

# POTENTIALS OF FORAGE CROPS PRODUCING IN PURPOSE OF ENCOURAGING THE SUSTAINABLE DEVELOPMENT OF UPPER DANUBE REGION<sup>1</sup>

*Marijana Jovanović<sup>2</sup>, Savo Vučković<sup>3</sup>*

## Abstract

*The goal of this paper is analysis of forage crop production in area of Upper Danube Region, which for the purpose of this research includes the territory of four municipalities: Apatin, Bač, Bačka Palanka and Sombor. We have used the data from the Republic Statistical Office for the period of 2002-2011, so that in analyzed municipalities represented the dynamics of production of most important forage crops (alfalfa and clover), as well as production of voluminous forage crops on meadows and pastures. It will be presented the significant of this type of plant production in sustainable development of mentioned bioregions.*

**Key words:** *forage crops, meadows, pastures, sustainable development, Upper Danube region.*

## Introduction

Sustainable development for its goal have task to satisfy the needs of consumer society, while at the same time decreasing or completely elimination of damaging impacts, which represents threat for environmental and natural conditions. Because of its wide applications, principle of sustainability for it goal have consolidation of *pier I – development of economics, economy and technology, pier II- sustainable development based on social balance and pier III – environmental*

---

<sup>1</sup>This paper is part of results on the project III 46006 "Sustainable agriculture and rural development in function of achieving the strategic goals of Republic of Serbia within Danube region", project funded by Ministry of Education, Science and Technological Development of Republic Serbia. Project period 2011-2014.

<sup>2</sup>Marijana Jovanović, B.Sc., Research Trainee, Institute of Agricultural Economics, Volgina 15 street, 11060 Belgrade, Serbia, phone: + 381 60 48 48 041, e-mail: [marijana\\_j@iep.bg.ac.rs](mailto:marijana_j@iep.bg.ac.rs)

<sup>3</sup>Savo Vučković, PhD, full professor, Faculty of Agriculture, Nemanjina 6, 11080 Belgrade, e-mail: [savovuck@agrif.bg.ac.rs](mailto:savovuck@agrif.bg.ac.rs)

*protection with rational managing of the natural resources.* The assumption of sustainable development is based on that society should be managed with three types of capital (economic, social and natural capital), on way which that hey considered an irreplaceable and which consumption can be irreversible. On that indicates and fact that natural capital not necessarily be replaced with economic or society capital, although is possible to find a replacement for certain natural resources (Jovanović, M.; Bekić, B.; 2012).

One of goals of *National strategy of sustainable development* (“*Official Gazette of Republic of Serbia, number 57/08*”)<sup>4</sup>, is increasing the agricultural land under organic and others ecologically acceptable systems of agricultural producing and also raising and strengthening awareness of agricultural producers about environmental protection issues, with respecting principals of protection the biodiversity and benefit of all kind of animals.

Conservation of environmental and genetic resources in agriculture represents turn point of development the agricultural productions on territory of local communities, because based on it later can be expected growth and development of sustainable production. In correlation with that, besides using the principals of sustainable development, it is useful to use the term – bioregionalism, as well as biodiversity.

Bioregionalism can be observed as subspecies of regionalism<sup>5</sup>, which borders are determined by natural borders of ecosystem. Title derives from Greek word *bios- life* and Latin word *lagere - space on which should rule (life territory – place defined by live forms which inhabit it)*. Conceptually, bioregionalism represents the way of development and organization of society life which relies on natural characteristics of place, i.e. bioregion (Puđak, 2010).

Bioregions strive to ecologic, economic and cultural self-sufficiency, so they interact with other (bio) regions in the surrounding, which in itself is

---

<sup>4</sup>“Official Gazette of Republic of Serbia, number 57/08”, National strategy of sustainable development, Government of Republic Serbia, Belgrade, 2008.

<sup>5</sup>Regionalism is conceptually above notion which defined bioregionalism and etymologically derives from latin word *legere – space on which should rule*. Region represent homogeneous space (on the basis of physical-geographical, historical-cultural, economic and/or political criteria) in relation to the parent entity, with the remark that one region can territorially include more countries.

considerate to natural environment (water, land, air, climate) and who its ecosystems do not consumed across their upper limits (*Sale, 2000.*). Bioregionalism was created in late '60s of past century as product of work the great number of activists, which try to find in her the modus between economic growth, from one side and cultural and ecologic sustainability, from the other hand.

Borders of bioregions are not determine based on administrative borders, but natural characteristics and borders of ecosystem, which are not clear, but gradually flow from one to another (*Puđak, 2010*). They are formed with creating of human settlements which follow the unique characteristics of climate, land, flora and fauna, which are characteristics for specified place.

Bioregionalism, because of that is completely leaning on biodiversity. Biodiversity represent the total biological diversity, which includes all forms of disparity, changes and occurrences, precisely all process of organisms and biosphere at all. It includes genetic, specific and ecosystem variability, which provides the diversification and sustainability of natural resources.

As a result of bad regional planning and non-application of good agricultural practice it coming up to impoverishment of biodiversity. Due to intensive and non-planning cultivation of soil and intensification of agricultural production comes to reducing of biodiversity and its weakening, in some cases to completely disappearance certain species or breeds of animals. Non-planning intensive agriculture can lead to rinsing the fertilizers, pesticides, animal excrements and rinsing of soil, which pollute overhead and underground water, until pollution with nitrates from agriculture presents major problem (*Jovanović, M.; Bekić, B.; 2012.*).

Considering that on the area of Upper Danube is dominated present the intensive conventional production of primary agricultural products for mass consumption, processing and export, may come to endangering of soil, water, air, biodiversity and landscapes (*Popović, Mijajlović; 2013*).

Because of that the respecting of standards in area of human protection, plants and animals, environmental protection and good agricultural practice during managing the soil and waters, parallel with the implementation of agro ecological measures and programs, is the way to

ensure the ecological sustainability of agriculture in this region (*Popović, Sarić, Jovanović; 2013*).

Using the potential for development of agriculture, in context of good agricultural practice, implies respecting of satisfying need of present on way which doesn't question the ability of future generation to satisfy their own needs. On that way will be establish the balance between on consuming the resources and ability of natural systems to satisfy need of future generations. Instruments which possible can contribute to creating this framework are **instruments of sustainable development**.

Sustainable development of local communities largely depends on the orientation of population on development of ecological conscience about limited resources. One of the spheres of sustainable development, important for the research in this paper is environmental protection (use of natural resources, appropriate management, prevention of pollution), through emphasizing smaller invasive methods of agricultural production in the smaller communities.

Production of sufficient amounts of forage crops presents basis for further development of crop production, as and creating technological basis for production of sufficient of quantities of milk, dairy and meat products in agricultural holdings and in industry, which was later improve livestock production and reduces the need for imports feed.

Advantage in using the characteristics of forage crops s that the their growing as a basic crop or stubble crops on meadows and pastures is realized constant utilization of surface soil, after removal of aboveground biomass soil remains loosely, non-infected by diseases, rich with organic remains and mineral substances.

Is created a good basis for the production of fresh voluminous feeds, while the process of haylage and silage can produce enough food for the periods when the stock is not in the open. On that way is create the good basis for proper differentiation of meals domestic animals, along with concentrates and supplements in a smaller proportion Forage production is the basis of sustainable development of the region in which it is grown because food causes the further development of sustainable farming.

In Republic of Serbia, the AP Vojvodina and the region of the Upper Danube, the production of all categories of crops facing a limit in terms of

area, soil quality and other factors. With the same problem is faced production of all categories of forage crops. With continued rises the area under cultivation of culture for human consumption and high energy plants, reducing the surface area that can be used for forage production. Therefore it is necessary that on the surfaces which are available, with more rational managing produces a sufficient amount of forage necessary to satisfy the emerging needs (*Z. Štafa and authors, 1997*).

On the surface is better and more economical to produce culture for feed mixtures, because with the dense planting is the best exploiting the land, light, nutrients, plants less flattening, it is easier to dry, for mowing, give the yields of better quality. Besides that, the production of forage it is possible to use a period in the production between of major crops (interpolation) - when it comes to fodder crops with a short growing period. (*Z. Štafa and authors, 1997*).

Given that the Research conducted on small location, which covers an area of special nature reserve "Upper Danube" (which are located Sombor municipality and Apatin) and municipality of Bač and Bačka Palanka, the notion of sustainability, as well as the concept of bioregionalism has its own significance and role. For the purposes of the subject research, the entire region will be called the Upper Danube region.

### **Materials and method**

For research purposes is defined area of the Upper Danube region, which includes the administrative territory of Sombor, Apatin, Bač and Bačka Palanka. Based on the data the Republic Statistical Office and the strategic documents of municipalities in the area of the Upper Danube region, it will be realized the analysis of the current situation of forage plants production, as the most important crops (alfalfa and clover) and production in meadows and pastures. Presented research are also performed and on national, and also on the level of AP Vojvodina, for purposes of comparative analysis. Research was conducted for period 2002-2011 year.

### **Results and discussion**

The entire area of Upper Danube region is characterized by favorable geostrategic position, natural resources, with richness of flora and fauna, with good infrastructural connection of all municipalities. On this area is

located the special nature reserve "Upper Danube", which represent the protected natural goodness of I category. This Reserve extends along the left bank of the Danube, from 1,367 to 1,433 km of the overall flow, covering an area of 19.500ha<sup>6</sup> and one of the last areas of the floodplain soil of the European continent. Because of interweaving of the ecosystem, which this nature reserve classified into one of the few bioregions in Europe, there is a mosaic of different vegetation forms.

Also, due to high micro of relief, at least the difference in altitude, cause the development and survival of different species. The most typical inhabitants of the region are shrub species: dogwood (*Cornus sanguinea*) and hawthorn (*Crataegus sp.*). In Red book of flora of Serbia are following endangered taxa: water violet (*Hotlonia palustris*), winter aconite (*Eranthis hyemalis*) and horsetail (*Hippuris vulgaris*). Addition to the above species which represent, there are a number of species of animals that are taken shelter here.

Development potentials of Upper Danube Regions municipalities lies in realization of strategic goals of local communities, which are possible to achieve by implementation different strategic documents, as well as realization certain programs cross border collaboration, which are realized in period 2007-2013 (IPA projects), in which emphasis is given on creation of framework priorities and measures which are related to sustainable socio-economic development, with special accent on protection and preserving of natural goodness of gross border area, taking joint measures and increased public consciousness, and particular attention is directed to agricultural production and association and organization of agricultural producers.<sup>7</sup>

Agricultural activity on territory of Upper Danube region have very long tradition, where is in spite of dominantly present intensive agricultural production, year after year, increasing the area under organic agricultural production (*Jovanović, Bekić, 2012*). The aim this kind of diverting is consequence of need for decreasing the influences of agricultural activity on environment, it's somewhere in opposing positions, when viewed from the production of basic agricultural products.

---

<sup>6</sup> Gornje Podunavlje Special Nature Reserve: [www.gornjepodunavlje.info](http://www.gornjepodunavlje.info) (12.09.2013.)

<sup>7</sup> IPA cross border program Hungary - Serbia 2007-2013., [www.hu-srb-ipa.com](http://www.hu-srb-ipa.com), IPA cross border program Croatia - Serbia 2007-2013., [www.croatia-serbia.com](http://www.croatia-serbia.com) (14.08.2013.)

Agricultural land represent significant natural resource, based on which is possible to talk about sustainable development. Because of that the land of good characteristics is crucial significant for agricultural production, because represents medium where taking place all biochemical process need for further growth and development of plants.

In the past few decades in the area of Republic of Serbia and AP Vojvodina is noticeable decrease total agricultural land (as for permanent settlement and expansion of industrial facilities and road infrastructure at the cost of quality sites. At the same time, in the Upper Danube region is noticeable slightly increase in agricultural fields. Based on the data from Tables 1 and 2, it is evident that on territory of the Upper Danube region are favorable characteristics for agricultural activities in the agricultural area. Table 1 provides an overview of agricultural land in the Republic of Serbia, AP Vojvodina and the area of the Upper Danube region.

**Table 1.** *Total agricultural land in Republic of Serbia, AP Vojvodina and Upper Danube region, in period 2002-2011*

*(in ha)*

	<b>Republic of Serbia</b>	<b>AP Vojvodina</b>	<b>Upper Danube region</b>
2002	5.106.900	1.783.175	198.974
2003	5.115.072	1.793.572	200.698
2004	5.113.307	1.792.159	199.876
2005	5.112.323	1.790.565	199.836
2006	5.105.008	1.780.950	198.798
2007	5.052.957	1.747.441	194.136
2008	5.093.192	1.781.253	199.606
2009	5.096.646	1.780.756	198.392
2010	5.091.507	1.784.352	201.271
2011	5.096.267	1.780.588	200.949

**Source:** *Municipalities in Serbia 2003-2010, Municipalities and regions in Serbia 2011-2012. Republic Statistical Office, Belgrade, Serbia.*

The following table gives an overview of the area under fodder crops in the Republic of Serbia, AP Vojvodina, and the Upper Danube region. Forage crops were statistically significant at all three monitored areas.

**Table 2.** Areas under forage crops on arable land and gardens, 2002-2011  
(in ha)

	Republic of Serbia		AP Vojvodina		Upper Danube region	
	Arable land and gardens	Forage crops	Arable land and gardens	Forage crops	Arable land and gardens	Forage crops
2002	3.351.086	466.444	1.580.541	76.159	179.445	6.717
2003	3.345.154	463.122	1.582.691	74.013	179.697	5.712
2004	3.343.916	463.924	1.581.822	76.814	179.964	6.050
2005	3.329.973	460.631	1.581.845	75.211	180.317	5.886
2006	3.318.392	458.413	1.574.421	72.751	180.474	5.274
2007	3.298.701	456.837	1.571.524	73.001	176.258	5.165
2008	3.302.089	465.558	1.574.477	74.975	179.696	5.464
2009	3.300.999	455.004	1.049.735	180.230	180.230	5.041
2010	3.294.922	459.987	1.578.331	182.749	182.749	4.979
2011	3.293.577	455.017	1.577.733	184.113	184.113	4.900

**Source:** *Municipalities in Serbia 2003-2010, Municipalities and regions in Serbia 2011-2012. Republic Statistical Office, Belgrade, Serbia.*

**Arable land and gardens** are the most present way of using the agricultural land. Based on Table 2 it can be seen that share of arable land and gardens at total agricultural areas ranges in next spans:

- 64,63%-65,75% on level of Republic of Serbia;
- 88,24%-88,95% on level of AP Vojvodina;
- 89,56%-91,62% on level of Upper Danube region.

Based on data in *table 2*, share of forage crops in arable land and gardens on level of **Republic of Serbia** is characterized a positive, but cyclical trend in observed period. Lowest share of forage crops are noticeable in 2009. (13,78%), biggest in 2008 (14,09%).

On territory of **AP Vojvodina** share of forage crops in arable land and gardens are also characterized with cyclical trend, and share moves from 4,62% (2006) until 17,17% (2009). Especially is interested that in last three years of observing share of forage crops increased to three to four times in compared with past year, which is consequence higher orientation of agricultural production in general to production of plants for domestic animals feed.

At the territory of **Upper Danube region**, there are favorable conditions for the development of forage plants in total area of arable land and



gardens, no matter what the second half of the period reduced the proportion of acreage under fodder crops (Table 2). The largest share of fodder crops in the fields and gardens was recorded 2002 year (3.74%), while the lowest proportion (2.66%) recorded in the 2011th year, which may be due to increase in area under cereals.

**Meadows and pastures** represent one of the most important ways for using the agricultural land, on which are of which produce different types of forage crops as well as other crops that are important for animal nutrition. Meadows and pastures are an important factor in determining the level of development of rural areas, although there is reason to fear that because of the reduction in the total number of animals that grazing biomass amounts, can completely change the floristic composition and share useful forage plants, because there is a higher share of weed culture, the account of reduction of useful legumes and other grasses. In Table 3 is given the presence of meadows and pastures in the total agricultural land in all three observed levels.

**Table 3.** *Share of meadows and pastures in total agricultural surface, on area of Republic of Serbia, AP Vojvodina and Upper Danube region (in %)*

Year	Republic of Serbia			AP Vojvodina			Upper Danube region		
	Total agricultural land	Meadows	Pastures	Total agricultural land	Meadows	Pastures	Total agricultural land	Meadows	Pastures
2002	100	11,55	15,99	100	2,02	5,95	100	2,68	4,18
2003	100	11,62	16,15	100	2,12	6,28	100	2,92	3,65
2004	100	11,70	16,10	100	2,06	6,25	100	2,63	3,91

<b>2005</b>	100	11,92	16,27	100	2,15	6,10	100	2,74	3,49
<b>2006</b>	100	11,94	16,42	100	2,16	6,01	100	2,86	3,32
<b>2007</b>	100	12,28	16,53	100	2,40	6,09	100	4,33	4,03
<b>2008</b>	100	12,19	16,35	100	2,30	5,91	100	3,34	3,21
<b>2009</b>	100	12,26	16,36	100	2,28	5,69	100	2,69	3,89
<b>2010</b>	100	12,25	16,41	100	2,37	5,72	100	2,70	3,83
<b>2011</b>	100	12,19	16,57	100	2,32	11,29	100	2,37	3,28

**Source:** *Municipalities in Serbia 2003-2010, Municipalities and regions in Serbia 2011-2012. Republic Statistical Office, Belgrade, Serbia.*

Increase the share of meadow in total agricultural land in the territory of the **Republic of Serbia** was recorded in the period from 2002 to 2009, after which, the last two years, lead to decreased areas under grassland. Pastures are present in higher percentage of the meadow, but their share in total agricultural land is characterized by cyclical trend, which may indicate problems in the production of sufficient quantities of nutrients and greater reliance on imports of raw materials and increased use of concentrated feed.

Share of meadows and pastures in total agricultural areas in **AP Vojvodina** are also characterized by cyclical trend. Biggest share of areas under meadows is notice in 2007 (2,40%), until the lowest share is recorded in 2002 (2,02%). areas under pastures are three to four time bigger that areas under meadows, so that the largest share of grassland recorded in the 2011 (11,29%) and the lowest was observed in the area 2009 (5,72%).

The **Upper Danube region** is characterized something smaller share of meadows related on pastures, which is case also on level of Republic of Serbia and AP Vojvodina. Observing the given data meadows and pastures represents stimulus for sustainable rural development, no matter that trend of share the meadows and pastures are characterized with cyclical rhythm. Highest share of agricultural lands under meadows is recorded in 2007 (4,33%), until the lowest share of meadows areas is recorded in 2011 (2,37%). Pastures recorded for one third higher areas relater to meadows, so is recorded that the highest share was in 2002 (4,18%), until lowest was in 2007 (3,21%).

Production of forage crops represents one of the most important links in the chain of maintenance of livestock fund. No matter if doesn't exist the forage fodder that contains all necessary nutrients in sufficient quantity and favorable relation, plant nutrition (forage crops) occupy the most important place in the diet of ruminants, and are the most important forages (fresh and cured in different ways). Food costs make up 50% of the total cost of livestock production, which adds to the cost of the final product. Cheaper feed can be found in the production of cheap fodder, purchase of necessary nutrients through a balanced meal. (*Jovanović i autori,2012*)

From pastures the green aboveground biomass caring out by graying of livestock, while from the lawn is caring out by haymow. Nutrition of forage crops depends from botanical composition (share of important legumes), from way of using (when we speak about pastures), as well from the way of storing/processing (in the form of silage, haylage or just dried - hay).

Clover and alfalfa are the most common and most important forage crops in livestock nutrition, occupying the largest area, which are at the same statistically significant. Reason profitability of these crops on arable land

can be explained by the high nutritional value which they have in use in fresh and processed state and that can be grown in almost all soil types.

Accordingly, in Table 4, it will be presented to the ten-year period of production of important forage crops (alfalfa and clover) and the production of green biomass meadows and pastures in Republic of Serbia, Autonomous Province of Vojvodina and Upper Danube region.

**Table 4.** *Production of forage crops in Republic Serbia, AP Vojvodina and Upper Danube region, in period 2002-2011*

(in t/ha)

	<i>Republic Serbia</i>				<i>AP Vojvodina</i>				<i>Upper Danube region</i>			
	<b>Clover</b>	<b>Alfalfa</b>	<b>Meadows</b>	<b>Pastures</b>	<b>Clover</b>	<b>Alfalfa</b>	<b>Meadows</b>	<b>Pastures</b>	<b>Clover</b>	<b>Alfalfa</b>	<b>Meadows</b>	<b>Pastures</b>
<b>2002</b>	525.328	1.006.359	1.198.891	384.762	24.102	321.953	50.454	76.895	3.078	25.977	9.343	8.052
<b>2003</b>	419.468	836.470	996.514	335.912	22.681	258.144	40.493	55.841	1.101	16.899	8.606	6.532
<b>2004</b>	572.483	1.135.347	1.309.738	452.711	39.005	352.323	61.830	97.554	1.423	36.031	10.549	5.196
<b>2005</b>	574.332	1.166.529	1.268.755	475.375	45.371	387.485	90.967	94.736	1.605	35.576	12.350	8.951
<b>2006</b>	548.436	1.104.287	1.253.319	489.375	49.688	363.390	71.058	98.450	1.808	28.169	12.649	9.809
<b>2007</b>	435.499	904.838	1.013.773	360.413	45.067	316.425	64.818	71.575	1.688	27.588	12.882	9.047

	2011	2010	2009	2008
	480.354	556.537	543.813	522.956
	985.410	1.104.840	1.114.846	1.069.668
	1.189.910	1.354.586	1.236.976	1.151.487
	478.939	509.636	471.043	424.747
	54.437	52.981	45.604	40.405
	350.291	384.331	378.204	359.418
	65.506	78.201	69.708	65.856
	111.864	105.657	90.805	81.544
	1.437	2.163	2.242	2.493
	17.838	27.628	32.058	28.581
	8.876	10.076	11.376	11.683
	9.838	12.949	13.063	9.509

**Source:** *Municipalities in Serbia 2003-2010, Municipalities and regions in Serbia 2011-2012. Republic Statistical Office, Belgrade, Serbia.*

Forage crops production (clover, alfalfa, meadows and pastures) in the territory of the **Republic of Serbia** occupies an important place after wheat and corn, while acknowledging unbalanced trend of production in the observed period. Clover production is characterized by a slight increase to the 2005, after which followed a decline in the 2006t and 2007, followed by a re-intensified production and yields have increased, but the 2011th were again noticeable decline significantly in yield clover. The yield of alfalfa records also unbalanced trend, what with clover. Yield was recorded with meadows and pastures are very important, but also unbalanced and recorded the alternating decline and increase yield per unit of area.

Share of clover production in territory of **AP Vojvodina** in relation to total production in Serbia ranges from 4.59%, respectively, in 2002, to 11.33%, respectively, in the 2011th year. Between the first and last years, there has been a cyclical trend yield clover. The yield of alfalfa, also varied in the observed period, with the highest yield recorded in the 2005th year (387.485 t / ha) and lowest in the 2003rd year (258.144 t / ha). Production of green biomass, in meadows and pastures AP Vojvodina is also an important factor in the overall development of the region, with the most intense year 2005 (for the meadow) and 2011th (for

pasture). The lowest yields were recorded in the 2003rd, and in meadows and pastures.

Regarding the production of fodder crops on the territory of the Upper Danube region Clover production is much smaller than alfalfa. Clover production is uneven; the largest quantity of Clover produced per unit area was 2002nd, while the lowest yield was recorded in the 2003rd. Last year (2011), was also characterized by decreasing returns clover. Production of alfalfa is far ahead from yield of clover, also and meadows and pastures, and the most intensive production recorded in the 2004th year (36.000 tons/ha) and the lowest in the 2011th year (17.838 t/ha). Meadows and pastures in total production per year, an important place and make up a quarter of biomass produced.

In the municipalities of the Upper Danube there are real opportunities for the production of sufficient quantities of fodder, as well as for the improvement of the current potential, with proper organization of production and the closing value chain of products on family farms. Sufficient quantities of fodder ensure utilization of natural resources meadows and pastures, which can act as an incentive for retail banking, to return and remain in rural areas, using the same sustainable agricultural practices.

### **Conclusion**

Production of forage in aim of preservation of bioregions and sustainable development at national and local level is high. By growing of these crops, you can create a foundation for further development of more efficient and productive livestock (by reducing the price of milk, meat and meat products), a beneficial effect that is manifested in the meadows and pastures bioregions and help preserve the environment.

Forage crops production in the observed location of the Upper Danube region is characterized by a variable proportion of the yield in ten-year period as a result of limited space, but also reduction livestock production. Potential for production of fodder crops are in the future it can be expected that the strategy documents and agricultural policy directed towards household livestock production, livestock pasture, etc., In accordance with the concept of organic farming and other non-conventional measures of production.

Exploiting benefits the strategic position of municipalities in the region of the Upper Danube, the presence of a special nature reserve can create opportunities to strengthen bilateral ties and strengthening of all forms of agricultural production, not just forage plants.

Although there are problems in the limited space that is used for the production of forage, which can reduce the account of cereal for human consumption, it can be expected that in the future additional use green conveyer mechanisms, which will ensure the continued use of agricultural land.

### Literature

1. "Official Gazette of Republic of Serbia, number 57/08", *National strategy of sustainable development*, Government of Republic Serbia, Belgrade, 2008.
2. Jelena Puđak (2010): *BIOREGIONALIZAM - Koncept organizacije društvenog života i model razvoja koji doprinosi očuvanju okoliša i integralnoj održivosti*, UDK 338.2:504.03 504.03:338 Soc. ekol. Zagreb, Vol. 19 (2010.), No. 1.
3. Marijana Jovanović, Bojana Bekić (2012): "*Lower Danube region as a model for application of the concept of sustainable agricultural development*", Thematic Proceedings from the International Scientific meeting „Sustainable agriculture and rural development in terms of the Republic of Serbia strategic goals realization within the Danube region“- preservation of rural values -, Tara 6-8.12.2012. pp. 398-416., ISBN 978-86-6269-018-0.
4. Marijana Jovanović, Slavica Arsić, Bojana Bekić (2013): *The role and importance of forage crops production in sustainable development of the Lower Danube region*; СБОРНИК СТАТЕЈ V Международной научно-практической конференции V International scientific practical conference (12–14 июня 2013 г.), Ставрополь. Modern problems of national economic development - ISBN 978-5-9596-0919-1, pp. 39- 44.

5. Popović Vesna, Sarić Radojica, Jovanović Marijana (2013): *Održiva poljoprivreda i ruralni razvoj u Podunavlju – koncepcijska polazišta*. Monografija: Stanje i mogućnosti razvoja održive poljoprivrede i ruralnog razvoja u Podunavlju. Institut za ekonomiku poljoprivrede., ISBN978-86-6269-024-1.
6. Popović, V., Mijajlović, N. (2013): *Climate change and sustainable development in agriculture and forestry*. Sustainable Technologies, Policies and Constrains in the Green Economy. IGI Global, Hersley, Pennsylvania (USA), pp. 140-171.
7. Sale, K. (2000): *Dwellers in the Land: the Bioregional Vision*. Georgia and Athens: The University of Georgia Press.
8. Zvonimir Štafa, Ivan Danjek (1997): *Proizvodnja kvalitetne krme u slijedu kao tehnološka osnovica za visoku proizvodnju mlijeka po hektaru*. Mljekarstvo 47 (1) 3-16, 1997. Izvorni znanstveni rad – Original scientific paper UDK: 636.084.523.
9. [www.croatia-serbia.com](http://www.croatia-serbia.com) (14.08.2013.)
10. [www.gornjepodunavlje.info](http://www.gornjepodunavlje.info) (12.09.2013.)
11. [www.hu-srb-ipa.com](http://www.hu-srb-ipa.com) (14.08.2013.)