45% and 46.11% on 08/02/16 and 01/04/17, respectively, compared to Šumadija and Western Serbia (Table 2).

The percentage analysis of number of cattle in the Republic of Serbia based on available data (without data for the Kosovo and Metohija region) shows that the total number of cattle in Southern and Eastern Serbia for the period analyzed was 72.29% in relative terms, compared to the Vojvodina region (Table 2). Given the result obtained, the difference between the territorial units i.e. areas at the NUTS-3 level for the regions of Šumadija and Western Serbia, Vojvodina, and Southern and Eastern Serbia was statistically highly significant ( $p \leq 0.001$ ). The analysis of the number of cattle across NUTS-3 statistical territorial units i.e. areas after the occurrence of the highly dangerous infectious LSD (see Table 3) shows certain deviations from the average number of cattle in the period analyzed.

Tab. 3. Basal indices between total and average numbers of cattle in the analyzed period across NUTS-3 territorial units i.e. areas

NSTJ-3*	2016/17th year						Average
	2 Aug	2 Sep	3 Oct	3 Nov	4 Dec	4 Jan	
Bor District	104.12	102.18	99.80	98.78	97.48	97.64	14010.33
Braničevo District	102.71	100.68	99.64	99.32	99.22	98.44	30786.50
Central Banat District	100.77	100.58	100.10	100.30	99.58	98.67	43512.67
City of Belgrade	103.51	99.96	99.78	99.08	99.35	98.32	50186.00
Jablanica District	105.65	101.73	98.58	98.35	97.96	97.72	26650.00
Kolubara District	102.08	100.46	98.54	98.98	100.23	99.71	53997.33
Mačva District	106.05	96.73	95.85	97.57	100.54	103.26	79416.67
Moravica District	103.38	102.27	99.90	98.51	97.92	98.01	38239.50
Nišava District	101.85	98.96	99.13	100.60	100.23	99.23	24221.33
North Banat District	102.64	102.01	100.52	98.99	98.14	97.70	40835.67
North Bačka District	101.55	100.46	100.39	99.55	99.23	98.83	36479.33
Pirot District	103.06	101.34	100.85	98.94	98.08	97.73	10343.67
Podunavlje District	105.58	97.76	98.97	99.13	99.11	99.44	20629.50
Pomoravlje District	102.88	99.34	98.78	99.35	99.47	100.17	26611.50
Pčinja District	101.41	99.81	98.83	99.21	100.07	100.67	27503.83
Rasina District	104.34	101.67	99.55	98.99	98.03	97.42	29981.17
Raška District	101.77	99.39	98.89	99.62	100.14	100.19	52917.50
South Banat District	103.09	100.44	100.41	99.14	98.50	98.42	27926.17
South Bačka District	100.91	100.61	100.10	100.18	98.90	99.30	47134.67
Srem District	106.48	98.35	97.88	99.37	98.98	98.94	33015.67
Toplica District	100.34	101.51	100.37	99.85	98.90	99.03	12544.17
West Bačka District	104.81	100.52	100.22	99.90	98.24	96.32	28779.50
Zaječar District	102.57	101.53	100.46	99.18	98.54	97.72	19598.17
Zlatibor District	103.37	101.90	100.80	98.98	97.48	97.46	78073.17
Šumadija District	101.77	99.65	99.60	99.71	99.40	99.87	40685.00

NSTJ 3- The third level of the Nomenclature of Territorial Units for Statistics;

\*Without data for Region of Kosovo and Metohija, which includes: Kosovo District, Kosovska Mitrovica District, Kosovo-Pomoravlje District, Peć District, Prizren District.

The average number of cattle for the period analyzed was the highest in the Mačva District (79,416.67 head), followed by the Zlatibor District (78,073.17 head), while the lowest average number was recorded in the Pirot District (10,343.67 head). In addition, a continuous decline in number of cattle was observed in the Pirot District in the period analyzed (see Table 3), as was the case in Jablanica and Zaječar Districts.

In some areas where no LSD presence was reported, a similar situation was found. An interesting case was observed in the Toplica District, with 0.34% and 1.51% of cattle reported on 08/02/16 and 09/02/16, respectively, in relation to the base.

Given that the number of cattle in this area on 10/03/16 was 0.37% relative to the base (see Table 3), it seems likely that some breeders were not eligible for transport, movement and public gathering of cattle in situations where the presence of LSD was identified (VAMA, 2016d).

Although there is some doubt as to the tendency of the highly dangerous infectious LSD towards further spread in the region (Tilahun et al., 2014; OGRS, 2016; VAMA, 2016a; VAMA, 2016b; VAMA, 2016c), the alarming fact is that this endemic disease has rapidly spread in the Serbian districts (functional entities at the NUTS-3 level) bordering with Bulgaria and Macedonia, where the disease was present. Regardless of the significantly lower number of cattle in Macedonia than in the Republic of Serbia (Bunevski, et al., 2016), it is a worrisome fact that AIR has no information for the Region of Kosovo and Metohija as a functional entity at the NUTS-2 level bordering with Macedonia.

## Conclusions

The comparison between indices for the number of cattle shows a decline in the total number of cattle in the analyzed period across statistical territorial units. This disease is believed to have somewhat impacted the total number of cattle slaughtered and the number of deaths, as well as the import and export of live cattle, animal products and by-products of animal origin. Also, the LSD had direct impact on the market value of calves, as well as on the number of feeding days for certain categories of cattle. Given the above, and in order to keep up to date with this current problem, future studies should include an analysis of annual balance sheets for cattle by category and functional entity at all levels, specifically focusing on disadvantaged territorial units. The results on the total number of cattle can be used, among other things, to create new and more complex questions arising from current and future farming problems.



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## Укупно бројно стање говеда у Републици Србији након појаве болести квржаве коже

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<sup>4</sup>Висока пољопривредно-прехранбена школа, Прокупље, Република Србија

### Сажетак

Бројне студије спроведене широм свијета указују на тенденцију континуираног опадања укупног бројног стања говеда. У циљу спречавања смањења укупног бројног стања говеда и повећања концентрације броја стоке по одгајивачу предузимају се одговарајуће мјере. У вези са тим, циљ овог рада био је анализа укупног бројног стања говеда након појаве болести квржаве коже у Републици Србији. Хитна и превентивна вакцинација у Републици Србији спроведена је у зараженим и угроженим подручјима након појаве нарочито опасне заразне болести квржаве коже на подручију Балкана и Југоисточне Европе. Ради спречавања ширења ове болести надлежне службе забраниле су јавно окупљање говеда на сајмовима, изложбама, сточним пијацама и догонима, што је код одређених одгајивача изазвало економске губитке. Сматра се да је болест квржаве коже имала утицај на укупан број клања и угинућа, као и на увоз и извоз живих говеда, производа животињског порекла и споредних производа животињског порекла. Индексном компарацијом бројног стања говеда може се констатовати одређени пад укупног бројног стања говеда у анализираном периоду по статистичким територијалним јединицама. Имајући у виду горе наведено, добијени резултати за укупно бројно стање говеда се, поред осталог, могу применити у креирању нових и сложенијих питања која произилазе из садашњих и будућих одгајивачких проблема.

*Кључне ријечи:* базични индекс, болест квржаве коже, статистичке територијалне јединице

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