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AGRO-RESOURCES IN THE ENERGY POLICY OF SLOVAKIA AND SERBIA

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Abstract. *Energetics is a key sector of the national Economy in Slovakia and Serbia as well. The main objectives and priorities are reflected in the strategic document "Action Plan on Energy Policy till 2035 with a view to 2050" in Slovakia and in the Energy Development Strategy till 2025 with projections till 2030 in Serbia. Both states increase their energetic security and self-sufficiency by diversification of energy sources in favor of renewables and low carbon technology deployment.*

Agricultural biomass has the largest technical potential in Slovakia. It is obtained from the direct production of field crops and energy plants as well as from the "rest" of farming and landscape maintenance (other biomass). Slovakia has the potential and the appropriate climate for the cultivation of energy plants and fast-growing trees/ Salix sp., Populus sp. and Robinia sp./ [3. vol 8, no. 2, pp. 47–55], [3, vol. 58, no. 4, pp. 651–662] and crops /Miscanthus, Panicum, Sorghum/ /[3,vol. 9, no. 2, pp. 29–34.]. The most suitable ecological conditions can be found in lowlands and highlands located in warmer climate conditions and rather humid soils.

Slovak legislation set the condition for fast-growing trees on agricultural land. The plantation can be established on soil that is classified in 5–9 quality

category indicated by BPEJ code (number 1 represents the highest quality soil, number 9 the lowest); contaminated soil; soil classified in 3 or 4 quality category if it is located in floodplain, the soil is waterlogged or exposed to wind erosion (Act No 34/2014 Coll.). Other potentially suitable areas include fallow lands and unused agricultural soils. The acreage of the fallow land in Slovakia is about 13,312.51 ha and the unused agricultural soils represent 15,575.85 ha [11.].

The highest share of the both areas can be found in Banská Bystrica region. Sensitive areas (contaminated soils) are suitable for fast-growing trees, due to the fact that they are excluded from food production. The sensitive areas are located in territory of Upper Nitra, Žilina, Ružomberok, Banská Bystrica, Žiarska valley (Žiar), Jelšava and Hačava. The largest identified areas suitable for agro-energy crops in Serbia are unused agricultural lands. Degraded land, which could also be used as a source of biomass for biofuels, is also present but in significantly lower amount.

The added benefit is the remediation of polluted soils and minimizing of degradation caused by surface resource exploitation. The fertile and moderate degraded agricultural land provides suitable conditions for agro-energy crops (such as Miscanthus) biomass production for energy and ecoremediation purposes. Production of agro-energy crops may improve the quality of life in rural areas, reduce poverty and prevent social and environmental degradation supporting the diversification of rural economy.

Keywords: agro-energy crops, energy policy, fast-growing trees, Slovakia, Serbia

Introduction. The energy policy of the EU is based on reducing all kinds of energy, increasing its efficiency in production and in consumption in each sector, curbing the use of fossil energy resources and their compensation of renewable resources of energy. Renewable non-fossil energy resources is wind, water, geothermal, solar, soil, air, landfill and sewage gas and biogas and biomass energy. The European Commission in 2014 formulated a new goal in the area of energetics, which would to be applied till the 2030. They are following:

- reduction of greenhouse gas emissions by 40% /below the level of 1990/, which is necessary to reach through applying of the measures in member states of the EU.

Obligatory aim fot the whole EU

- secure the transition on competitive, safe and sustainable energy system, which is energy from renewable resources;
- raise the energetic efficiency, its improving contributes to filling all goals of energy policy of the EU;
- introduce a new system of management: incoming from national plans for competitive, safe and sustainable energetics.

Biomass such as renewable resource of the energy, does not have on the EU level separate obligatory policy. It is considered as an applied policy of the EU, which obliging criteria and recommendations for Europe have been implemented to action plans of all member states. In Slovak republic the

energy policy is managed by National action plan for energy from renewable resources, which was elaborated based on the directive of European parliament and the Council /2009/28/ES.

Broadly, the topic of the renewable energy resources was integrated in Rural Development Program 2014–2020. More specifically, Biomass Action Plan 2008–2013, Strategy of higher use of the renewable energy resources in Slovakia and Strategy of energy security of Slovakia till 2030 have been adopted. The overall strategic goal is to increase the share of renewable energy resources on total gross energy consumption by 20% in EU countries. For Slovakia, the specific goal was set at 14% of the share (11,3% share in 2011) till 2020.

The Republic of Serbia has adopted to implement various directives in the field of renewable energy sources, and in accordance with Directive 2009/28/E3 Serbia accepted binding targets for member states of the European Union to ensure that renewable energy by 2020, account for 20% of gross final consumption at EU level; also, in the same period, Serbia accepted to improve energy efficiency for 20%. In accordance with Directive 2009/28/E3 and the Decision of the Ministerial Council of the Energy Community (18/10/2012), Serbia has set itself the ambitious target of 27% RES in gross final energy consumption in 2020, and in relation to that goal adopted significant number of laws and administrative provisions [6, p. 42–57.].

For the human the biomass were before the industrial revolution predominant type of the energy, later, after the introduction of technologies based on combustion of the oil and gas, interest about its consumption declined rapidly. Nowadays, biomass from agriculture, forestry and organic communal waste has strategic importance. The reason is reducing world reserves of fossil energy resources, but also the prediction of the consequences of climate changes, awaiting, severe economic, environmental and social consequences [1, p. 74.]. Finally, it is also the interest of the consumer society about cheaper solution of energy consumption, while various forms of biomass are accessible and for its growing and processing relative low costs is needed.

In recent years in the number of countries /Poland, Spain, Italy, Great Britain, Romania, Lithuania, Hungary and not least also Slovakia/ are developing bioenergetics systems, where at the beginning biomass is purposefully grown, from which are split firewood /pellet, briquette and others/ produced, which combusted a used for heat production, or gassed and use for gas production.

In the Slovak Republic, according the statistical office of Slovakia SR /2013/, fast growing plants and ground woods had been growing at 676,01 ha of arable land, whereby this area should rise on 213 000 ha by 20130.

Slovak legislation sets the condition for growing fast-growing trees on agricultural land. The plantation can be established on soil that is classified in 5-9 quality category indicated by BPEJ code (number 1 represents the highest quality soil, number 9 the lowest); contaminated soil; soil classified in 3 or 4 quality category if it is located in flood plain, the soil is waterlogged or exposed to wind erosion (Act No 34/2014 Coll.).

The aim of the paper was to analyze the potential of abandoned and degraded land in Slovakia and Serbia with the focus on determining the quantity of such land and its potentials for agro-energy crops cultivation and biomass production.

Materials and methods. The maps representing areas of individual types of land use were created in Arcview 3.2 software based on data obtained from [11].

Obtaining relevant data to assess the presence of abandoned agricultural and degraded land in the Republic of Serbia was done from multiple sources which include relevant literature, data from the Statistical Office of the Republic of Serbia, Corine Land Cover data, remotely sensed data, field data and other. Comparation of data collected through two agricultural censuses has been done with the aim of determination of the amount of abandoned agricultural land. Data for sizes and locations of land degraded through surface resource exploitation was obtained through remotely sensed data and with the use of Google Earth. For every site where determining of the precise location was possible all data was transferred in GIS with ArcMap.

Results and Discussion. Fast-growing trees, mainly willows and poplars and perennial grass Miscanthus are expected to play a big role in Slovak renewable energy policy, due to the fact that they are suitable for our agro-ecological and economic conditions. The most suitable ecological conditions can be found in lowlands and highlands located in warmer climate conditions and rather humid soils [11.]. The land used for energy cropping is a natural resource, comprising soil, minerals, water and biota. As such it plays an important role in delivering valuable ecosystem services, such as supporting the cultivation of biomass for food, energy and other products, and regulating the environment.

Other potentially suitable areas include fallow lands and unused agricultural soils. The acreage of the fallow land in Slovakia is about 13,312.51 ha and the unused agricultural soils represent 15,575.85 ha [11.]. The highest share of the both areas can be found in the Banská Bystrica region (Fig.1).

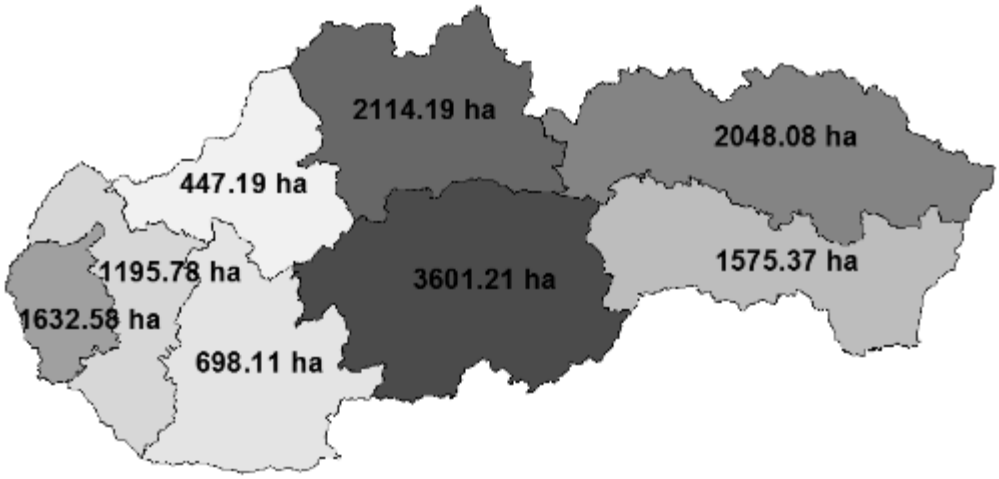

Fig. 1. Acreage of fallow land in Slovak counties *(based on data from VÚPOP and according to Hauptvogl 2015)*

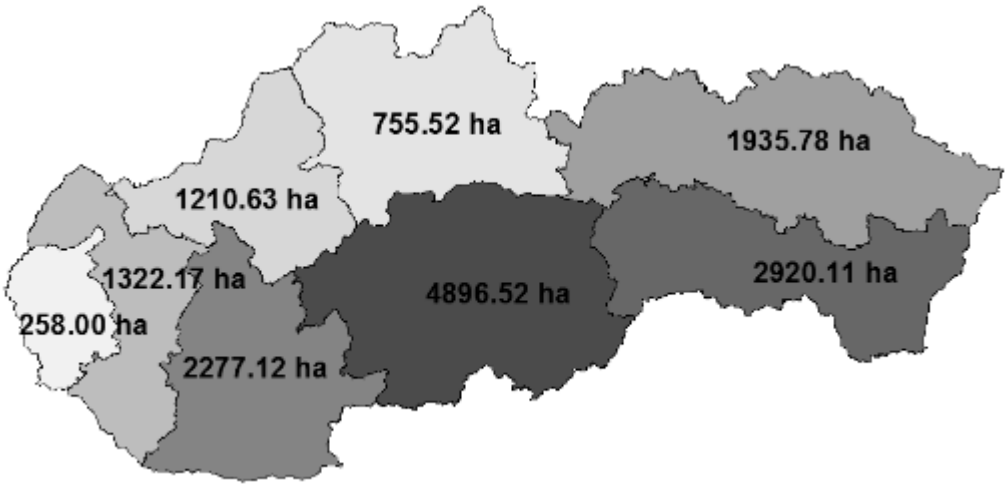

Fig. 2. Acreage of unused agricultural soils in Slovak counties [ha] ***(based on data from VÚPOP and according to Hauptvogl 2015)***

Sensitive areas (contaminated soils) are suitable for fast-growing crops, due to the fact that they are excluded from food production. The sensitive areas are located in territory of Upper Nitra, Žilina, Ružomberok, Banská Bystrica, Žiarska valley (Žiar), Jelšava and Hačava (Fig. 3).

Fig. 3. Location of sensitive areas in Slovakia ***(based on data from VÚPOP and according to Hauptvogl 2015)***

The analyzed area shown in Figure 1–3 evidence that Slovak republic dispose significant area by extension suitable for establishing plantations of fast-growing energetic crops. We would like to alert on reality, that growing so called energy crops by plantation method might threat recuperative potential and ecological stability of the area. Growing cycles /5–6 triennial cycles/ durate 15–20 years, hovewer the area might be threated by water circulation changes, requirements on higher inputs and by pests. Concentrated growing of the biomass might affect also rural regions, which actually are exploited by monopoly suppliers of the energy, without the possibility of farmers significantly affect the price.

This is also the reason, why we have focused on alternative models for instance integrated food-energy system, which was proposed by Sachs et al. in 1991 and it is supported by the FAO via the promotion of international technical consultations. Integrated Food-Energy Systems optimalizes the relation /synergy/ between the crops assigned for production of food and crops growing for energy purposes, as well as substrates becoming from breeding of the livestock /fish eventually/. Futhermore, system uses agroindustrial Technologies /gassificatin, anaerobic digestion/, which enables processing of secondary products, recyclation and economic use production residues. It could be argued, that in such a system would be conflict of interest betwen the producers of the food and energy crops.

There must clearly decide the farm management, according the technological and economical opportunities and local conditions, how much acreage of the area will assign for growing the crops for food or energy use. This is combined system of resources in which the inputs and additional energy for growing the crops do not increase and in crop rotations are incorporated also intercrops, feed and energy crops. In the system, there is nothing considered as a waste / which remain as a result of the one process is starting product for another process.

Data on unused agricultural land, as well as differences among different parts of Serbia are shown in table 1. A total of 424.054 ha, which is about 5% of the territory of Serbia, represents agricultural land which currently not being used [7, p. 51–55.].

1. Unused agricultural land in different parts of Serbia

Region	Unused Area (ha)
Belgrade region	12 076
Vojvodina	72 313
Šumadija and Western Serbia	141 220
South and Eastern Serbia	198 445
Total	424 054

Comparing previous available data with data from the recent agricultural census indicates that the percentage of unused agricultural land is rising. This is also evident in data obtained from Corine land cover for year 1990 and 2000, table 2.

2. Corine land cover changes between 1990–2000

Land cover type	Detected change
Artificial areas	Increase of around 4000 ha
Agricultural areas	Decrease of around 8000 ha
Forests and semi-natural areas	Increase of around 2000 ha

Regarding ash dumps and surface coal and mineral exploitation, there are around 1 500 ha of ash dumps area, close to 80 000 square kilometres of degraded areas associated with surface coal exploitation, and around 30 000

square kilometres of degraded areas associated with surface mineral exploitation, Fig. 4 [7, p. 51–55].

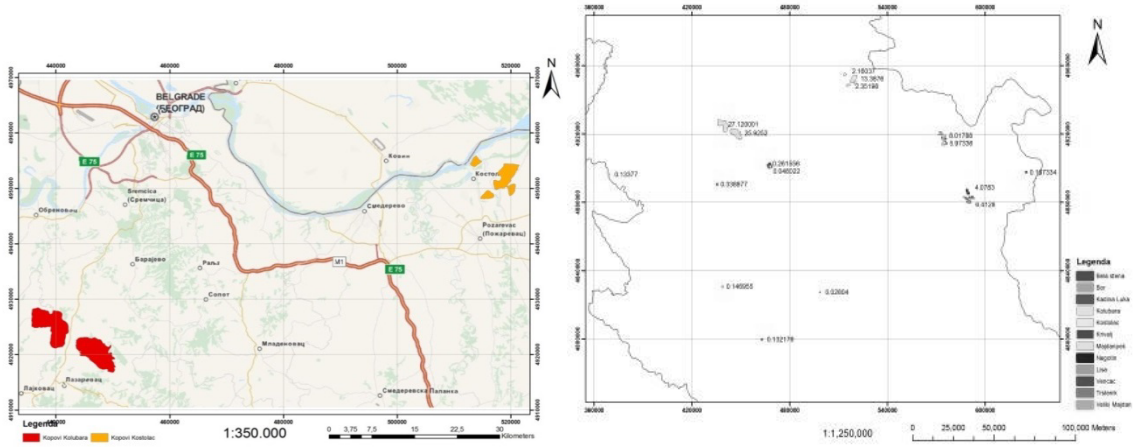

Fig. 4. Locations of surface coal and mineral exploitation in Serbia

Conclusions. Energy policy of the Slovak republic is based on reducing consumption of all kinds of the energy, increasing its efficiency in production and consumption in each sector, limitation of use of fossil resources and its compensations by renewable resources of energy. It is governed by the National action plan for energy from renewable resources /2010/. Slovakia has potential and suitable climate for growing the energy crops, fast-growing crops / *Salix sp.*, *Populus sp. a Robinia sp.,Paulownia sp./* a bylín /*Miscanthus, Panicum* , *Sorghum*/ The most suitable ecological conditions can be found in lowlands and highlands located in warmer climate conditions and rather humid soils [11.].

Slovak legislation set the condition for fast-growing trees on agricultural land. The plantation can be established on soil that is classified in 5–9 quality category indicated by BPEJ code (number 1 represents the highest quality soil, number 9 the lowest); contaminated soil; soil classified in 3 or 4 quality category if it is located in floodplain, the soil is waterlogged or exposed to wind erosion (Act No 34/2014 Coll.). Other potentially suitable areas include fallow lands and unused agricultural soils. The acreage of the fallow land in Slovakia is about 13,312.51 ha and the unused agricultural soils represent 15,575.85 ha [11.]

The largest identified areas suitable for agro-energy crops in Serbia are unused agricultural land, the presence of degraded land, which could also be used as a source of biomass for biofuels is also present but in significantly lower amount. Total possible available land for agro-energy crops in Serbia is close to 440 000 ha. For this land to be used as source of biomass for biofuels it is necessary to determine their spatial characteristics, more precisely their exact locations and sizes of specific sites. This can be achieved through further and more detailed remote sensing with field validation.

Considerable scope for acquisition of agricultural biomass we see even in changing the management on the farm and to the adaptation of the model Integrated Food – Energy Systems that optimizes the relationship / synergy / between crops destined for food production and grown for energy purposes , as well as substrates derived from breeding livestock . The system also uses

agroindustrial technology / gassification , anaerobic digestion / enabling the processing of by-products , recycling and economical use of production residues

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АГРОРЕСУРСИ В ЕНЕРГЕТИЧНІЙ ПОЛІТИЦІ СЛОВАЧЧИНИ ТА СЕРБІЇ

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Анотація. *Енергетика є ключовим сектором національної економіки в Словаччині та Сербії. Основні цілі й пріоритети відображені в стратегічному документі «План дій з енергетичної політики до 2035 року з перспективою до 2050 року» в Словаччині, і в «Стратегії розвитку енергетики до 2025 року з прогнозами до 2030 року» в Сербії. Обидві держави збільшують свою енергетичну безпеку й самодостатність шляхом диверсифікації джерел енергії на користь відновлюваних джерел енергії та впровадження низьковуглецевих технологій.*

Сільськогосподарська біомаса має найбільший технічний потенціал у Словаччині. Її отримують з безпосереднього виробництва польових культур та енергетичних установок, а також від «відпочинку» сільського господарства й ландшафтного обслуговування (іншої біомаси). Словаччина має потенціал і відповідний клімат для вирощування енергетичних рослин і швидкорослих дерев (Salix sp., Populus sp. and Robinia sp.) [3. vol 8, no. 2, pp. 47–5], [3. vol. 58, no. 4, pp. 651–662] і зернові культури /Miscanthus, Panicum, Sorghum/ /[3. vol. 9, no. 2, pp. 29–34.]. Найбільш придатні екологічні умови можуть бути знайдені в низинах і височинах, розташованих у більш теплих кліматичних умовах і достатньо вологих ґрунтах.

Словацьке законодавство встановило умови для швидко зростаючих дерев на сільськогосподарських землях. Плантація може бути встановлена на ґрунті, який класифікується в 5–9 категорії якості, зазначеній BPEJ кодом (номер 1 представляє високу якість ґрунту, номер 9 – найнижчу); забрудненний ґрунт; ґрунти поділяються на 3 або 4 категорії якості, якщо вони розташовані в заплаві, заболочені або піддаються вітровій ерозії (Закон № 34/2014 Coll.). Інші потенційно придатні райони включають поклади й невикористовуваних сільськогосподарських земель. Площа посіву на перелогових землях в Словаччині становить близько 13,312.51 га й невикористаних сільськогосподарських ґрунтів –15,575.85 га [11].

Найвищу частку обох областей можна знайти в місті Банська область – Бистриця. Чутливі ділянки (забрудненого ґрунту) підходять для швидкорослих дерев, через те, що вони виключені з виробництва харчових продуктів. Чутливі ділянки розташовані на території Верхнього Нітра, Жиліна, Ружомберок, Банська Бистриця, Жарська долини (Ziar), Елшава і Хасава. Найбільшими було визначено області, придатні для агроенергетичних культур – невикористані сільськогосподарські землі в Сербії. Деградовані землі, які теж можуть бути використані як джерело біомаси для виробництва біопалива, є також, але в значно меншій кількості.

Додатковою перевагою є рекультивація забруднених ґрунтів і зведення до мінімуму деградації, викликаних експлуатацією поверхневих ресурсів. Родючі й помірно деградовані сільськогосподарські угіддя забезпечують сприятливі умови для агроенергетичних культур (таких як Miscanthus) виробництво біомаси для виробництва енергії та екорекультивації. Виробництво агро-енергетичних культур може сприяти поліпшенню якості життя в сільській місцевості, скороченню бідності й запобіганню соціальної та екологічної деградації, яка підтримує диверсифікацію сільської економіки.

Ключові слова: агроенергетичні культури, енергетична політика, швидкорослі дерева, Словаччина, Сербія

АГРОРЕСУРСЫ В ЭНЕРГЕТИЧЕСКОЙ ПОЛИТИКЕ СЛОВАКИИ И СЕРБИИ

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Аннотация. *Энергетика является ключевым сектором национальной экономики в Словакии и Сербии. Основные цели и приоритеты отражены в стратегическом документе «План действий по энергетической политике до 2035 года с перспективой до 2050 года» в Словакии и в «Стратегии развития энергетики до 2025 года с прогнозами до 2030 года» в Сербии. Оба государства увеличивают свою энергетическую безопасность и самодостаточность путем диверсификации источников энергии в пользу возобновляемых источников энергии и внедрения низкоуглеродистых технологий.*

Сельскохозяйственная биомасса имеет наибольший технический потенциал в Словакии. Ее получают из непосредственного производства полевых культур и энергетических установок, а также от «отдыха» сельского хозяйства и ландшафтного обслуживания (биомассы). Словакия имеет потенциал и благоприятный климат для выращивания энергетических растений и быстрорастущих деревьев /Salix sp., Populus sp. and Robinia sp./ [3. vol 8, no. 2, 47–55 [3. vol. 58, no. 4, pp. 651–662] и зерновые культуры /Miscanthus, Panicum, Sorghum/ [3. vol. 9, no. 2, pp. 29–34.]. Наиболее подходящие экологические условия могут быть найдены в низинах и возвышенностях, расположенных в более теплых климатических условиях и достаточно влажных почвах.

Словацкое законодательство установило условия для быстро растущих деревьев на сельскохозяйственных землях. Плантация может быть установлена на грунте, который классифицируется в 5–9 категории качества, указанной BPEJ кодом (номер 1 представляет высокое качество почвы, номер 9 – низкое) загрязненная почва; почвы

делятся на 3 или 4 категории качества, если они расположены в пойме, заболоченные или подвергаются ветровой эрозии (Закон № 34/2014 Coll.). Другие потенциально пригодные районы включают залежи и неиспользуемых сельскохозяйственных земель. Площадь посева на залежных землях в Словакии составляет около 13,312.51 га и неиспользованных сельскохозяйственных почв – 15,575.85 га [11].

Самую высокую долю обеих областей можно найти в городе Банска область – Быстрица. Чувствительные участки (загрязненной почвы) подходят для быстрорастущих деревьев, потому, что они исключены из производства пищевых продуктов. Чувствительные участки расположены на территории Верхнего Нитра, Жилина, Ружомберок, Банска Быстрица, Жарска долины (Ziar), Елшава и Хасава. Крупнейшими были определены области, пригодные для агро-энергетических культур – неиспользованные сельскохозяйственные земли в Сербии. Деградированные земли, которые также могут быть использованы в качестве источника биомассы для производства биотоплива, также есть, но в значительно меньшем количестве.

Дополнительным преимуществом является рекультивация загрязненных почв и сведения к минимуму деградации, вызванных эксплуатацией поверхностных ресурсов. Плодородные и умеренно-деградированные сельскохозяйственные угодья обеспечивают благоприятные условия для агро-энергетических культур (таких как Miscanthus) производство биомассы для производства энергии и экорекультивации. Производство агроэнергетических культур может способствовать улучшению качества жизни в сельской местности, сокращению бедности и предотвращению социальной и экологической деградации, которая поддерживает диверсификацию сельской экономики.

Ключевые слова: агроэнергетические культуры, энергетическая политика, быстрорастущие деревья, Словакия, Сербия

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THE IMPORTANCE OF LOANS FOR FARMERS IN COOPERATIVES BANKS IN POLAND BETWEEN 2010–2015

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Abstract. *The objective of the article was to analyze how the share of agricultural credits changed in the credit portfolio of Polish cooperative banks*