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STATUS AND MEASURE FOR IMPROVE PASTURE CONDITIONS IN THE EASTERN PLANNING REGION OF MACEDONIA

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Abstract
The Eastern Planning Region occupies an area of 3548,7 km^2 or 14,2% of the territory of the Republic of Macedonia. The region has 188.387 ha agricultural land. By that, the grasslands covers 119.504 ha, of which 110.640 ha under pastures and 8.864 ha under meadows, representing a significant source in the production of animal feed, especially in the mountainous areas of the region. On the other hand, on livestock unit comes 2,23 ha pasture area which shows that in this region livestock is poorly developed. As a consequence of this situation which from year to year deteriorates, pastures as a natural resource for providing feed degrade, reducing the quality of grass production and their economic value. In the absence of human factor as a corrector of the specific environmental conditions, hay production is relatively small, ranging from 300-600 $kg^{-1}ha^{-1}$. Considering the current situation, it is necessary to take certain agro-technical measures, such as introduction of methods of systematic grazing, overseeding, fertilization, weeds protection, etc., butalso introduced a system of organizational measures,as well a certain investments for larger agro and hydro technical operations how this status will be improved and agriculture but particularly livestock production become an important branch in economic development of this part of the country.

Keywords: pastures, yield, protection, overseeding, fertilization.

Introduction

The grasslands (meadows and pastures) are important land areas covered with annual, biennial and multi-annual plant species that are used for production of fodder – one part for hay and the remainder for grazing of the cattle. These areas are permanently or over long years overgrown with plants which are used as food for the domestic animals. According to the recent statistics data 1.264.000 thousand ha i.e. around 50% of the total land of the country is categorized as agricultural land (State Statistical Office of the Republic of Macedonia, 2016). Around 64% of the agricultural land 809.823 ha belongs to the category of 'pastures' (750.359 ha) and 'meadows' (59.464 ha), and the remainder is arable land. In the same period, the areas under grasslandsin the Eastern Planning Region are 119.504 ha – 110.640 ha under pastures, and 8864 ha under meadows (14,7% of the total grasslandsin Macedonia), which emphasizes their importance in fodder production, especially in the mountainous-hilly parts of the region.The reason for such very small productivity, on one side, is the fact that only land areas that are not good or not capable for production of other agricultural crops are left under meadows (such as uneven land, slopes, shallow or rocky ground, flooded areas, etc.); and on the other side very little attention was traditionally paid to the grasslands(with rare exceptions). It is an undeniable fact that the production potential of the grasslandsin the Eastern Planning Region is significantly higher than the current production, but it is also a fact that the grasslands were continuously exploited and never replenished in terms of nutrients, hence the small average yield as a result of the extensive production, minor or zero investments, incorrect exploitation of the greenswards, etc. (Ждерски, 1998). In accordance with the above, in this paper we tried to show data and propose measures that will assist the Eastern Planning Region and the relevant national and regional institutions in the future planning of the development of the forage

production in the region and also help the improvement of the regional and local development in sustainable manner. The economic, social and environmental protection (including protection of the biodiversity) shall be satisfied, by defining the manners in which the biodiversity can be used in a sustainable manner.

Material and methods

The main objective of this research is to provide a clear image, data and informations on the current status of the pastures in the Eastern Planning Region and in those parts of the municipalities that gravitate towards the Bregalnica River basin. The aim is to:

- preserve their territory and increase their value,
- ensure the largest maximum accretion of the grass in accordance with the natural conditions,
- identify the possibility for their renewal, development, measures for cultivation, protection, improvement, etc.

The assessment of the Region in this paper is based on the overall understanding of the advantages and challenges in relation to realization of the following three functions: 1) protection; 2) development and 3) logistical support. The investigations should provide framework for actions and future efficient management, including decisions aimed towards all sectors involved and their potential and challenges regarding protection and improvement of the situation with the pastures as nature resources. This will, in turn, help to advance the animal husbandry in the region and improve the living standard of the local population.

Results and discussion

The Eastern Planning Region occupies 3548.7 km^2 i.e. 14.2% of the territory of the Republic of Macedonia (State Statistical Office, 2015). The Region includes 11 municipalities: Berovo, Pehchevo, Delchevo, Shtip, Vinica, Zrnovci, Karbinci, Makedonska Kamenica, Kochani, Cheshinovo-Obleshevo and Probishtip. Altogether they comprise 74.12% of the Bregalnica River basin. The rest of the territory belongs to the municipalities in the neighboring planning regions: Sveti Nikole, Konche, Lozovo, Radovish and Kratovo. Furthermore, the municipalities of Gradsko, Kriva Palanka, Kumanovo and Veles include significant portions of the Bregalnica River basin (between 13 and 52 km^2).

Agriculture and use of agricultural land

According to State Statistical Office (2016), the Eastern Planning Region has 188,387 ha of agricultural land, of which 77,718 ha (41.2%) is arable land and the rest are pastures.In terms of land under pastures, most of this land is under hill pastures. Carriers of cheap food for the grazing animals are the municipalities of Berovo, Stip and Kochani. The pastures in these municipalities are 58,858 ha i.e. 64.9% of the total land under pastures in the Eastern Planning Region. The farming capacities for production of hay mainly exist in Berovo, followed by Delchevo and Pehchevo. Together they have over 77% of the total meadows in the Region. As a result of the migrations from village into cities, that started in the second half of 20th Century and is still present (State Statistical office, 2012), the intensity of use of the land under pastures has been significantly reduced and continues to decline (Jovanovska & Melovski 2013). For example, the neglecting of the animal husbandry gradually leads towards abandoning of the land that was used as pastures, which in turn leads towards nature taking over that land with bushes and other vegetation. The traditional animal husbandry practices have special relevancy for cherishing of the antropogenous habitats which are relevant for preservation of the biodiversity. Hence, the implementation of activities and making od development and enabling policies in the context of revitalization of the animal husbandry practices will be necessary, in order to sustain this traditional manner of land use in the future.

Pasture types in the Eastern Planning Region

Depending on the season in which the pastures are used, they are divided into:

- Summer pastures,
- Winter pastures.

The *summer pastures* in the Eastern Planning Region so far were only exploited without any significant improvements. The strip grazing is not used, and there is no fertilizing, cleaning of rocks, weeds and other agrotechnical measures. Greater care is paid on water supply to the pastures – water cisterns are established at Ograzhden as well as watering places on Golak, Vlaina, Obozhna, Plachkovica, Osogovo, Maleshevo mountains and others, and they were also cleaned from spruces. Very little was done, though, in terms of roads. Most of the pastures are difficult to access and far away from the main roads.

Winter pastures include: low-land pastures, hill pastures, and forest pastures.

Low-land (valley) pastures: These areas mainly feature meadows but there are pastures as well. The mixing of the continental and the Mediterranean climate and the local mountain climate, results in occurrence of specific grass vegetation. The production yield on these areas is not satisfactory – it is up to 2.0 t/ha of hay.The floral (grass) communities feature many annual species, most of which are leguminosae (*Fabaceae*), which is especially relevant for these areas.

Hill pastures: This type of pastures is mainly present in the Northern and northwestern part of the surveyed area (Mangovica, Kuchukov, Bogoslovec and Slan Dol). Large areas under pastures can be also seen in the southern and (partially) western slopes of Osogovo, Maleshevo and the northern mountains of Plachkovica. They spread up to the altitude of 800 meters.Species that are present are low-growing, and they also thrive in the winter period, although with reduced rhythm. In the warm summer months (July, August), the top soil cover dries off and in autumn, when the temperature drops and the first rain occurs, the grass vegetation regenerates again. Although the grazing on these pastures is long-term, the production is low and varies between 300 and 800 kg/ha of hay.

Forest pastures: These pastures are located in the zone with permanent forests. In the Eastern Planning Region and in the areas that gravitate towards the Bregalnica River basin, they spread above the hill pastures, all to way to the upper zone of the forests i.e. the high-mountain pastures (800 – 1600 and up to 2000 meters altitude) and they are defined as forest enclaves. They are used as natural resource in late summer, when the cattle migrates towards the high mountain pastures; in summer when the cover mass on the high mountain pastures dries out; and in autumn, when the cattle migrates again now in opposite direction.

Capacity of the pastures in the Eastern Planning region

The information on production of hay at the pastures in the Eastern Planning Region and in the parts that gravitate towards the Bregalnica River basin for 2015 show that their average production is consistent with the national level production, which means that their economic value is within the productivity of other pastures in Macedonia. The average production at these pastures is 440 kg/ha of hay, which corresponds to the manner and dynamics of the animal husbandry practiced by the rural population in the East Planning Region (Table 1).

The productivity of the pastures along the Bregalnica River basin is from 320 kg/ha of hay in Probishtip, to 680 kg/ha in Berovo. This is low productivity by it has potential to be higher. In addition to the human factor, the absence of meliorative and agro technical measures, one of the main reasons for this weak production i.e. economic value of the pastures, is the rapid decline of the number of cattle and the declining tendencies in the animal husbandry as main activity. We need to emphasize here that the yield from the pastures cannot be the only indicator and basis for determination of their capacity, but should be used only for orientation. During our field research we take sample at several square meters of land, in relation to the entire pasture area, and they show only the average mean value for a particular vegetation period (when the yield was measured).

Table 1. Areas under pastures (ha) and production from the pastures (kg/ha of hay) in the Eastern Planning Region and in the parts that gravitate towards the Bregalnica River basin in the period 2011 – 2015

Municipalities	Botanic species at the pastures	% representation at the pastures	Land under pastures (ha)	Grass production of the pastures (kg/ha of hay)
Berovo	Poaceae	55	14924	630
	Fabaceae	18		
	Various grass	27		
Delchevo	Poaceae	60	7123	520
	Fabaceae	20		
	Various grass	20		
Vinica	Poaceae	45	10306	490
	Fabaceae	35		
	Various grass	20		
Makedonska Kamenica	Poaceae	50	26	380
	Fabaceae	35		
	Various grass	15		
Pehchevo	Poaceae	35	20602	570
	Fabaceae	55		
	Various grass	10		
Zrnovci	Poaceae	40	85	440
	Fabaceae	40		
	Various grass	20		
Kochani	Poaceae	40	13368	415
	Fabaceae	45		
	Various grass	15		
Karbinci	Poaceae	50	38	390
	Fabaceae	30		
	Various grass	20		
Probishtip	Poaceae	45	15359	320
	Fabaceae	48		
	Various grass	7		
Cesinovo-Oblesevo	Poaceae	38	14	365
	Fabaceae	44		
	Various grass	18		
Stip	Poaceae	53	22205	430
	Fabaceae	37		
	Various grass	10		
Sv. Nikole	Poaceae	65	14675	370
	Fabaceae	22		
	Various grass	13		
Lozovo	Poaceae	66	?	355
	Fabaceae	21		
	Various grass	13		
Konce	Poaceae	59	2300	430
	Fabaceae	25		
	Various grass	16		
Kratovo	Poaceae	47	12200	445
	Fabaceae	38		
	Various grass	15		
Total			110640	440 (average)

Source: Markova et al. 2011; Prentovic, T. (own research)

For more correct results, the sampling should be continuous and the yield should be measured every year, in a course of several decades. Only that average yield would be the solid basis for determination of the capacity of such heterogeneous floral circumstances as they exist with the grass vegetation at the pastures in the Eastern Planning Region.

Measures for pastures protection

Several measures can be implement in terms that would maintain or improve pasture status from quantitative and qualitative aspect. In this paper our focus are agrotechnical measures, especially those which should be applied every year or every second year, such as: surface cultivation, fertilization and reseeding.

The *surface cultivation* includes a number of agro technical operations implemented due to the regular natural changes in the phytocenoses and in the soil and, due to the climate influence, changes in the plant cover and in the manner of use of the greenswards. The actual cultivation includes measures in order to create ploughed soil layer that will allow reseedings of the pastures.

Fertilizing. The use of the pastures for grazing takes away large quantities of mineral nutrients from the soil, the soil becomes poorer i.e. its fertility is reduced. One average natural pasture that includes a number of natural grass species, and less other plant communities, needs the following quantities of nutrients in order to produce 100 kg of hay (Table 2).

Table 2. NPK quantities required for production of 100 kg of hay, depending on the development phase

Mineral nutrition	Utilization in the phase of stem elongation – before blooming/kg	Utilization in the phase of blooming of the grass /kg
Nitrogen (N)	1.8 – 2.0	4.6 – 5.4
Phosphorus (P_2O_5)	0.7 – 1.0	0.4 – 0.5
Potassium (K_2O)	1.8 – 2.2	0.7 – 0.8

Source: Ivanovski, 2000

The mineral fertilizers on the pastures in the Eastern Planning Region never been used. It is expensive agrotechnical measure and to be used it has to be financially supported by the relevant institutions. In our conditions, the most favorable NPK ratios could be: 1-2 : 1 : 1 or 2 : 1,5 : 1, for pastures where the content of phosphorus and potassium are in deficit as well as on land areas with greater humidity. In practice there are three approximate doses used when fertilizing the natural pastures (Table 3).

Table 3. Approximate quantities of nitrogen, phosphorus and potassium (kg/ha) when applying fertilizers to natural pastures

Fertilizing norms	Quantities – kg/ha		
	N	P_2O_5	K_2O
I – small dose	60 – 80	40 – 50	40 – 50
II – middle dose	100 - 120	70 – 80	70 – 80
III – high dose	140 – 160	90 – 100	90 – 100

Source: Ivanovski, 2000

Usually, the small doses are appropriate for the hill-mountain pastures, the middle doses are appropriate for the hill and valley pastures and the higher doses for flat-land, valley and the better-quality hill pastures from which better yield and quality of the feed will be produced.

Fertilizing with the use of organic fertilizers. The organic fertilizers (specifically the manure) improve the fertility of the soil by enriching the microbial activity, which is especially relevant for the mineralization of the organic matters in the soil. They also regulate the pH value, especially at more

acidic soils, and reduce the alkalinity of the respective soils, improve the heat and air regime thus reducing the natural phenomenon of anaerobization of the greenswards in the degradation processes. The manure has significant impact on the floral composition of the pastures. Because of the surface use, quantities of 20 t^{-1} ha^{-1} show small effect. It is much more useful to use greater quantities – 40 t^{-1} ha^{-1} – which result in higher yields. However, great care must be paid with the planned quantities because too extensive quantities suppress the development (mainly of the leguminous species) due to the large quantity of nitrogen, and in turn stimulate the development of harmful weeds and grass. The manure should be used in late autumn or early spring, every second or third year, depending on the condition of the pasture. The existing grass vegetation reacts positively, grows quickly, but dye to the specific smell that could be repelling for the cattle, it is better if the first sweeping is used for hay, and the others for grazing. The liquid manure could be used on the pastures in quantities of 20 – 40 t^{-1} ha^{-1}, initially dissolved in water in 1 : 4-5 ratio (liquid manure : water). Sometimes, in a case of summer sweeping, this concentration is 1 : 10. For the sake of better and more complex effect, it is better to use it combination with some phosphorous fertilizer, in a quantity of 50 – 60 kg/ha. It is applied by spraying the surfaces with special cisterns. The organic liquid manure mainly includes nitrogen and potassium so the use of this manure should be in combination with phosphorus, in quantities of 50 – 60 kg/ha. If used every year, if it is not diluted well and if no phosphorus is used as addition, it could case diseases among the domestic animals in a form of diarrhea or bone problems. It is therefore recommended to be used every second year, always in combination with some phosphorus fertilizer.

Reseeding. The reseeding is used for improvement of the natural pastures, specifically those where the vegetation is rare or where low grass with shallow roots started to dominate. The purpose is to increase the yield and improve the quality of the feed, as well as to protect the soil from erosion (on fields subject to intensive erosion processes). This additional sowing is deployed when:

- the grass is rare;
- the grass is destroyed.

The following factors need to be taken into account when selecting the plant species for making of these mixtures: the natural conditions in the environment (the needs of the particular species in terms of soil reaction, climate conditions, nutrition regime, air regime and other agro-ecological conditions); the agronomic characteristics of particular species (yield, nutrition value, resistance to diseases and pests, dynamics of development during the vegetation period, etc.); the biological characteristics of the species (the duration of the lifecycle, the ability to replenish, multiply, etc.); the relations between different species (low vs high grass, etc.); the duration of use of the pastures (problems related to the persistence of particular species in the mixture and maintaining of productivity in situation of different lifespan of the pastures); the economic purpose of the pastures (use of mixtures intended for grazing, use of mixtures for production of hay, combined use of the pasture), etc. Considering the above parameters, one of the mixtures for advancing of the pastures could include the following plant species:

- Red clover *(Trifolium pretense):* 6 – 8 kg/ha;
- Timothy-grass *(Phleum pretense):* 5 – 6 kg/ha;
- Meadow fescue *(Festuca pratensis):* 6 – 7 kg/ha;
- Smooth brome *(Bromus inermis):* 8 – 10 kg/ha

If reseeding is used on terrains for remedying of the erosion, the following combinations of grass-clover mixtures that have significant positive impact in regulation of this process of degradation of the soil are recommended:

I. Leguminous based mixtures:

1. Onobrychis sativa	100%			
2. Onobrychis sativa	70%	+	Agropyron cristatum	30%
3. Onobrychis sativa	80%	+	Bromus inermis	20%

4. Onobrychis sativa	70%	+	Dactylis glomerata	30%
5. Lotus corniculatus	60%	+	Dactylis glomerata	10%
			Agropyron cristatum	20%
			Festuca rubra	10%
6. Lotus corniculatus	30%	+	Trifolium repens	30%
			Dactylis glomerata	20%
			Agropyron repens	10%
			Festuca sulcata	10%

II. Grass based mixtures

7. Dactylis glomerata	30%	+	Agropyron crystatum	30%
			Lolium perenne	20%
			Lotus corniculatus	10%
			Trifolium incarnatum	10%
8. Dactylis glomerata	10%	+	Festuca pratensis	10%
			Agropyron cristatum	10%
			Festuca arundinaceae	20%
			Bromus sp.	10%
			Trisetum flavescens	10%
			Lolium perenne	20%
			Festuca sulcata	10%

a) Mixtures for skeletal-carbonate soils

1. Onobrychis sativa	100%			
2. Onobrychis sativa	70%	+	Dactylis glomerata	30%

The reseeding of pastures located on terrains with mild inclination must be accompanied with intensive fertilization. The areas that were additionally sown must be carefully used in the first year, otherwise very serious thinning out could occur.

Conclusions

The Eastern Planning Region occupies 3,548.7 km^2. The region has 119,504 ha under grasslands, from which 110,640 ha is under pastures and 8,864 ha is under meadows, representing important source of production of feed, especially in the hilly-mountain areas of the region. As a result of the environmental condition (arid climate, and shallow, skeletal and poor with nutrients soils), the pastures in the Region have low productivity. In the absence of humans as correctors of the specific environmental conditions, they contribute with small hay production, in average from 300 – 600 kg/ha. In order to increase the yield and to improve the quality of the forage, it is necessary to apply measures that improve the state of the pastures, such as: surface cultivation, fertilization, reseeding, protection from weeds, additional sowing and some other measures for care. The contemporary use of the pastures must also include activities for melioration that play great role in the protection of the endangered terrains from erosion and in the regulation of the water regime (arranging of springs; arranging/making of watering places) as well as creating conditions for watering of the livestock via catchments and reservoirs with rainwater.

References

1. Jovanovska, D., Melovski, Lj. (2013). Land cover succession as a result of changing land use practices in northeast Macedonia. Proceedings of the 4th Congress of Ecologists of Macedonia

with international Participation, Ohrid. Macedonian Ecologist Society, Special issue 28, Skopje, 185-197.
2. Markova, N., Hristova, E., Zlatkovski, V., Ilieva, V., Mitrev, S. (2011). Pasture utilization in the Eastern planning region in Republic of Macedonia and the necessity for determination of their grass composition. 1st National Agriculture Congress andExposition on behalf ofAli Numan Kıraç withInternational Participation, Turkey, 2657-2664.
3. State Statistical Office of the Republic of Macedonia. (2015). From: http://www.stat.gov.mk/.
4. State Statistical Office of the Republic of Macedonia. (2016). From: http://www.stat.gov.mk/.
5. Аждерски, Ј. (1998). Агоеколошки ефекти при користење на тревници за зголемување на овчарското производтво во Малеш и Пијанец. Докторска дисертација, Земјоделски факултет – Скопје.
6. Ивановски, П. (2000). Фуражно производство, Универзитет „Св. Кирил и Методиј“ Скопје